

BA 11-A Mounting Box and Power System Technical Manual

1st Edition, December 1979
2nd Edition, March 1981

Copyright © 1979, 1981 by Digital Equipment Corporation

All Rights Reserved

The material in this manual is for informational purposes and is subject to change without notice.

Digital Equipment Corporation assumes no responsibility for any errors which may appear in this manual.

Printed in U.S.A.

The following are trademarks of Digital Equipment Corporation, Maynard, Massachusetts:

DIGITAL	DECsystem-10	MASSBUS
DEC	DECSYSTEM-20	OMNIBUS
PDP	DIBOL	OS/8
DECUS	EDUSYSTEM	RSTS
UNIBUS	VAX	RSX
	VMS	IAS

CONTENTS

	Page
CHAPTER 1 INTRODUCTION	
1.1 GENERAL.....	1-1
1.2 PHYSICAL DESCRIPTION.....	1-1
1.3 H7140 POWER SUPPLY.....	1-2
1.4 H7750 BATTERY BACKUP UNIT (OPTIONAL).....	1-2
1.5 RELATED DOCUMENTS.....	1-2
CHAPTER 2 INSTALLATION	
2.1 UNPACKING AND INSPECTION.....	2-1
2.1.1 BA11-A Mounting Box Removal.....	2-1
2.2 BA11-A MOUNTING BOX INSTALLATION	2-1
2.2.1 Power Connections (AC)	2-1
2.2.2 AC Power Control Cabling.....	2-4
2.2.3 120 Vac to 240 Vac Power Supply Conversion.....	2-5
2.3 OPTIONAL UNIT INSTALLATION	2-8
2.3.1 872-D, -E Power Controller Installation	2-8
2.3.2 H7750 Battery Backup Unit Installation.....	2-8
2.4 OPTIONAL BACKPLANE MODULE ASSIGNMENTS	2-13
CHAPTER 3 FUNCTIONAL OPERATION	
3.1 H7140 POWER SUPPLY FUNCTIONS	3-1
3.1.1 Signals and Voltages.....	3-1
3.1.1.1 Internal Signals and Voltages.....	3-1
3.1.1.2 External Voltages and Signals.....	3-2
3.2 POWER SUPPLY OPERATIONS.....	3-3
3.2.1 Input Assembly.....	3-8
3.2.2 Bias and Interface Circuits.....	3-8
3.2.2.1 Bias Voltage.....	3-8
3.2.2.2 DC Voltage Monitoring.....	3-8
3.2.2.3 Normal Operation	3-8
3.2.2.4 Standby Operation	3-12
3.2.2.5 Temperature Sensing.....	3-12
3.2.2.6 Line Time Clock (LTC) Signal	3-12
3.2.3 Memory Voltage	3-12
3.2.3.1 +35 Vdc.....	3-12
3.2.4 Memory Voltage Regulators.....	3-15
3.2.4.1 +5 B Regulator Circuit	3-15
3.2.4.2 +12 B Regulator Circuit	3-15
3.2.4.3 -12 B Regulator Circuit	3-18

CONTENTS (Cont)

		Page
3.2.5	Logic Voltage Generation.....	3-18
3.2.5.1	+ 5 V at 120 A Logic Power.....	3-21
3.2.5.2	– 15 V Logic Power	3-21
3.2.5.3	+ 15 V Power.....	3-23
3.2.6	Fan Voltage Generation.....	3-23
3.3	872-D, -E POWER CONTROLLER FUNCTIONS	3-23
3.4	H7750 BATTERY BACKUP FUNCTIONS.....	3-23
3.4.1	Signals and Voltages.....	3-27
3.4.2	Battery Backup Operation.....	3-27

CHAPTER 4 SERVICE

4.1	POWER CHECKS.....	4-1
4.1.1	AC Power Distribution	4-1
4.1.1.1	Initial AC Power Checks.....	4-1
4.1.2	DC Power Distribution	4-2
4.1.2.1	Initial DC Power Checks.....	4-2
4.2	REMOVAL AND REPLACEMENT PROCEDURES.....	4-2
4.2.1	BA11-A Mounting Box in PDP-11/X44 or Similar Cabinet.....	4-2
4.2.1.1	Mounting Box Removal.....	4-2
4.2.1.2	Interface Bracket Removal/Installation	4-11
4.2.1.3	Mounting Box Replacement.....	4-11
4.2.2	BA11-A Mounting Box on Slides.....	4-13
4.2.2.1	BA11-A Slide Mounting Unit Removal	4-13
4.2.2.2	Index Plate Installation	4-17
4.2.2.3	BA11-A Slide Mounting Unit, Replacement	4-18
4.2.3	Fan Assembly Removal and Replacement	4-18
4.2.4	H7140 Power Supply Unit.....	4-20
4.2.4.1	Power Supply Unit Removal	4-20
4.2.4.2	Power Supply Unit Replacement	4-24
4.2.5	CPU Backplane Assembly.....	4-25
4.2.5.1	Backplane Assembly Removal	4-25
4.2.5.2	Backplane Assembly Replacement	4-26
4.3	POWER SUPPLY UNIT, COMPONENT LOCATIONS	4-29
4.3.1	Input Assembly.....	4-29
4.3.2	Bias and Interface Components	4-29
4.3.2.1	Bias and Interface Module	4-30
4.3.2.2	Mother Module.....	4-30
4.3.3	Memory Voltage Assembly	4-30
4.3.3.1	Memory Inverter Module.....	4-30
4.3.3.2	Memory Regulator Module.....	4-30
4.3.4	Logic Voltage Assembly	4-31
4.3.4.1	Logic Inverter Control Module	4-31
4.3.4.2	Logic Inverter Module	4-31
4.3.5	Output Assembly.....	4-31
4.3.6	Power Distribution Module	4-31

FIGURES

Figure No.	Title	Page
1-1	BA11-A Dimensions.....	1-1
1-2	Mounting Box in H961 Cabinet.....	1-2
1-3	Mounting Box in System Cabinet	1-3
2-1	BA11-A Mounting Box Packaging.....	2-2
2-2	Mounting Box, Rear Panel Components.....	2-3
2-3	BA11-AA, AB AC Connector Specifications	2-4
2-4	872-D, -E Power Controller Unit AC Connector Specifications.....	2-5
2-5	Typical Power Control Cabling.....	2-6
2-6	H7140 Unit, AC Power Cord Assembly Removal.....	2-7
2-7	872-D, -E Power Controller Front Panel Locations	2-9
2-8	H7750 Unit, Cable Connections	2-10
2-9	H7140 Unit, +300 Vdc Test Location	2-11
2-10	Optional Backplane Connector Assignments.....	2-13
3-1	Power Supply, External Signals and Voltages	3-2
3-2	H7140-AA, -AB Power Supply Interconnection.....	3-4
3-3	Power Supply Functional Block Diagram.....	3-7
3-4	Bias and Interface Circuits, Block Diagram	3-9
3-5	Memory Voltage Generation Functional Block Diagram	3-13
3-6	+5 B Voltage Regulator, Circuit Block Diagram.....	3-16
3-7	+12 B Voltage Regulator, Block Diagram.....	3-17
3-8	–12 B Regulator, Block Diagram	3-19
3-9	Logic Module Voltage Generation, Functional Diagram	3-21
3-10	–15 V Power, Functional Diagram	3-22
3-11	+15 V Power, Functional Diagram	3-24
3-12	Fan Voltage Generation, Functional Diagram.....	3-25
3-13	872-D, -E Unit, Simplified Diagram.....	3-25
3-14	H7750 Unit, Simplified Diagram	3-26
4-1	Backplane Assembly, Pin Designations	4-3
4-2	Cabinet Type Identification.....	4-4
4-3	Mounting Box Release Lever, System Cabinet	4-5
4-4	Top Cover Mounting (Type A)	4-5
4-5	Top Cover Mounting (Type B).....	4-6
4-6	BA11-A Unit Cable Clamps	4-7
4-7	BA11-A Type B Box Slide Latch Locations	4-8
4-8	System Cabinet Safety Lever	4-9
4-9	System Cabinet, Mounting Box Hardware.....	4-10
4-10	Interface Bracket Mounting	4-11
4-11	Mounting Box Release Lever Slide Mounted Unit.....	4-14
4-12	Slide Hold Levers.....	4-15
4-13	Slide to Index Plate Mounting	4-16
4-14	Index Plate Mounting	4-17
4-15	Fan Assembly Removal	4-19
4-16	Power Supply Unit, Rear Mounting Screws	4-21
4-17	Power Supply Unit Removal.....	4-21
4-18	Mounting Box, Power Cable Connections.....	4-22
4-19	Power Distribution Panel Connectors and Cable Assembly	4-23
4-20	CPU Backplane Assembly Mounting	4-27
4-21	Backplane Assembly Alignment	4-28

FIGURES (Cont)

Figure No.	Title	Page
4-22	H7140 Unit Module and Assembly Locations	4-29
4-23	Input Assembly, Component Locations	4-30
4-24	Bias and Interface Module, Interface and Control Components	4-31
4-25	Bias and Interface Module, Bias Voltage Components	4-33
4-26	Bias and Interface Module, Fan Voltage Components	4-33
4-27	Mother Module Components	4-34
4-28	Memory Voltage Assembly Components	4-34
4-29	Memory Inverter Module Components	4-35
4-30	Memory Regulator Module, + 5 B Components	4-35
4-31	Memory Regulator Module, + 12 B Component Locations	4-37
4-32	Memory Regulator Module, - 12 B Components	4-37
4-33	Logic Inverter Assembly Components	4-38
4-34	Logic Inverter Control Module, Voltage Reference and Sensing Components	4-39
4-35	Logic Inverter Control Module, - 15 V and + 15 V Components	4-40
4-36	Logic Inverter Module Components	4-41
4-37	Output Assembly Components	4-42
4-38	Snubber Module Components	4-42
4-39	Power Distribution Module Components	4-43
4-40	Power Distribution Cable Assembly Wiring	4-43

TABLES

Table No.	Title	Page
1-1	H7140-AA, -AB Power Supply Specifications	1-4
1-2	H7140 Output Specifications	1-6
1-3	Related Publications	1-7
2-1	Input Power Cable Assembly	2-5
3-1	Control Panel Signals	3-1
3-2	Backplane Signals	3-3
3-3	Power Controller Signals	3-3
4-1	CPU Backplane Connector P1, Signals and Voltages	4-3

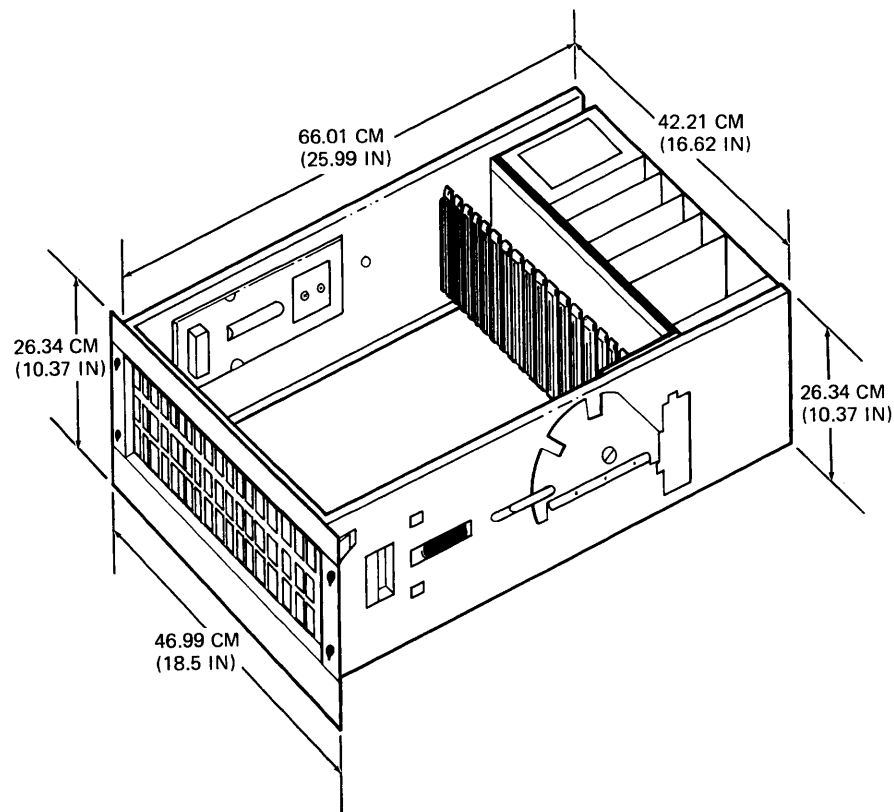
CHAPTER 1 INTRODUCTION

1.1 GENERAL

This manual describes the BA11-A mounting box, its power system and the optional battery backup unit. The BA11-A is used to house the PDP-11/44 and other PDP-11 processors.

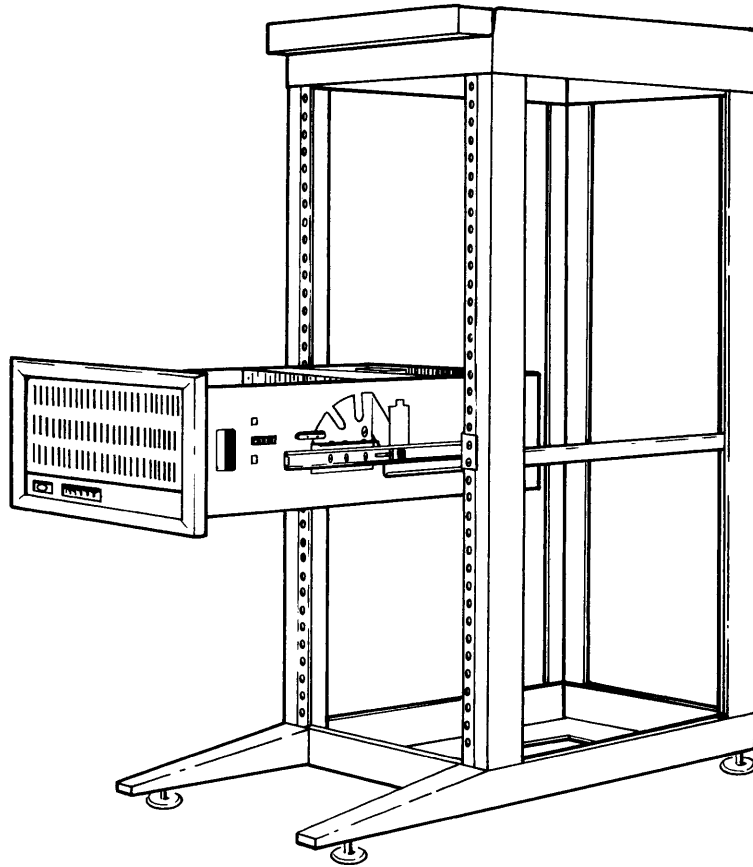
1.2 PHYSICAL DESCRIPTION

The BA11-A mounting box is shown in (Figure 1-1). It contains the H7140 power supply, the specified systems backplane (the PDP-11/44 backplane), and three cooling fans for the mounting space and power supply. The BA11-A also has space for mounting optional backplanes such as the DD11-CK and DD11-DK. The BA11-A may be mounted in a slide mount installation (Figure 1-2) or a cabinet system (Figure 1-3).



TK-3479

Figure 1-1 BA11-A Dimensions



NOTE:
SLIDE AND SLIDE INDEX PLATE
ARE USED WITH RACK MOUNTED VERSION.

TK-4183

Figure 1-2 Mounting Box in H961 Cabinet

1.3 H7140 POWER SUPPLY

The H7140 power supply is used in the BA11-A. Table 1-1 lists the H7140 input specifications. Table 1-2 lists the H7140 output specifications.

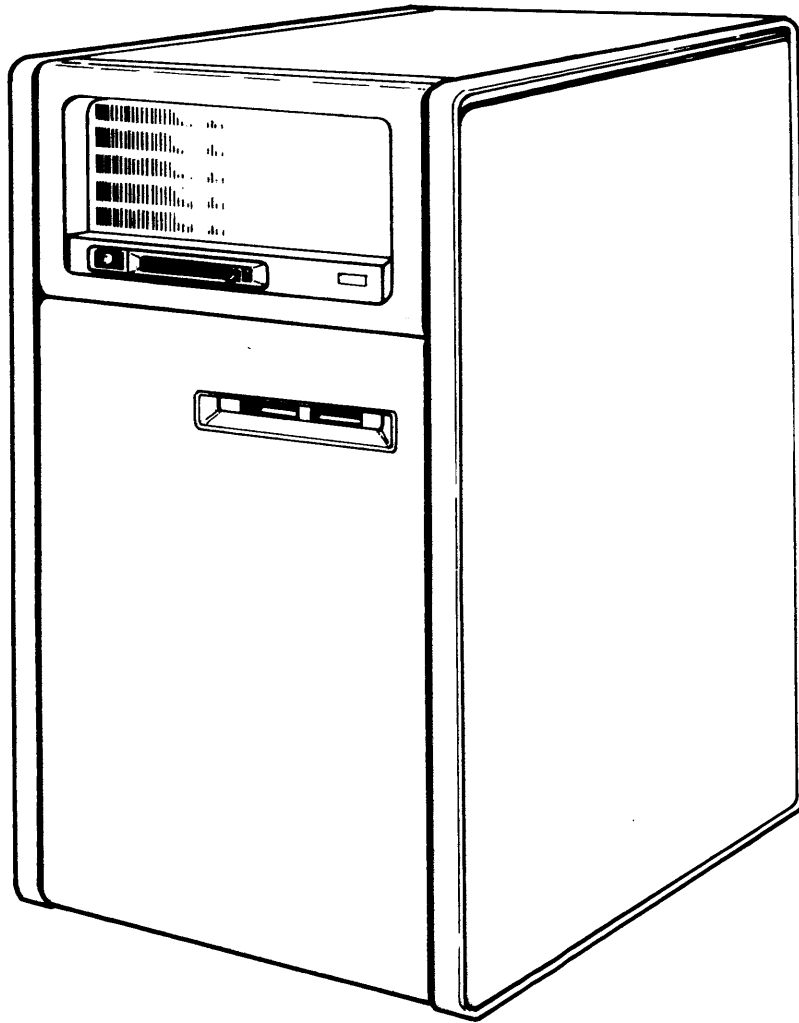
1.4 H7750 BATTERY BACKUP UNIT (OPTIONAL)

The H7750 battery backup unit provides dc refresh power to MOS memory and keeps the cooling fans operating in the event of an ac power failure.

The unit contains three sealed, 12 Vdc, lead acid batteries that supply 36 Vdc to the memory regulators in the H7140 and the cooling fans.

1.5 RELATED DOCUMENTS

Table 1-3 lists manuals and publications that contain information related to the installation and operation of the BA11-A mounting box.



TK-3631

Figure 1-3 Mounting Box in System Cabinet

Table 1-1 H7140-AA, -AB Power Supply Specifications

Characteristics	Description
H7140-AA Power Supply	
Line voltage	90 Vrms – 128 Vrms, single phase, two wire and ground (120 Vrms nominal)
Frequency	47–63 Hz
Current (ac)	15 A rms max. at 120 Vac 55 A peak max. at 120 Vac
Power factor	Greater than 0.60 at full output load and low input voltage (90 V)
Inrush current	65 A peak at 128 Vrms for one-half cycle, followed by repetitive peaks of decreasing amplitude for an additional 8 cycles of the input voltage
Power	1350 W with maximum load applied at nominal voltage output
Overvoltage condition	Can withstand input overvoltage of 150 Vrms for one second
Noise transient (Maximum acceptable)	
Low energy transients	300 V peak voltage spike* containing not more than 0.2 watt-seconds of energy per spike
High energy transients	1 KV peak voltage spike* containing not more than 2.5 watt-seconds of energy per spike
Conducted noise	CW-10 KHz to 30 MHz, 3 Vrms
Radiated noise	RF field strength – 10 KHz to 30 MHz, 1 V/M 30 MHz to 1 GHz: 10 V/M
H7140-AB Power Supply	
Line voltage	180 Vrms – 256 Vrms, single phase, two wire and ground (240 Vrms nominal)
Frequency	47–63 Hz

Table 1-1 H7140-AA, -AB Power Supply Specifications (Cont)

Characteristics	Description
Current (ac)	9.0 A rms max. at 240 Vac 33 A peak max. at 240 Vac
Power factor	Greater than 0.60 at full output load and low input voltage (180 V)
Inrush current	130 A peak at 256 Vrms for one-half cycle, followed by repetitive peaks of decreasing amplitude for an additional 8 cycles of the input voltage
Power	1350 W with maximum load applied at nominal voltage output
Overvoltage condition	Input overvoltage of 300 Vrms for one second (maximum)
Noise transient (Maximum acceptable)	
Low energy transients	300 V (peak voltage spike* containing a maximum of 0.2 watt-seconds of energy per spike)
High energy transients	1 KV (peak voltage spike* containing a maximum of 2.5 watt-seconds of energy per spike)
Conducted noise	CW-10 KHz to 300 MHz, 3 Vrms
Radiated noise	RF field strength – 10 KHz to 30 MHz, 1 V/M 30 MHz to 1 GHz: 10 V/M

*A spike is a voltage transient of either polarity and of either common or differential mode, with a rise time (10% to 90%) of 0.1 μ s or less, and a fall time (to 10%) of 10 μ s or more. The average power of spikes should not exceed 0.5 W.

Table 1-2 H7140 Output Specifications

Nominal Output Voltages						
Parameter	Logic Voltages			Memory Voltages		
	+5.1 V	+15.0 V	-15.0 V	+12.0 V	-12.0 V	+5.1 V
Output Current						
Minimum	6.0 A	0.0 A	0.0 A	0.0 A	0.0 A	0.0 A
Maximum	120.0 A	3.0 A	3.0 A	5.0 A	1.0 A	10.0 A
Static Load/Line	±0.10 V	±0.30 V	±0.30 V	±0.24 V	±0.24 V	±0.10 V
Regulation						
Ripple Voltage	±100 MV, P-P	±300 MV, P-P	±300 MV, P-P	±240 MV, P-P	±240 MV, P-P	±100 MV, P-P
Noise Voltage	±51 MV, P-P	±150 MV, P-P	±150 MV, P-P	±120 MV, P-P	±120 MV, P-P	±51 MV, P-P
Dynamic Regulation	±18 A	±0.5 A	±0.5 A	±1.0 A	±0.25 A	±2.0 A
Over/Undershoot	100 MV	300 MV	300 MV	240 MV	240 MV	100 MV
Current Limit	125 to 140 A	3.2 to 4.0 A	3.2 to 4.0 A	5.5 to 6.5 A	1.8 to 3.0 A	10.5 to 13.5 A
Initiation Point						
Overvoltage Limit	+6.5 V	18.0 V	18.0 V	+15.0 V	-15.0 V	+6.5 V
Maximum Trip Point						
Maximum Voltage	+7.0 V	+7.0 V	+21.0 V	+16.0 V	-16.0 V	+7.0 V

Table 1-3 Related Publications

Title	Document Number
PDP-11/44 System Technical Manual	EK-KD11Z-TM
PDP-11 Peripherals Handbook	EB-07667-20/78
PDP-11 Processor Handbook	EB-17716-18/79
BA11-A Box Assembly Field Maintenance Print Set	MP-00832
11/44 System Field Maintenance Print Set	MP-00809
872 Power Controller Field Maintenance Print Set	MP-00865
BA11-A Unit Assembly (IPB*)	EK-BA11A-IP
H7140 Power Supply (IPB*)	EK-H7140-IP

*Illustrated Parts Breakdown

CHAPTER 2 INSTALLATION

2.1 UNPACKING AND INSPECTION

The BA11-A mounting box is packaged and shipped in reinforced cartons and protected internally by foam inserts and a polyethelene bag. Before unpacking any carton, remove the packing list from the container.

NOTE

Retain the packing material and shipping containers in the event reshipping is required.

2.1.1 BA11-A Mounting Box Removal

The BA11-A mounting box is packaged in reinforced cartons and protected by foam inserts and a polyethelene bag as shown in Figure 2-1. To remove the unit from the container, perform the following procedure.

CAUTION

The BA11-A unit weighs approximately 34 kg (75 lbs). Use care when lifting the unit from the carton.

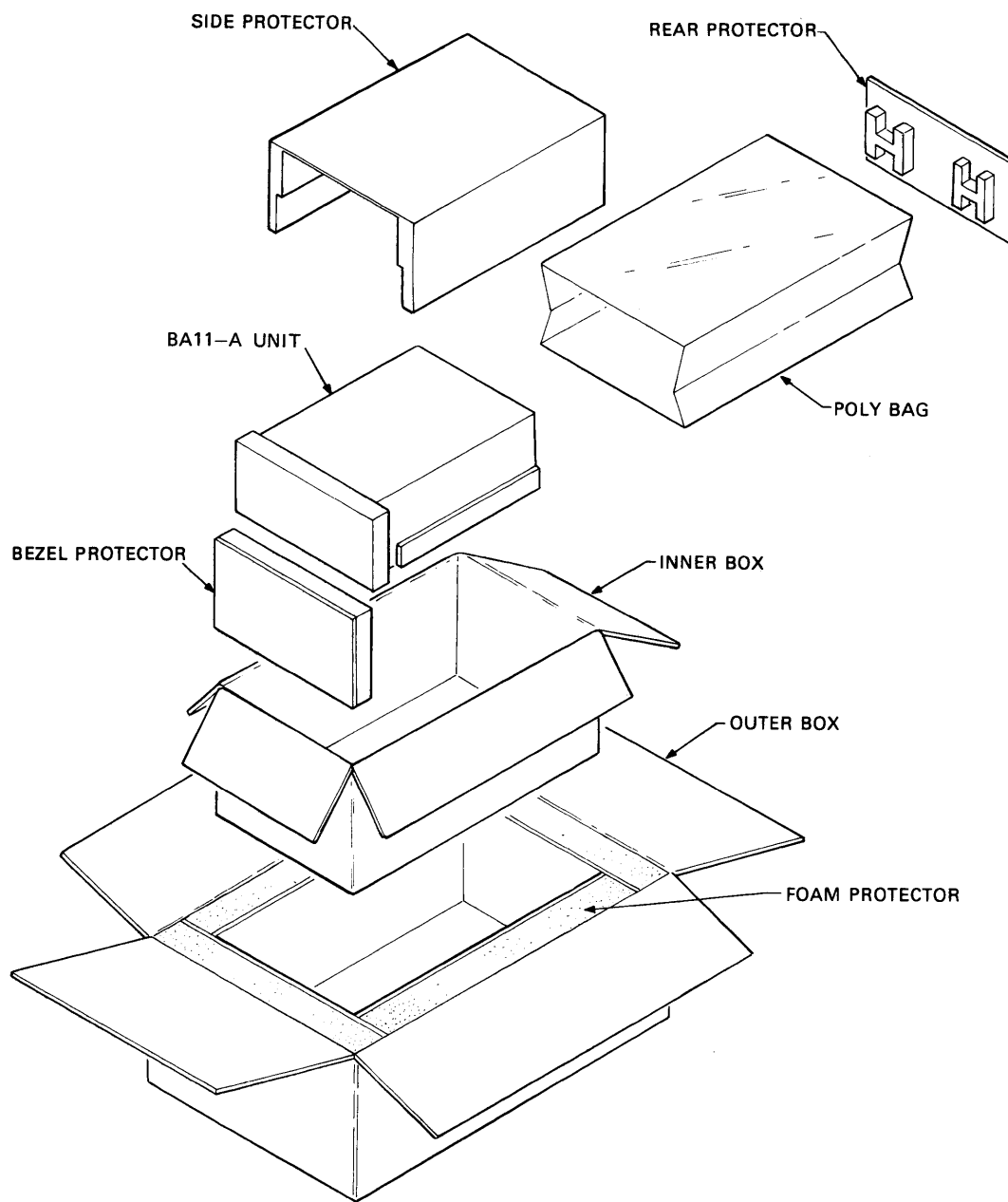
1. Open the leaves of the outer carton by cutting the tapes at the seams.
2. Remove the inner carton from the foam protector.
3. Open the leaves of the inner carton by cutting the tape at the seams.
4. Remove the side and rear protectors.
5. Remove the unit from the polyethelene bag.
6. Remove the bezel protector.
7. Inspect the unit for visible damage and ensure that the contents are complete.

2.2 BA11-A MOUNTING BOX INSTALLATION

The BA11-A mounting box may be installed in a system cabinet like the one used in the PDP-11X44, or the mounting box may be mounted on slides in a 48.26 cm (19 in) cabinet. For instructions on the installation of the BA11-A mounting box refer to Paragraph 4.2 of this manual.

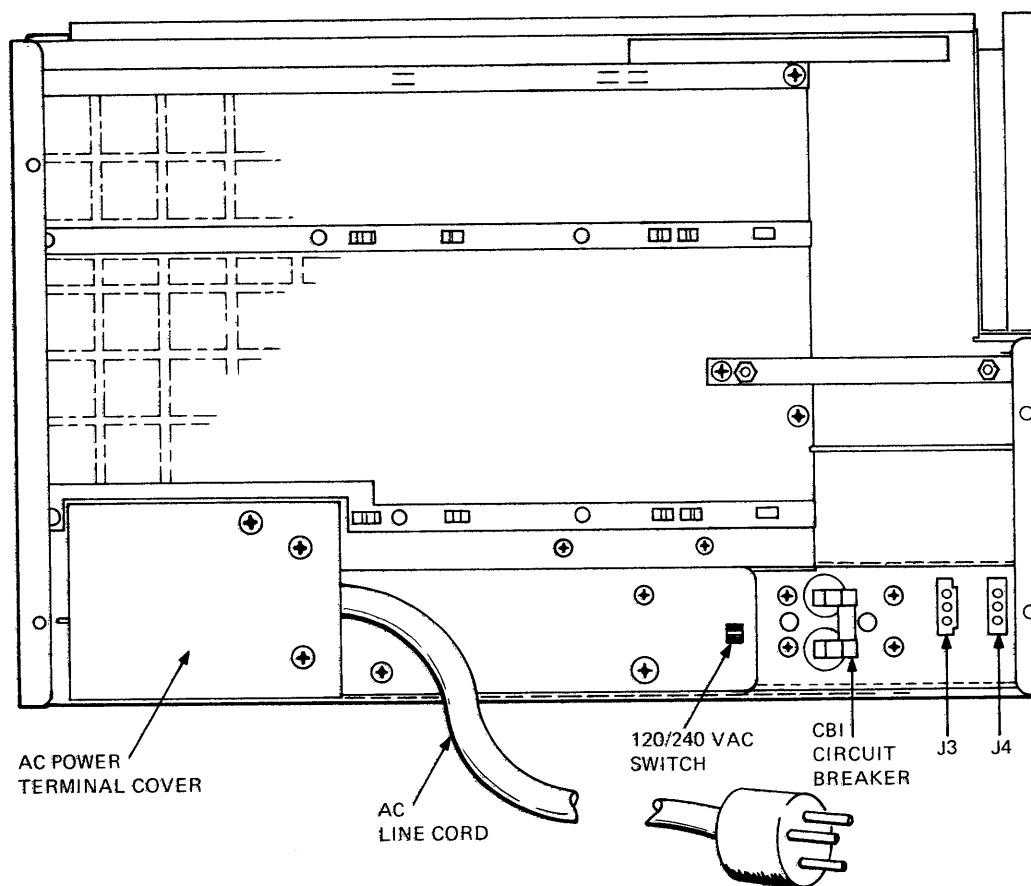
2.2.1 Power Connections (AC)

The BA11-AA, -AB mounting boxes are supplied with a 2.74 m (9 ft) line cord attached to the rear of the unit. Figure 2-2 shows the ac line cord, circuit breaker, and connectors. The line cord plug may be connected to an 872-D, -E power controller unit (or equivalent) or directly to the ac power receptacle at the site.



TK-3529

Figure 2-1 BA11-A Mounting Box Packaging

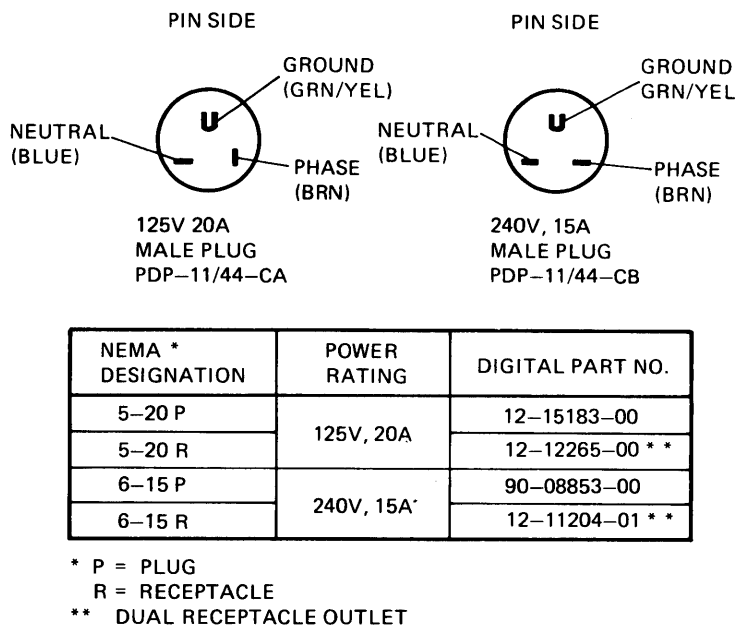


TK-4389

Figure 2-2 Mounting Box, Rear Panel Components

The 872-D, -E power controller, used in systems such as the PDP-11X44, allows the key switch on the control panel to apply and remove ac power from all units connected to the switched outputs of the power controller. In addition, the power control bus, used to control the ac power internally, can be routed externally to switch ac power from any other power control unit.

Figure 2-3 shows the type of connector plugs and receptacles used, and the DIGITAL part numbers for the connectors. The color of the cable wires connected to the plug is also indicated. The NEMA 5-20 P plug is attached to the BA11-AA cable. The NEMA 5-20 R and 6-15 R are dual-receptacle outlets that can be installed within a wall outlet box or a power distribution unit.



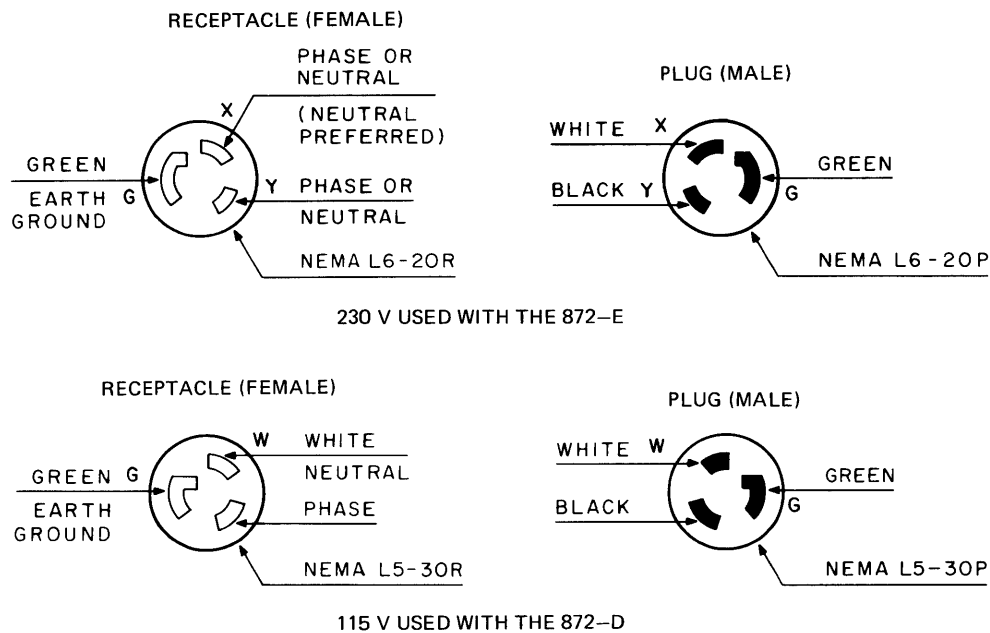
TK-4390

Figure 2-3 BA11-AA, -AB AC Connector Specifications

The 872-D, -E power controller is supplied with a 4.57 m (15 ft) cord and plug that connects to a receptacle at the site. Figure 2-4 shows the cord connector configurations and the DIGITAL part numbers for the plugs and receptacles.

2.2.2 AC Power Control Cabling

Figure 2-5 shows a typical cabling configuration that enables control of the ac power from the control panel keyswitch on the BA11-A CPU unit. The power control bus cabling also contains an over-temperature line which will remove the ac power from the units connected to the switched receptacles of the 872-D, -E unit when the internal temperature of a unit exceeds a specified level.



CONNECTOR SPECIFICATIONS

MODEL NUMBER	POWER	RATING	PLUG NEMA CODE	RECEPTACLE (SUPPLIED BY CUSTOMER)	
				NEMA CODE	DEC PART NO.
872-D	115 V	30 A	L5-30P	L5-30R	12-11194
872-E	230 V	20 A	L6-20P	L6-20R	12-11191

TK-4391

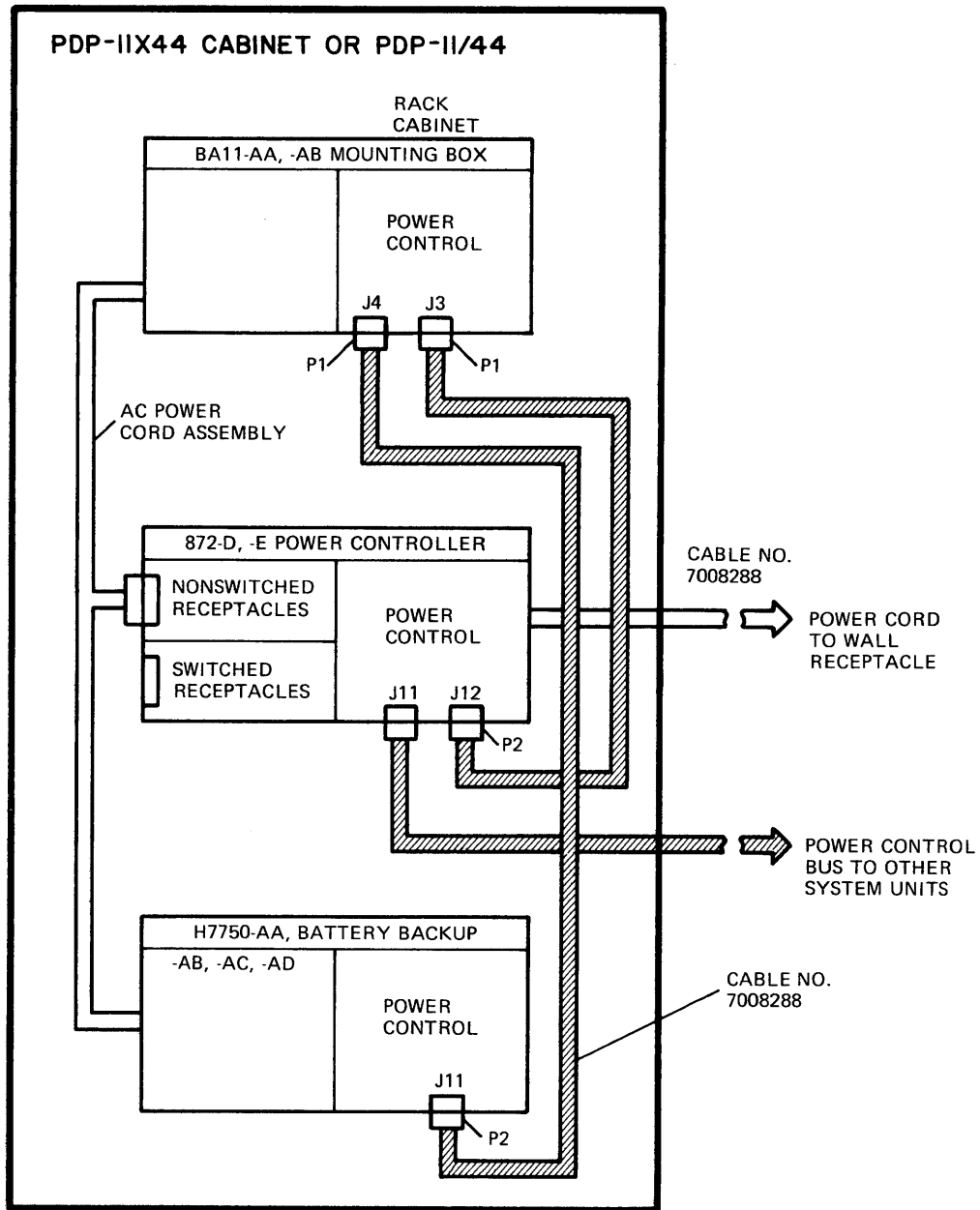
Figure 2-4 872-D, -E Power Controller Unit AC Connector Specifications

2.2.3 120 Vac to 240 Vac Power Supply Conversion

The H7140 power supply can be converted to operate with either 120 Vac input power or with 240 Vac input power. The conversion requires the replacement of the input power cable assembly. This assembly consists of the line cord, connector cover, and plastic bezel. Table 2-1 lists the DIGITAL part number for each assembly.

Table 2-1 Input Power Cable Assembly

Part No.	Input Power	Power Supply Designation
7016478-00	120 Vac	H7140-AA
7016478-01	240 Vac	H7140-AB



TK-5637

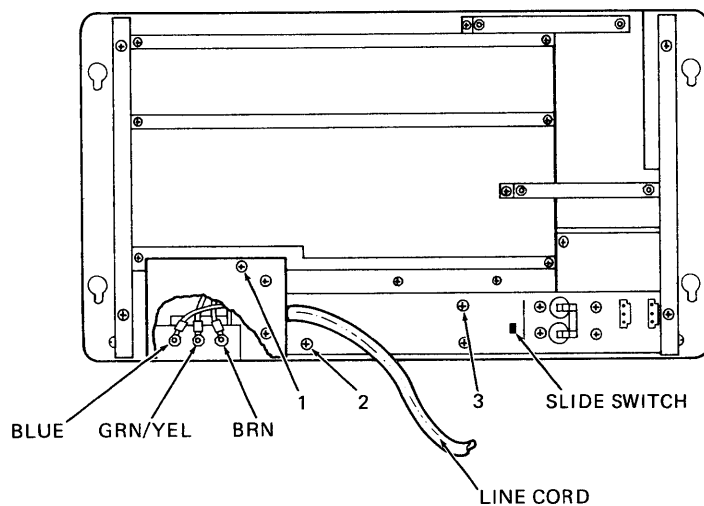
Figure 2-5 Typical Power Control Cabling

To convert the power supply from one voltage to another, perform the following procedure.

1. Remove the ac power cord connector of the power supply from the power controller receptacle or wall receptacle.
2. Remove the cable clamps or fasteners used to secure the power cord to the cabinet frame.
3. Remove and retain the 8-32 (1) screw in the connector cover and the two 8-32 screws and washers (2) and (3) shown on Figure 2-6.
4. Slide the cable assembly away from the supply so that the three 10-32 nuts that secure the line cord leads to the filter assembly are accessible.
5. Remove the nuts using a 3/8 inch nut driver and remove the line cord assembly.
6. Change the position of the 120 V/240 V slide switch S1 to the position that corresponds to the voltage of the replacement line cord assembly. When the switch is in the up position, 120 Vac is selected, and when in the down position, 240 Vac is selected.
7. Secure the replacement line cord assembly to the cabinet frame using the hardware removed in steps 3 and 5.

NOTE

The plastic bezel holds switch S1 in the position corresponding to the voltage of the mounted line cord assembly.



TK-3658

Figure 2-6 H7140 Unit, AC Power Cord Assembly Removal

2.3 OPTIONAL UNIT INSTALLATION

2.3.1 872-D, -E Power Controller Installation

The 872-D, -E power controller may be used with the BA11-A mounting box. To install a unit into a standard cabinet or rack, perform the following procedures.

1. Mount the 872-D, -E unit onto the cabinet rails using the hardware supplied with the unit.

NOTE

The power controller can be mounted at the front or rear of the cabinet.

2. Connect the ac line cords from the units within the cabinet to the appropriate ac power receptacles (switched or unswitched) on the power controller. The BA11-A CPU (PDP-11/44) must be connected to an unswitched receptacle in the power controller unit.
3. Route the ac power cords away from the signal cables and secure the cords with cable clamps or tie wraps.
4. Attach connector P1 of cable assembly (DIGITAL no. 7008288) to connector J3 or J4 located at the rear of the H7140 power supply (Figure 2-2).
5. Attach connector P2 of the cable assembly to connector J11 or J12 of the power controller unit (Figure 2-7).
6. Set the LOCAL/OFF/REMOTE switch of the power controller unit to the REMOTE position.
7. Connect the ac power cord of the 872-D, -E power controller to the main power receptacle at the site.
8. Set the circuit breaker of the power controller to the ON position (up).

2.3.2 H7750 Battery Backup Unit Installation

The H7750 battery backup unit may be installed in a system cabinet or in any standard 48.2 cm (19 in) mounting rack. For example, in the PDP-11X44 system cabinet, the H7750 unit is mounted on the vertical cabinet rails at the lower front of the cabinet. The battery backup cable assembly (DIGITAL No. 1700177) connects from the rear of the H7750 to the H7140 power supply in the mounting box. To connect the unit, perform the following procedures.

1. In a PDP-11X44 system cabinet or similar installation, perform steps 1, 2, and 5 through 11 of Paragraph 4.2.1.1.
2. In installing the H7750 into a 48.2 cm (19 in) cabinet where the mounting box is attached to slides, perform steps 1, 2, and 5 through 9 of Paragraph 4.2.2.1.
3. Mount the H7750 unit to the cabinet rails using the hardware supplied with the unit. Make certain the toggle switch on the front panel of the H7750 unit is in the OFF position.

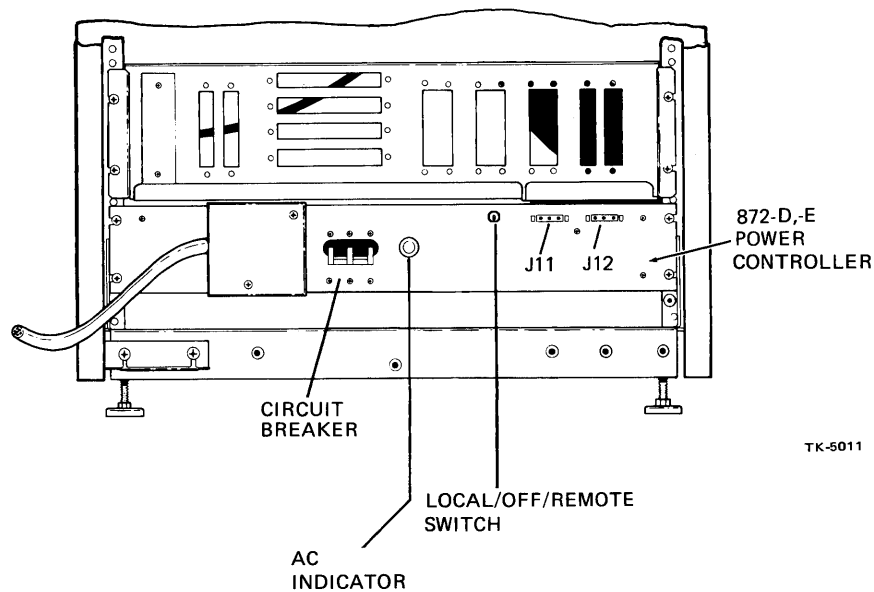


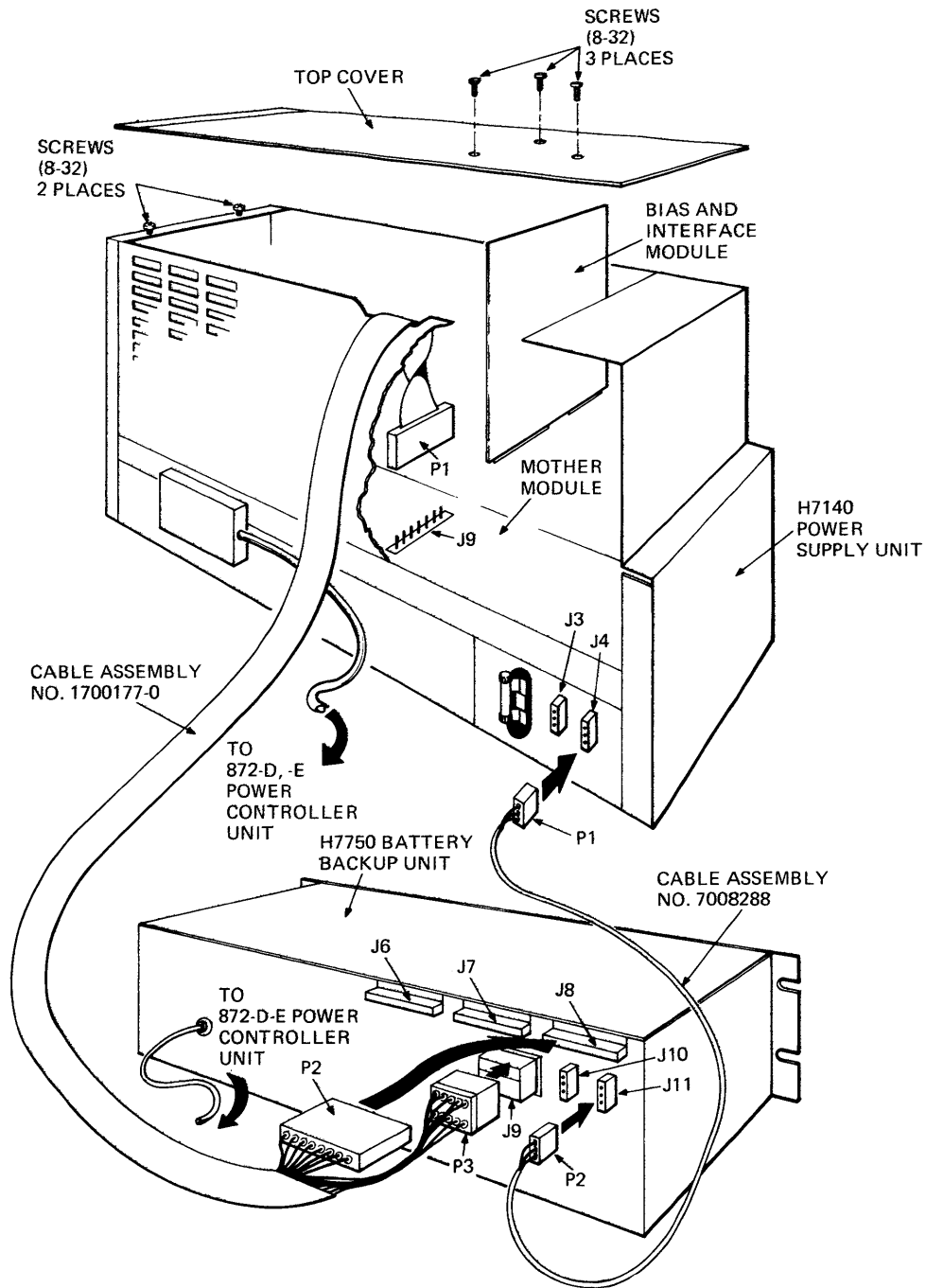
Figure 2-7 872-D, -E Power Controller Front Panel Locations

4. At the rear of the H7750 unit, attach connector P3 of the cable assembly 1700177-0) to J9 and connector P2 to J8 (Figure 2-8).
5. Connect the ac power cord plug of the H7750 unit to an *unswitched* receptacle of the power controller.
6. Route the cable assembly through the rear of the cabinet and up to the rear of the mounting box. Allow enough cable slack to prevent tension on the cable or cable connectors.

CAUTION

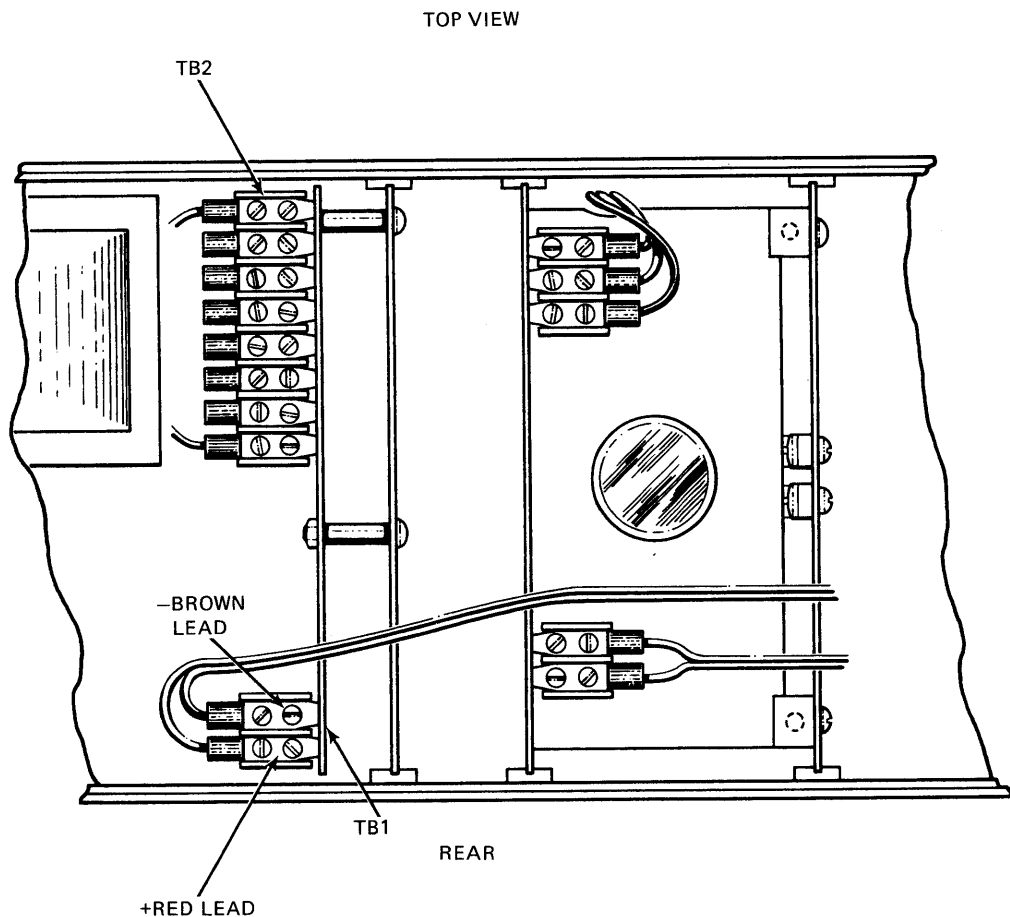
The H7140 power supply contains dangerous voltage and high current capabilities. Allow five minutes after the ac power is removed from the supply to ensure proper discharge of the power supply currents.

7. Remove and retain the three (8-32) screws that secure the top cover of the H7140 power supply. These screws are located in the depressions on the top cover (Figure 2-8).
8. Loosen the two (8-32) screws that secure the end of the top cover to the power supply. Do not remove the screws.
9. Slide the cover assembly away from the screws loosened in step 8.
10. Using a multimeter set to the 300 Vdc range, measure the voltage across pins 1 and 2 of TB1 as shown on Figure 2-9. The voltage should be less than 20 V after the 5 minute interval.
11. Remove the bias and interface module (Figure 2-8) by sliding the module up.



TK-5009

Figure 2-8 H7750 Unit, Cable Connections



TK-5010

Figure 2-9 H7140 Unit, +300 Vdc Test Location

12. Attach connector P1 of the cable assembly to J9 on the mother module of the power supply. The black leads of the cable assembly should be positioned toward the front of the mounting box. The notches in the connectors will interlock when the connectors are properly positioned.

NOTE

When attaching P1 to J9, make sure all the pins of J9 are inserted into P1. If all the pins of J9 are not inserted into P1, the battery backup unit and power supply will be damaged.

13. Dress the cable up and over the depression in the rear panel of the power supply.
14. Replace the bias and interface module that was removed in step 11. Ensure that the connector on the bottom of the module mates correctly with the pins that project upward from the surface of the mother module.

15. Replace the top cover of the power supply that was removed in steps 7 through 9.

NOTE

Several leads of the power supply are routed close to the top cover. When replacing the cover, ensure that none of the leads will be punched or pierced when the cover is mounted.

16. In the PDP-11X44 or similar cabinet, perform steps 16 through 20 of Paragraph 4.2.1.3 to replace the top cover assembly.
17. If an overtemperature control of the output of the H7750 is desired, install the cable assembly (DIGITAL No. 7008288). Connect P1 of the cable assembly to connector J3 or J4 at the rear of the H7140 power supply. Connect P2 of the cable assembly to connector J10 or J11 of the H7750 battery backup unit (Figure 2-8).
18. Position the cables previously installed away from sharp objects and insure that no cable strain exists when the mounting box is extended to its maintenance position.
19. Secure the cables to the cabinet rails, or sections, using the existing cable clamps or other cable fasteners.
20. Apply ac power to the 872-D, -E power controller unit by setting the circuit breaker to the ON (1) position (Figure 2-7).
21. Ensure that the ac circuit breaker at the rear of the BA11-A mounting box is in the ON (1) position.
22. Set the toggle switch on the front of the H7750 battery backup unit to the ON (1) position.
23. Ensure that the rotary key switch on the control panel is in the LOC, LOC DSBL or STD BY position.
24. Ensure that the DC ON and BATT indicators of the control panel are lighted. The BATT indicator is on continuously if the batteries are fully charged, or the indicator flashes slowly if the batteries are charging (less than 90 percent of full charge).
25. Verify that the battery backup unit is functioning by performing the following steps.
 - a. Deposit a BRANCH SELF instruction (777₈) at location 200₈.
 - b. Load address 200₈ and start the CPU.
 - c. Disconnect the BA11-A ac power cord from the receptacle. The BATT indicator light will blink fast.

NOTE

The keyswitch should not be turned to the DC OFF position when performing this test. This would remove all power from memory and destroy its contents.

- d. Reconnect the BA11-A ac power cord to the receptacle.

- e. Examine location 200g. Its contents should be 777g, the BRANCH SELF instruction, if the battery backup unit is functioning properly.

2.4 OPTIONAL BACKPLANE MODULE ASSIGNMENTS

The BA11-A mounting box may contain optional backplane assemblies in addition to the basic CPU backplane (PDP 11/44) installed in the unit.

The slot locations of the optional backplanes are divided into three categories: standard UNIBUS, modified UNIBUS, and small peripheral control (SPC). Particular areas of the backplane are reserved for the different types of modules as shown in Figure 2-10.

The DD11-CK and DD11-DK are general purpose backplanes. The standard UNIBUS locations contain all the UNIBUS connections. Rows A and B of slot 1 are the beginning of the UNIBUS in the DD11-CK backplanes and DD11-DK, and should be occupied by the BC11-A UNIBUS cable or a M9202 UNIBUS connector. Sections A and B of slot 9 in the DD11-DK backplane, or of slot 4 in the DD11-CK backplane, are the end of the UNIBUS on the backplane. These sections should be occupied by the BC11-A UNIBUS cable, M9202 UNIBUS connector, or an M9203 terminator module.

Other dedicated backplanes, such as the RH11, DH11, RK22, or RK6/711, are available as options. The UNIBUS inputs and outputs and terminator usage are the same as described for the general purpose backplanes, however, the module types and their locations are dedicated in these backplanes.

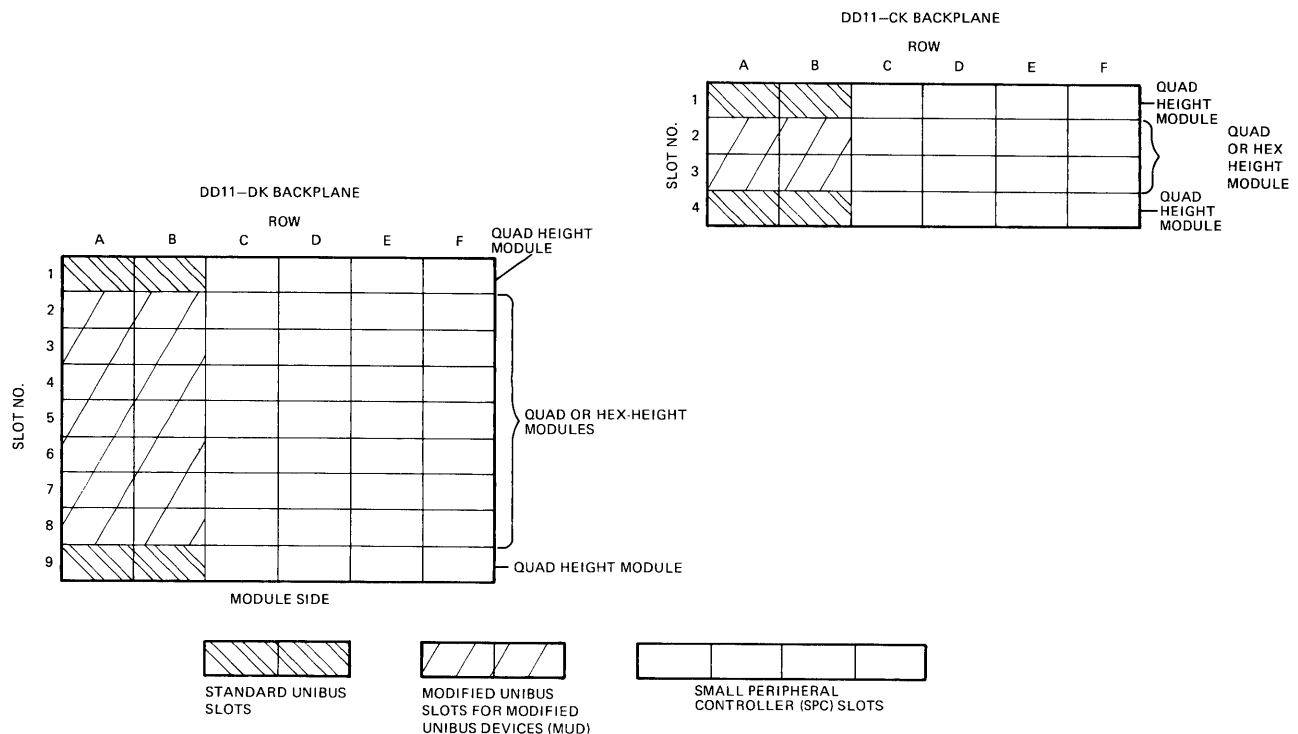


Figure 2-10 Optional Backplane Connector Assignments

CHAPTER 3

FUNCTIONAL OPERATION

This chapter describes the functional operation of the H7140 power supply, the 872 power controller unit, and the H7750 battery backup unit. Refer to the appropriate manuals listed in Table 1-2. The field maintenance print sets, also listed in Table 1-2, contain the assembly drawing related to these units and the circuit schematics (CS) referenced in this chapter.

3.1 H7140 POWER SUPPLY FUNCTIONS

The H7140-AA (120 Vac) and the H7140-AB (240 Vac) units are high-frequency-switching power supplies that provide the dc voltages for the logic modules and memory modules installed in the BA11-A mounting box. The power supply also generates the square wave voltage used to power the fans within the fan assembly. Therefore, it is not necessary to change fans when converting from 120 Vac to 240 Vac operation.

3.1.1 Signals and Voltages

Figure 3-1 shows the signals and voltages that are transferred between the power supply and the assemblies and units within the BA11-A mounting box and between the power supply and external units. The 872-D, -E power controller unit is included with the PDP-11/X44 or similar system. The H7750 battery backup unit is optional with the PDP-11/44 or other PDP-11 systems mounted in the BA11-A mounting box.

3.1.1.1 Internal Signals and Voltages – Three signals are transferred between the control panel and the power supply. Table 3-1 lists the signals and their functions.

Table 3-1 Control Panel Signals

Signal	Function
DC ON (L)	From the control panel keyswitch S1-B. Set to ground when the positions LO-CAL and LOC DSBL are selected. Enables all the dc voltage outputs of the power supply.
STANDBY (L)	From the central panel keyswitch S1-B. Set to ground when position STDBY is selected and disables the logic module dc voltage outputs (+5 V, +15 V, –15 V). Fan and memory voltage outputs (+5 B, +12 B, –12 B) remain enabled.
BATT MON	From the power supply. Controls the BATT indicator on the control panel when the H7750-AA, -AB battery backup unit is included in the system.

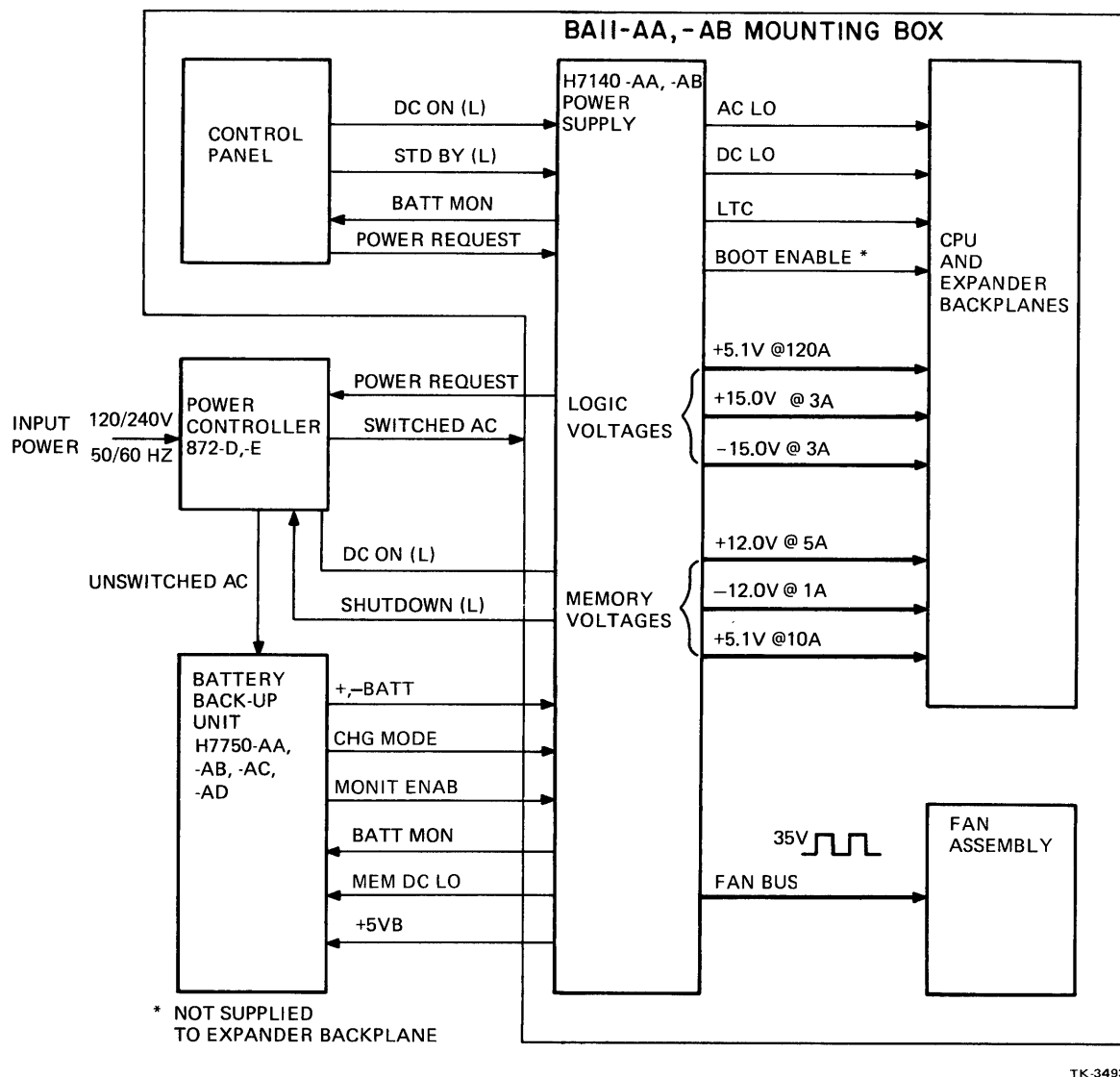


Figure 3-1 Power Supply, External Signals and Voltages

In addition to the output voltages from the power supply, several signals are transferred between the power supply and the CPU and expander backplanes. Table 3-2 lists the signals and their functions.

3.1.1.2 External Voltages and Signals – The 872-D, -E power controller distributes and controls the ac input voltage to the power supply and other units. The power controller contains a circuit breaker that can remove all power from the switched and unswitched power receptacles. Control signals from the power supply can also remove the ac power from the switched receptacles. Table 3-3 lists the control signals and their functions.

3.2 POWER SUPPLY OPERATIONS

Figure 3-2 show the interconnections of the circuits and modules within the H7140-AA, -AB power supply. The input voltage is selected by switch S1 which is located at the rear of the power supply. The ac voltage is received by the input assembly which performs the function of a voltage doubler when the 120 Vac input is selected, and of a full wave rectifier when the 240 Vac input is selected. The dc outputs of the input assembly provide the voltage to the memory inverter module, to the logic inverter module, and to the bias and interface module via the mother module. The bias and interface module generates the bias voltages required by the regulators, the voltage generator circuits, and the fans. Figure 3-3 is a functional block diagram of the power supply.

Table 3-2 Backplane Signals

Signal	Function
AC LO	From the power supply. Asserted to indicate to the processor and bootstrap device logic that the ac power, as measured by the 300 Vdc bus to the power supply, is not within required limits.
DC LO	From the power supply. Asserted to indicate to the processor, memory, and device interfaces that the dc power from the power supply is not within required limits.
LTC	Line Time Clock. From the power supply. Asserted every cycle of the line power to indicate real time to the processor.
BOOT ENAB	From the power supply. Asserted to enable the bootstrap loader program to occur when power is applied to the system. If the content of main memory has been maintained by the battery backup unit after a power failure, a power failed restart sequence can be initiated instead of the power-up reboot.

Table 3-3 Power Controller Signals

Signal	Function
POWR REQUEST	From the LOCAL or LOC DSBL position of the keyswitch on the CPU control panel. Set to ground to enable the ac power at the switched receptacles.
SHUTDOWN	From the overtemperature sensor in the H7140-AA, -AB power supply. Set to ground during an overtemperature condition to remove the ac power from the switched receptacles.

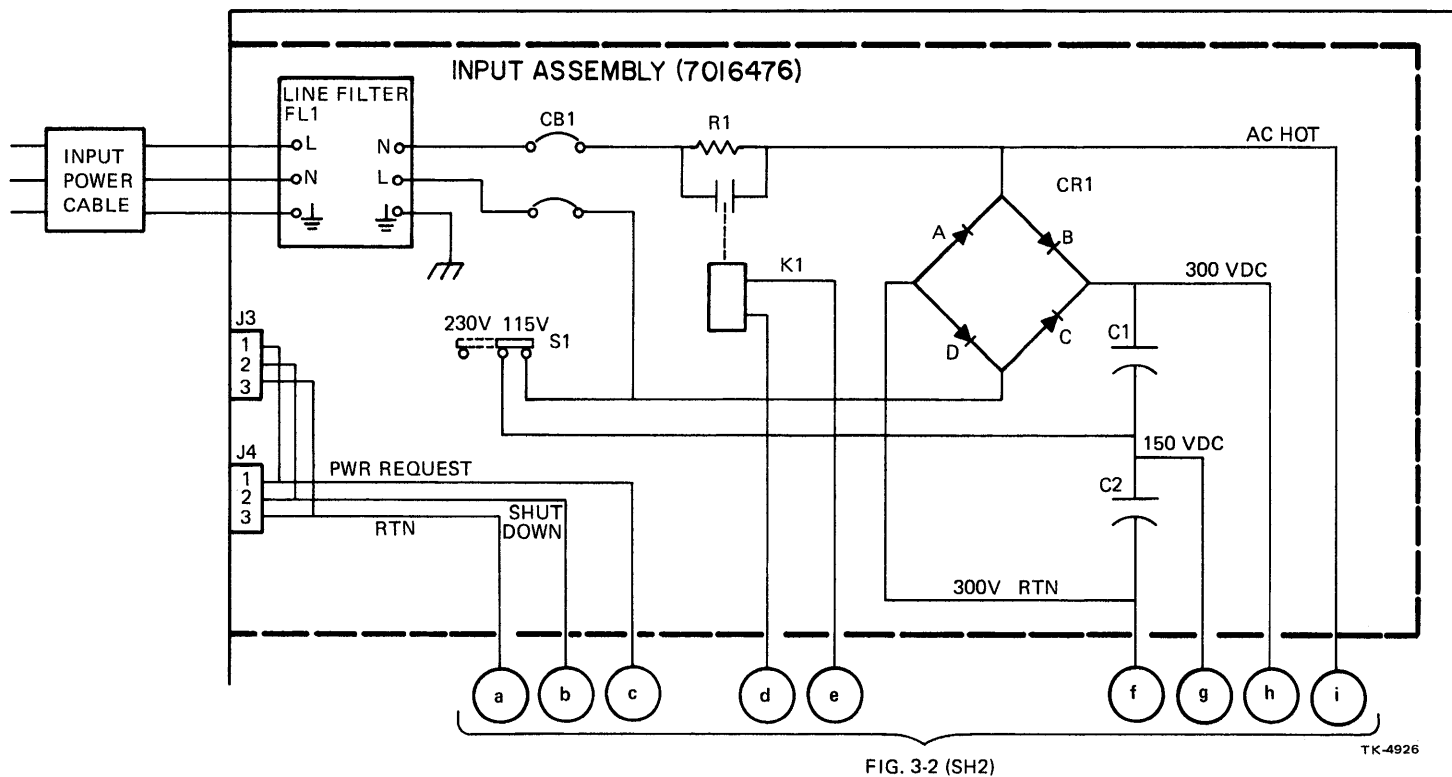


Figure 3-2 H7140-AA, -AB Power Supply Interconnection Diagram
(Sheet 1 of 3)

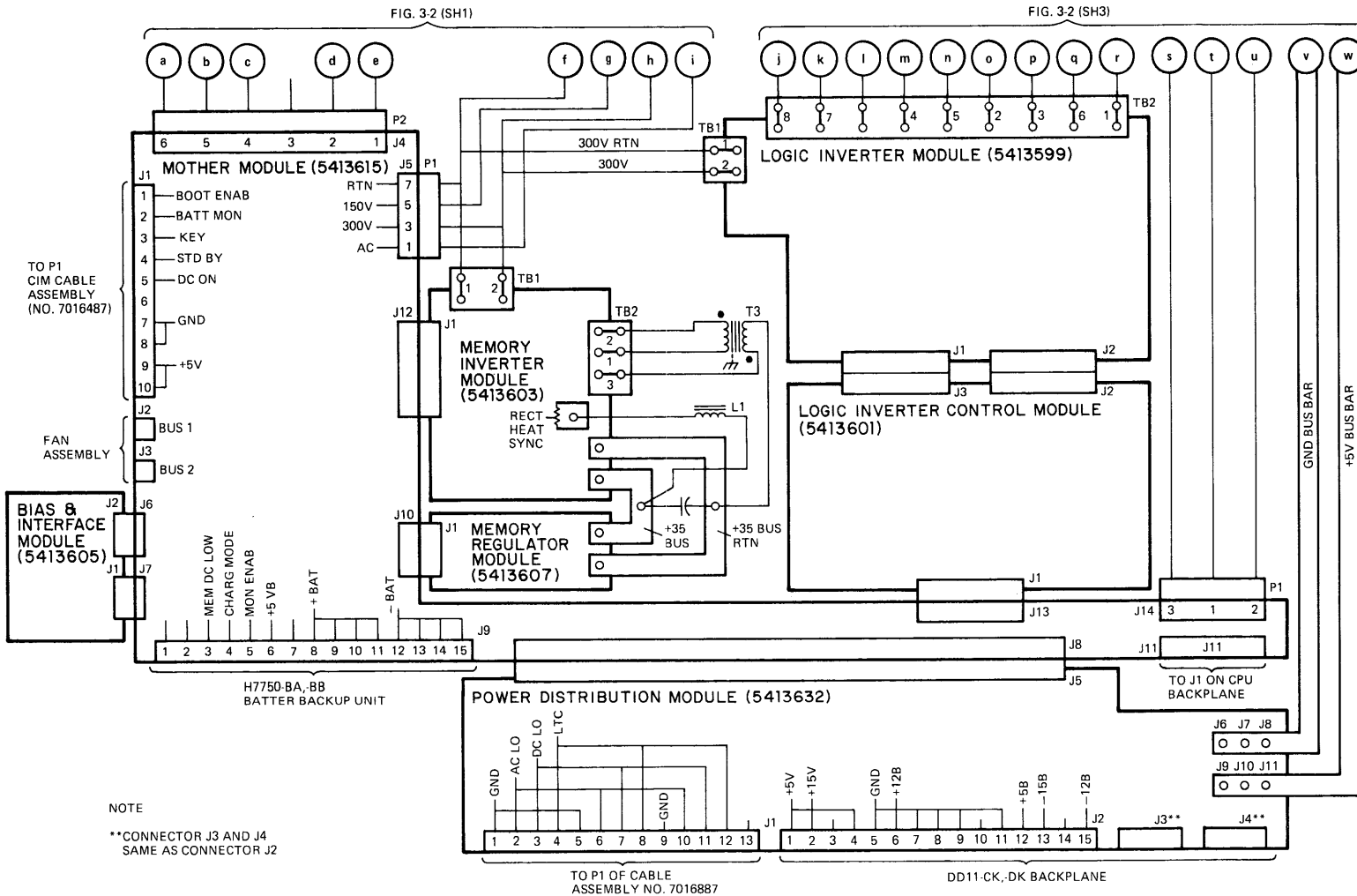


Figure 3-2 H7140-AA, -AB Power Supply Interconnection Diagram
(Sheet 2 of 3)

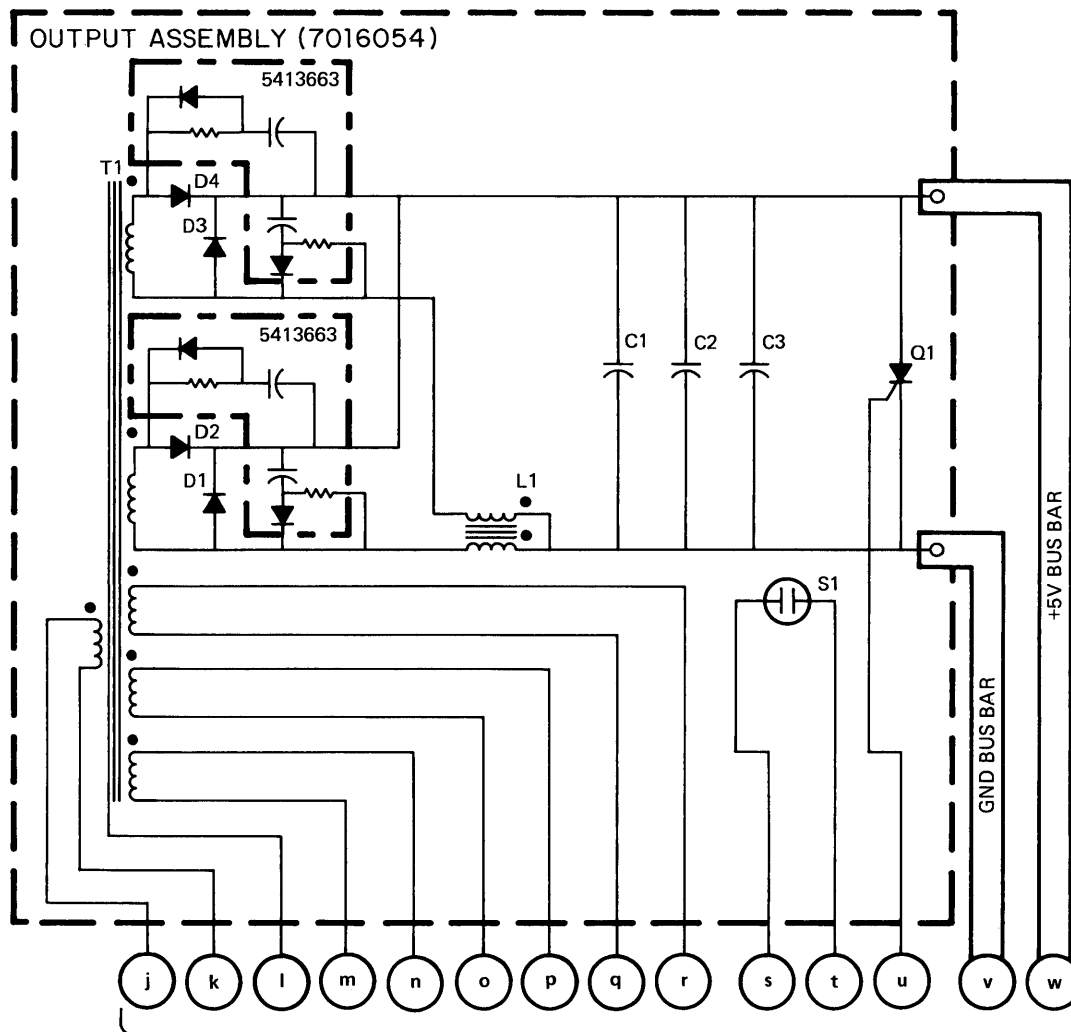


FIG. 3-2 (SH2)

TK-4924

Figure 3-2 H7140-AA, -AB Power Supply Interconnection Diagram
(Sheet 3 of 3)

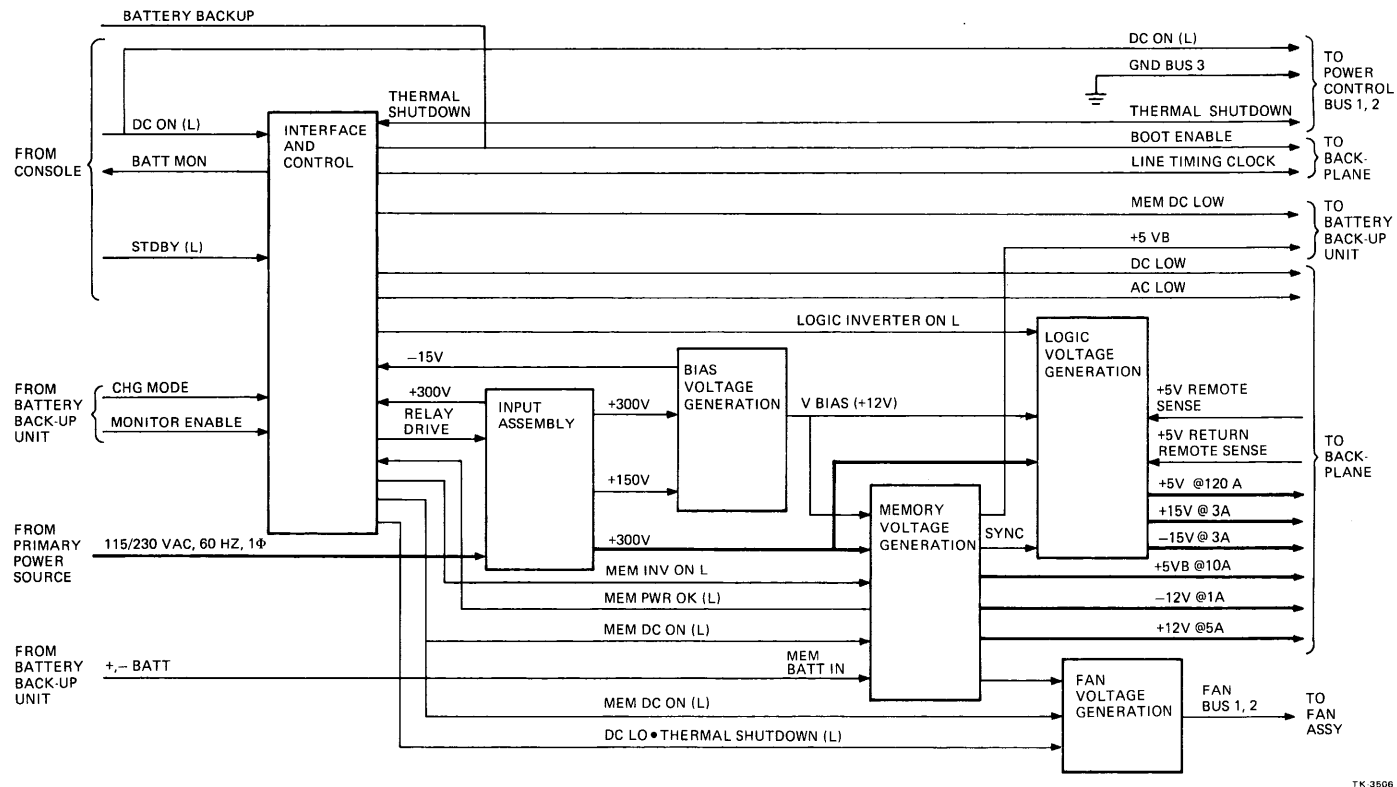


Figure 3-3 Power Supply Functional Block Diagram

3.2.1 Input Assembly

Figure 3-4 is a simplified diagram of the circuit schematic (CS7016476). The ac input from the cable assembly is connected to the EMI line filter FL1. The output of the filter connects to circuit breaker CB1 and to the in-rush current limiting circuit consisting of resistor R1 and relay K1. When ac power is applied, relay K1 is deenergized and resistor R1 limits the input current. When the dc output voltage of the input assembly becomes 230 V, the relay is energized, the relay contacts close, and resistor R1 is bypassed. When switch S1 is in the 120 V position the input circuit operates as a voltage doubler. When the N terminal of the FL1 is more positive than the L terminal, current flows through CB1, the relay contacts, R1, and diode CR1-B to charge capacitor C1. The current return is through S1, CB1, and to the L input of FL1.

On the next half cycle of the ac voltage, the L terminal of FL1 is more positive than the N terminal. Current flows through CB1 and switch S1 to charge capacitor C2. The return current is from C2 through diode CR1-A, the relay contacts, R1, CB1 and to the N terminal. Once relay K1 is energized, the charge across C1 and C2 is approximately twice the peak value of the input ac voltage.

When the switch S1 is set to the 230 V position, the circuit provides full wave rectification of the input ac. With terminal N more positive than L, current flows through CB1, the relay contacts or resistor R1, diode CR1-B, and charges capacitors C1 and C2. The return current is through CR1-D, CB1, and the L terminal.

On the next half of the ac cycle, terminal L is more positive than terminal N. Current flows through CB1, diode CR1-C, and again charges capacitors C1 and C2. The return current flows through CR1-A, or the relay contacts, or R1, CB1, and terminal N.

3.2.2 Bias and Interface Circuits

Figure 3-4 shows the functions associated with the bias and interface module. The signals and voltages developed by this module are transferred through the mother module to the other circuits in the power supply. The bias and interface module monitors the voltages and signals and controls the power supply operation.

3.2.2.1 Bias Voltage – Two bias voltages are developed and distributed to the modules in the power supply. Sheet 1 of Figure 3-4 shows the circuits used to generate the +12 V and –15 V bias. The +300 V from the input assembly is switched at a 20-kHz rate at transformer T1, mounted on the mother module. The switching circuit is located on the bias and interface module. The output of transformer T1 is rectified and filtered to produce the two bias voltages +12 V and –15 V. The +12 V bias voltage is applied to relay K1 of the input assembly. When the RELAY DRIVE signal from the bias and interface module is asserted, the relay is activated and the relay contacts bypass the series limiting resistor in the ac line.

3.2.2.2 DC Voltage Monitoring – Sheet 2 of Figure 3-4 shows the circuit used to monitor the dc voltages developed by the input assembly circuits. The +300 Vdc is applied as an input to the +300 V monitor circuit. When ac power is initially applied to the power supply, relay K1 on the input assembly (Figure 3-2) is deenergized and allows the input ac current to flow through the current limiting resistor R1. When the dc voltage to the 300 V monitor circuit becomes 230 V or greater, the output of the relay drive current energizes relay K1 and the relay contacts bypass resistor R1.

3.2.2.3 Normal Operation – When the keyswitch on the front panel is set to the LOCAL or LOC DSBL position, the DC ON (L) signal to the bias and interface module (Figure 3-4, sheet 3) will be low. This signal is applied to the turn-on control logic to produce a low LOGIC INV ON L signal. The LOGIC INV ON L signal is used to enable the +5 V, +15 V, and –15 Vdc outputs of the logic inverter control module. The DC ON (L) signal is also used to enable the MEM DC ON L and the MEM INV ON L signals which generate the +5 V, +12 V and –12 V memory voltages.

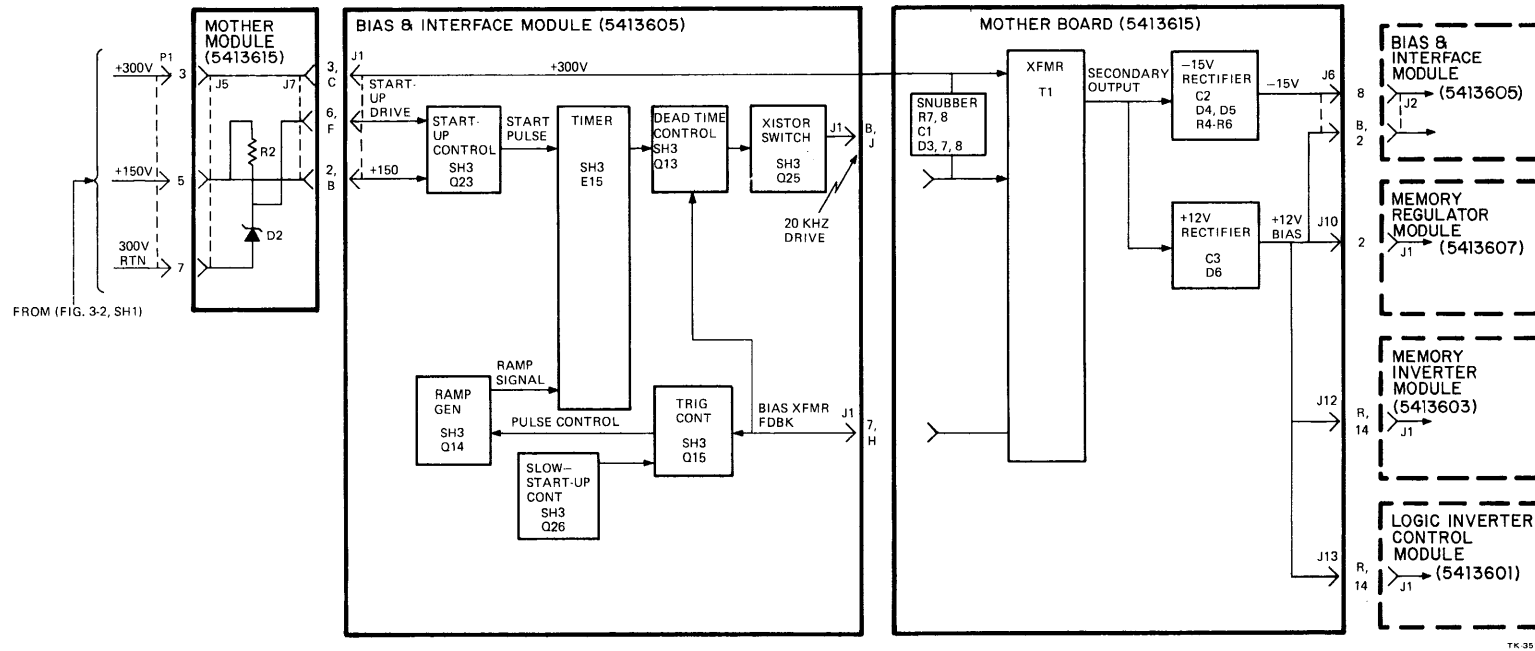
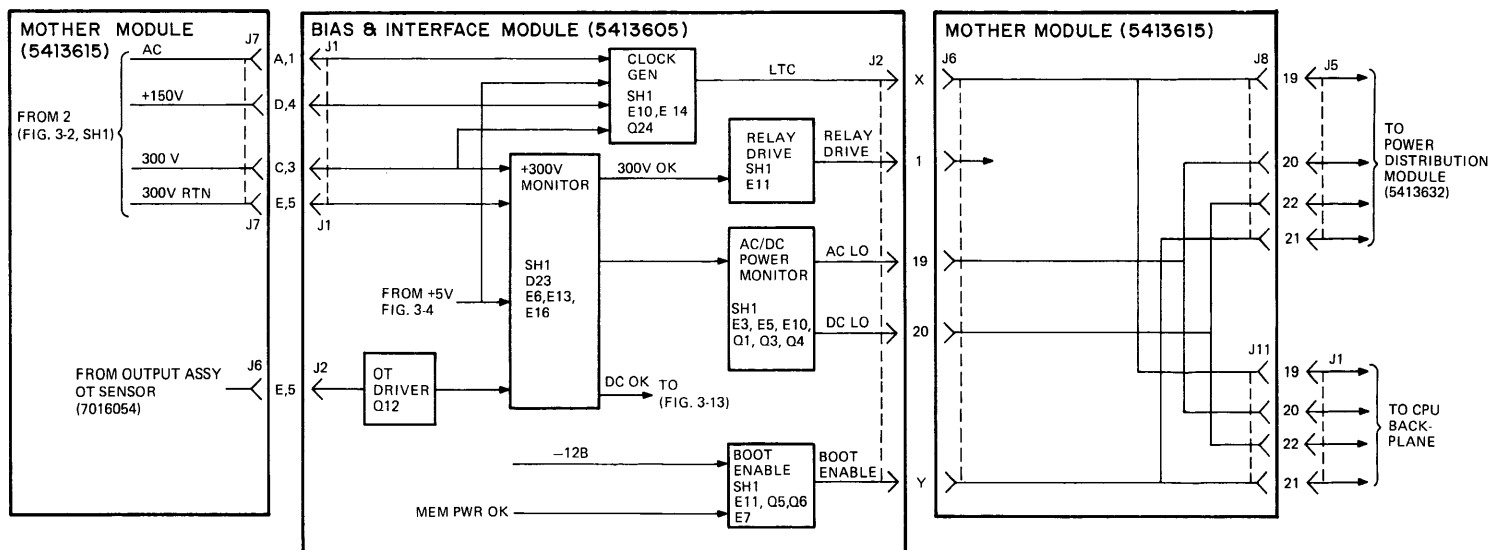
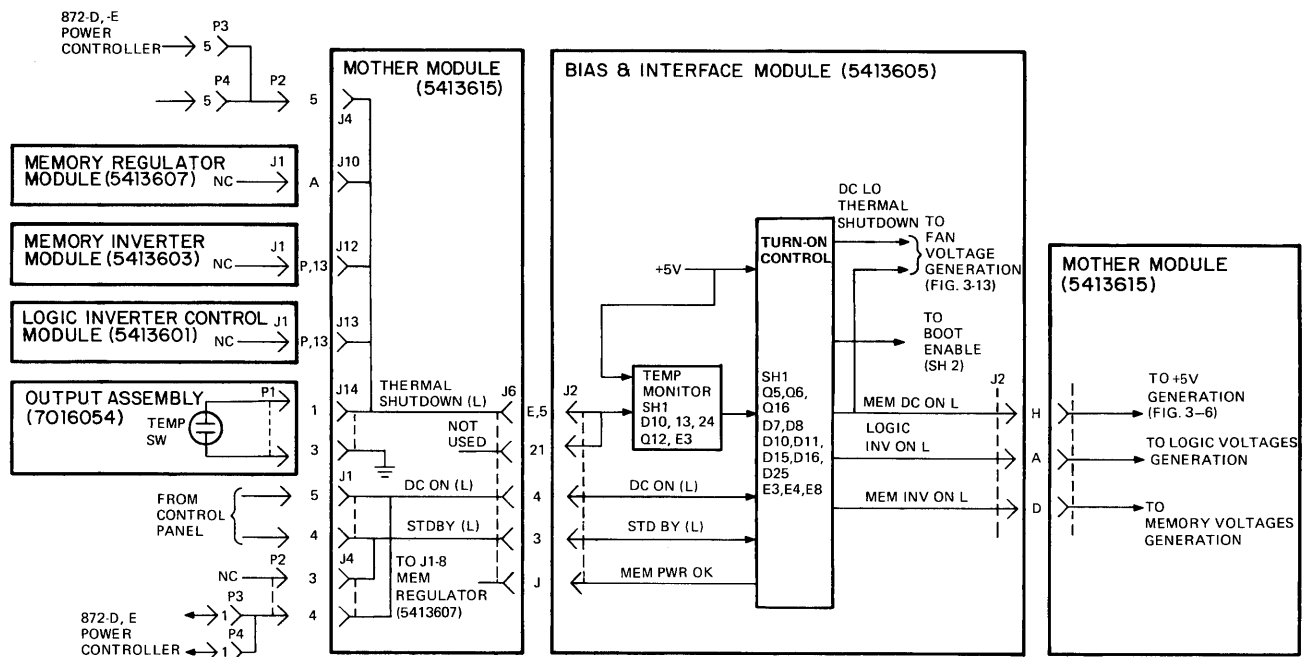


Figure 3-4 Bias and Interface Circuits, Block Diagram
(Sheet 1 of 4)



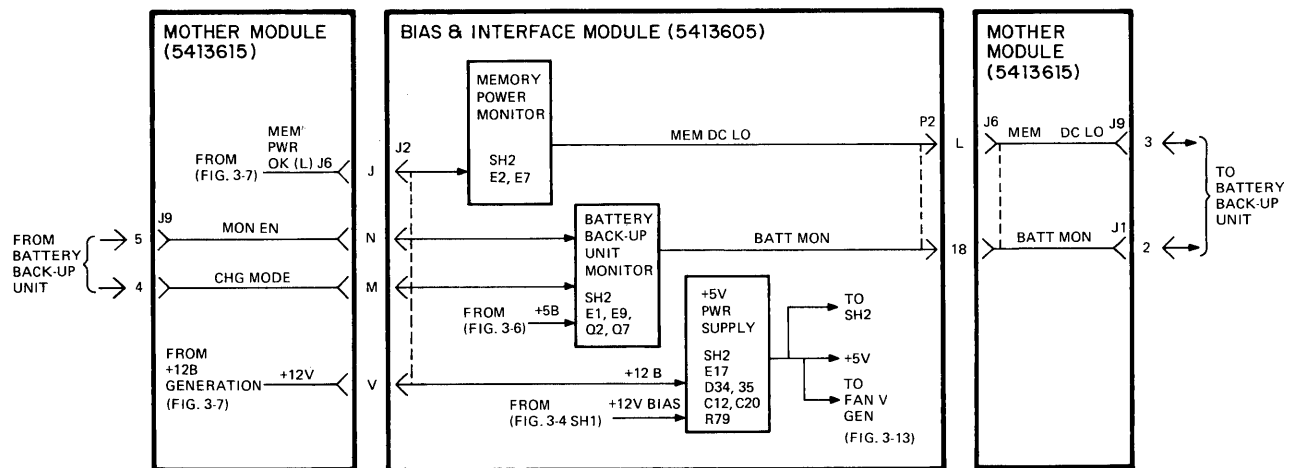
TK-3507

Figure 3-4 Bias and Interface Circuits, Block Diagram
(Sheet 2 of 4)



TK-3505

Figure 3-4 Bias and Interface Circuits, Block Diagram
(Sheet 3 of 4)



TK-3498

Figure 3-4 Bias and Interface Circuits, Block Diagram
(Sheet 4 of 4)

3.2.2.4 Standby Operation – When the keyswitch on the front panel is set to the STDBY position, the STDBY (L) signal to the bias and interface module becomes low. This signal is transferred through the mother module to the turn on control logic. The MEM DC ON L and MEM INV ON L outputs generated during normal H7140 operation remain asserted and thus enable continued operation of the memory voltages and fan voltage generation circuits. The LOGIC INV ON L output however becomes unasserted during standby operation. This inhibits operation of the logic voltages generation circuit.

3.2.2.5 Temperature Sensing – The temperature sensor (S1), mounted on the output assembly heat sink, has normally open contacts that close during an overtemperature condition. When the contacts close, a grounded input is applied to a temperature monitor circuit in the bias and interface control module. The THERMAL SHUTDOWN (L) signal inhibits the generation of MEM DC ON L, LOGIC INV ON L and MEM INV ON L.

3.2.2.6 Line Time Clock (LTC) Signal – The LTC signal is generated by monitoring the ac line frequency from the input assembly. The LTC output is a square-wave pulse synchronized with the frequency of the input ac (47 to 63 Hz) and isolated via photo transistor E14. The LTC signal is distributed through the mother module to the CPU and expander backplanes.

3.2.3 Memory Voltage

The memory inverter module and the memory regulator module generate and distribute three memory voltages (+5 B, +12 V and –12 V) to the CPU backplane. The memory inverter module converts the 300 Vdc supplied by the input assembly into +35 Vdc. The memory regulator module converts the +35 Vdc into +12 V, –12 V and +5 B. Figure 3-5 is a simplified diagram of the memory voltage generation circuits.

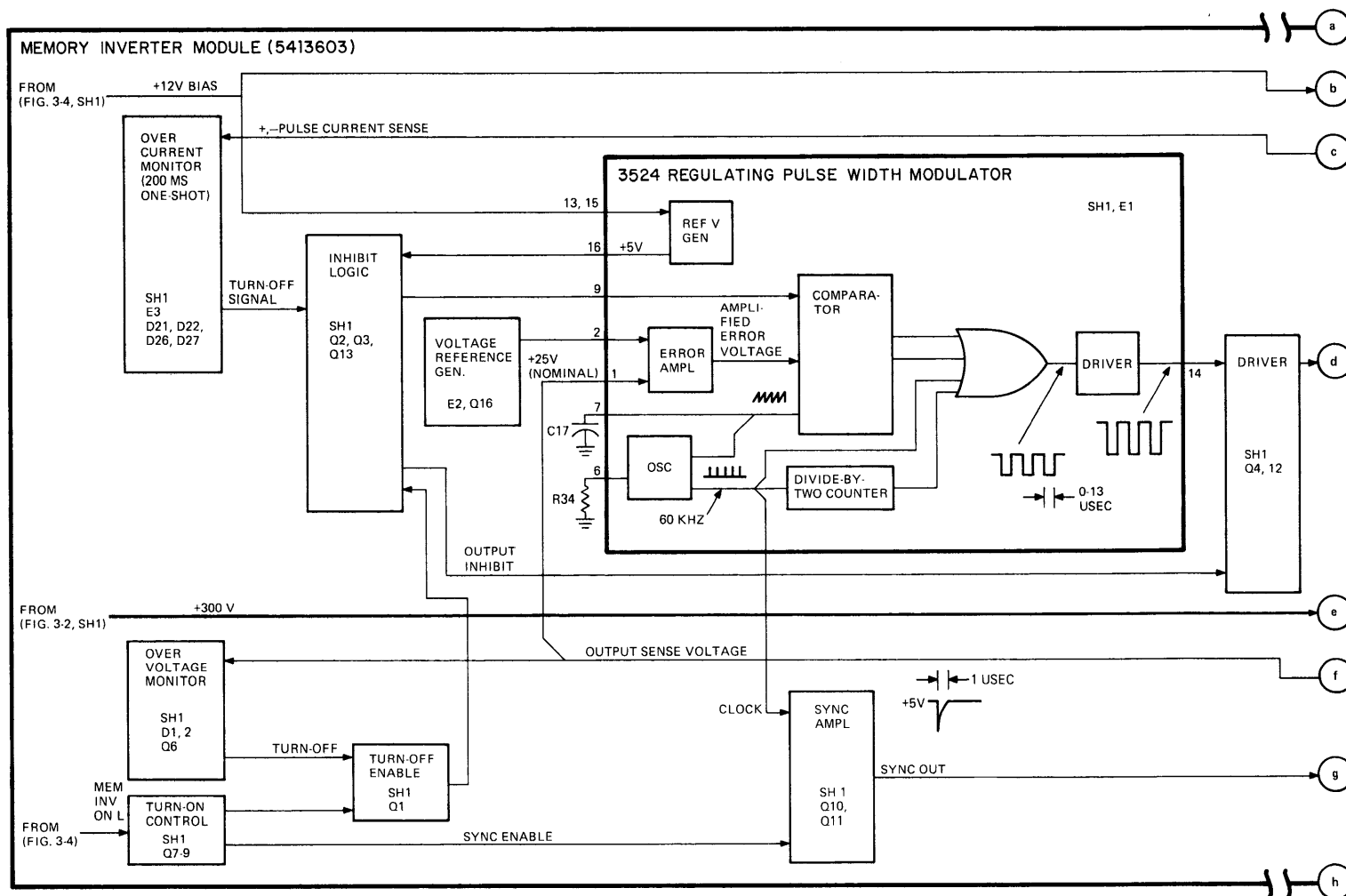
3.2.3.1 +35 Vdc – The +35 Vdc is produced by a dc-to-ac inverter circuit on the memory inverter module shown in sheet 2 of Figure 3-5. The inverter receives +300 Vdc from the input assembly and is switched at a 30-kHz rate by the output of the driver circuit.

The 3524 pulse-width modulator (sheet 1) contains a 60-kHz oscillator which provides the basic switching frequency. The 60 kHz is divided by two and the output is used to control the conduction time of the driver transistor.

The output of the rectifier filter is monitored by the pulse-width modulator and by the overvoltage monitor on the output sense voltages line. An error amplifier in the modulator compares the +35 Vdc with the voltage developed by the reference generator. When a difference is sensed between the two voltages, the output of the error amplifier varies the width of the 30-kHz pulse, thereby controlling the conduction interval of the transistor in the driver circuit.

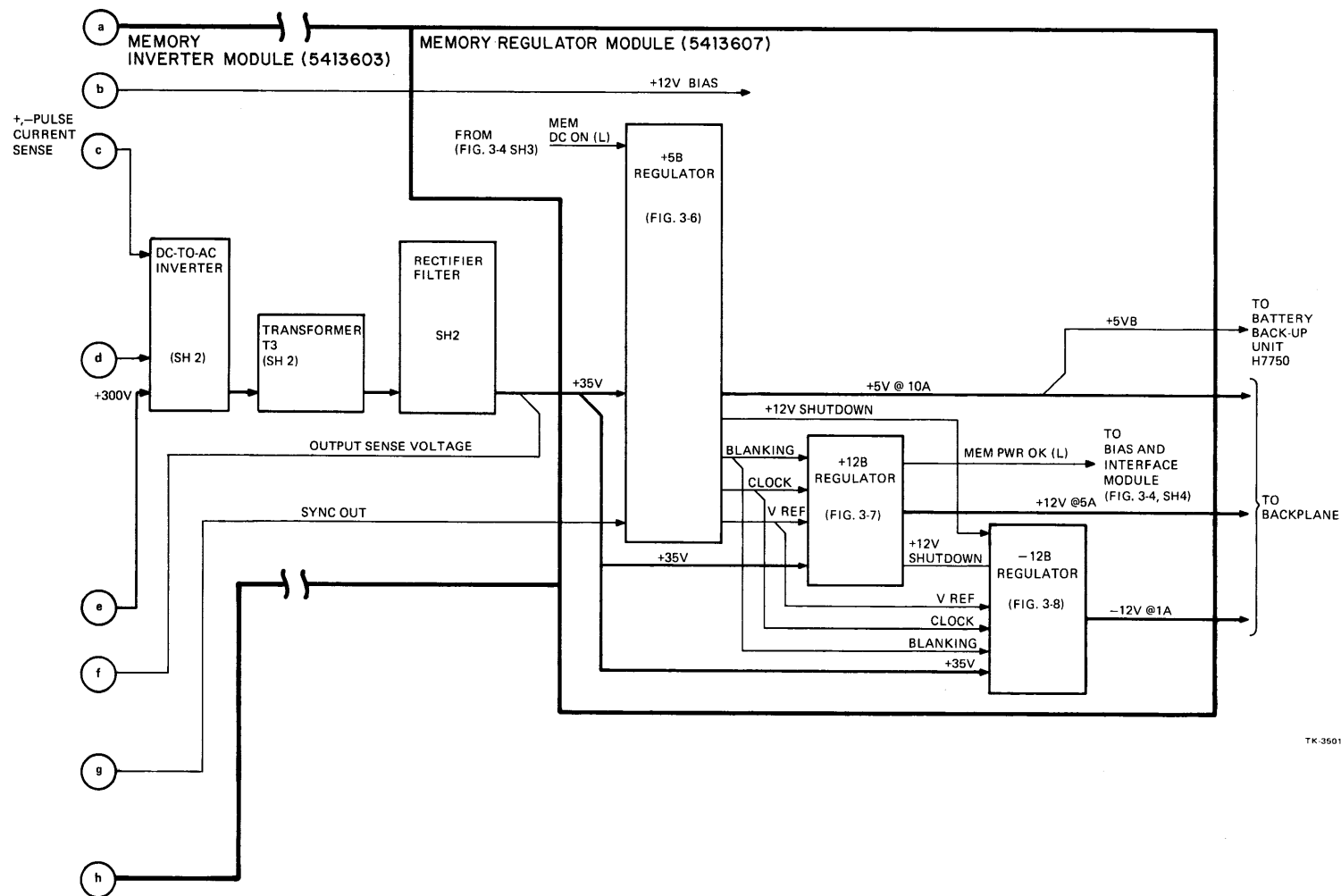
The overvoltage monitor circuit disables the generation of the +35 Vdc in the event the +35 Vdc is increased to +48 V or greater. The output of the monitor controls the turn-off enable circuit. The output of the turn-off enable circuit is applied to the inhibit logic which generates the output inhibit signal. This signal will disable the dc-to-ac inverter when the +35 V increases to the level previously specified.

The over current monitor circuit senses the current through a transformer in the dc-to-ac inverter. The + and – pulse current sense input to the monitor develops a voltage to a comparator. This voltage is compared with a reference voltage and the output of the comparator controls the operation of a one-shot pulse generator. When the pulse current sense voltage increases due to an overcurrent condition in the dc-to-ac inverter, an output of the one-shot pulse is produced. The 1.5-ms turn-off signal to the inhibit logic disables the dc-to-ac inverter in a similar manner as the overvoltage condition. The overcurrent monitor continues to generate the inhibit pulses until the overcurrent condition is removed.



TK 3500

Figure 3-5 Memory Voltage Generation Functional Block Diagram
(Sheet 1 of 2)



TK 3501

Figure 3-5 Memory Voltage Generation Functional Block Diagram
(Sheet 2 of 2)

3.2.4 Memory Voltage Regulators

The memory regulator module, shown in sheet 2 of Figure 3-5, supplies the three memory voltages to the backplane. The +35 Vdc is supplied to each of the voltage generators and the memory output voltages are controlled by the conduction times of the three independent switching regulator circuits.

If the H7750 battery backup unit is installed when the ac power fails, the +35 V is supplied by the H7750 unit. This ensures that the memory regulator module continues to generate the +5 B, +12 V, and -12 V to memory and that the bias and interface module continues to generate power for the fans.

3.2.4.1 +5 B Regulator Circuit – Figure 3-6 is a block diagram of the +5 B regulator circuit. The +5 B is generated from the +35 V by the series switch circuit consisting of transistors Q5 and Q6, and the charging circuit consisting of diode D4, choke L1, and C4. When Q5 and Q6 are off, the stored energy in L1 provides the current to the load.

The switching circuit is controlled by transistor Q11 which is switched on by the output of the pulse-width modulator E7. The pulse-width modulator is driven by the clock-pulse generator E9 which triggers the one-shot pulse generator E5B. The pulsed output of E5B provides the basic timing of the power supply.

The +5 B output current is monitored by the overcurrent comparator E1. If excessive current occurs on the +5 B output, comparator E1 turns off the series switching circuit to open and prevent an overload condition on the +5 B power supply.

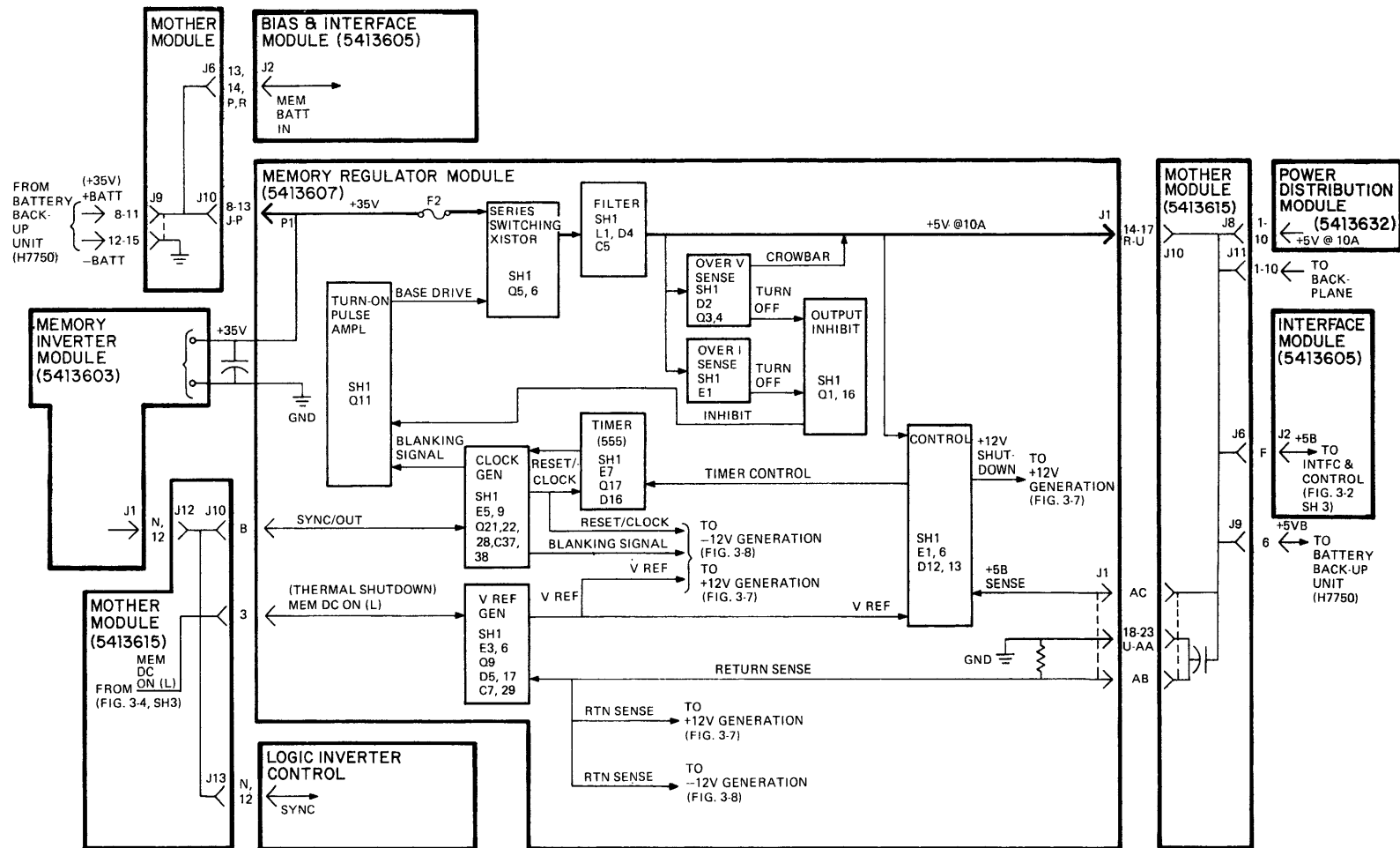
The overvoltage circuit, consisting of thyristors Q3 and Q4, monitors the voltage at the +5 B output. When the voltage exceeds a specified level, Q3 and Q4 are switched on and short the output to be grounded. The overvoltage circuit also causes the series switch to open, preventing the high current caused by the grounded output from damaging the circuits.

The +5 B output is normally controlled by the pulse-width modulator E7. This modulator provides pulses of variable duration to the switch control Q11. The pulse widths can vary from 0–13 μ s at the 30 kHz switching frequency. The +5 B sense comparator monitors the +5 B output and compares the voltage with V REF developed by the reference voltage circuit consisting of transistor Q9, regulator E3, and amplifier E6.

The output of the sense comparator E6 varies the dc input to the control input of the pulse-width modulator. When the +5 B voltage is lower than the V REF voltage, the sense comparator output causes the width of the pulses from the modulator E7 to be increased. The series switching circuit is then allowed to conduct for a longer duration and the +5 B output voltage is increased.

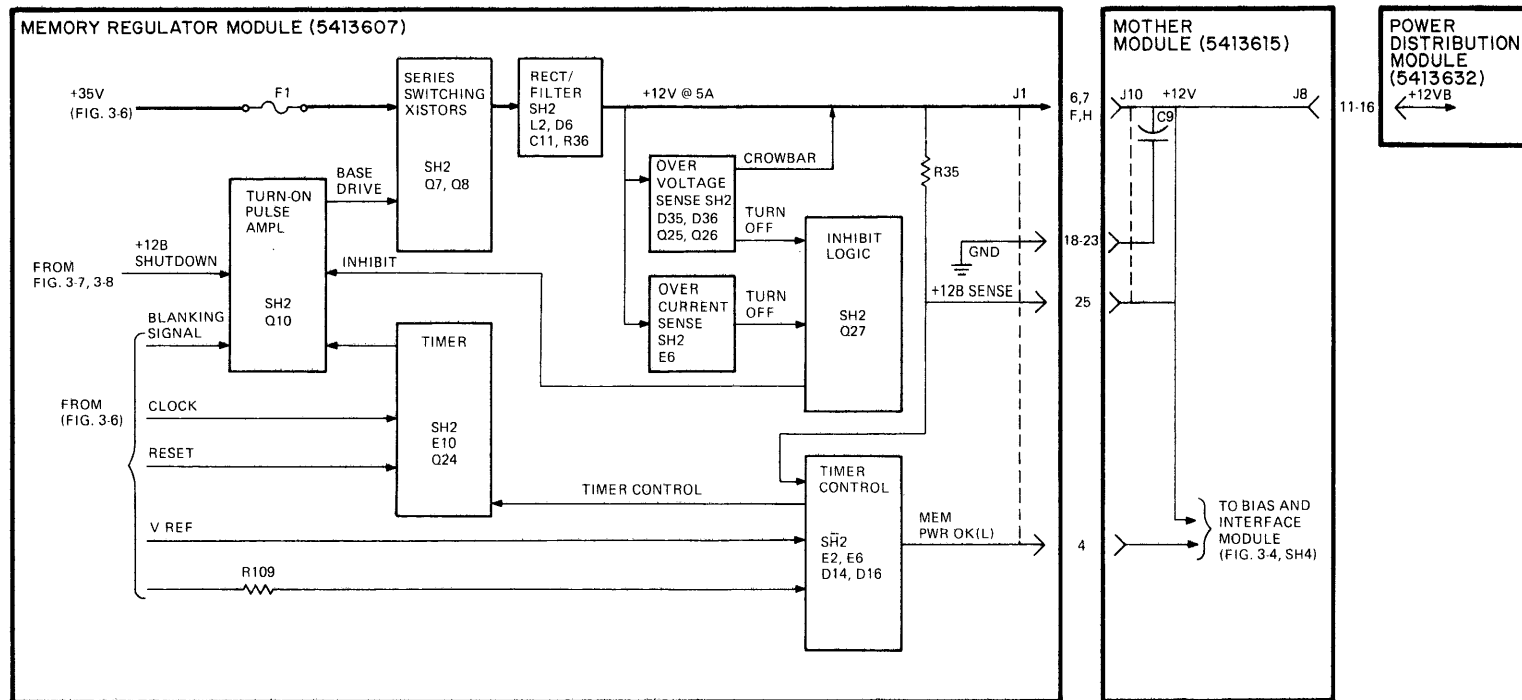
When the output voltage is greater than the V REF voltage, the sense comparator output causes the width of the pulses from modulator E7 to decrease. This results in a lower +5 B output voltage.

3.2.4.2 +12 B Regulator Circuit – Figure 3-7 is a block diagram of the circuits that develop the +12 B voltage for the memory modules. These circuits operate in a similar manner to the circuits described for the +5 B. The +35 V is converted to +12 B by the switching transistors Q7 and Q8, the flyback and averaging circuit D6, L2, and C11. The overcurrent circuit E9 and the overvoltage circuit Q2, Q26 and diode D36 provide the overload protection for the +12 B power supply circuits. The pulse-width modulator E10 is triggered at a 30-kHz rate by the clock-pulses from the +5 B output (Figure 3-6). The blanking pulse prevents switch control Q10 from conducting until 10 μ s after the leading edge of the pulse from the pulse-width modulator has occurred. This allows the pulse width to be reduced to zero when required.



TK-3508

Figure 3-6 +5 B Voltage Regulator, Circuit Block Diagram



TK 3504

Figure 3-7 +12 B Voltage Regulator, Block Diagram

The +12 B SHUTDOWN level from the +5 B regulator circuit disables the generation of the +12 B voltage when the +5 B is not within the preset levels, and provides the power generation sequence required by certain devices.

The +12 V voltage comparator E6 monitors the +12 B output voltage and compares it with the V REF level generated on the +5 B regulator (Figure 3-6). The comparator output controls modulator E10 in a similar manner to modulator E7 in the +5 B regulator. The +12 B comparator E2 generates the MEM POWER OK (L) signal to enable the controlling signals in the bias and interface module.

3.2.4.3 –12 B Regulator Circuit – Figure 3-8 is the block diagram of the –12 B regulator circuit. These circuits operate in a similar manner to the circuits described for the +5 V regulator. The +35 V is converted to the –12 B voltage by the operation of the switching circuit consisting of transistors Q13 and Q14, and by the charging circuit consisting of diode D3 and choke L3. The negative voltage is developed by L3 which is connected to ground instead of being in series with the output. The over-current circuit E6 and the overvoltage circuit consisting of Q6, Q12, and D18 prevent damage when the output voltage or current exceeds the preset levels.

The pulse-width modulator timer E8 is also triggered at a 30-kHz rate by the clock pulses from the +5 B regulator circuit. The blanking pulses perform the same function as the +12 B regulator circuit.

The duration of the pulses from pulse-width modulator E8 is controlled by the output of sense amplifier E6. The +12 B SHUTDOWN level will also disable the generation of the +12 B voltage when the –12 B regulator voltage is not within specified levels.

3.2.5 Logic Voltage Generation

The logic inverter module, the logic inverter control module, and the output assembly generate the voltages used by the CPU modules in the system. The output voltages are +5.0 V at 120 A*, +15 V at 3 A, and –15 V at 3 A and are distributed to the CPU backplane and to any additional backplanes. Figure 3-9 is a functional diagram of the circuits used to develop the logic module voltages. The logic inverter module receives +300 V (nominal) from the input assembly. This input is pulsed by a variable-width pulse generated in the logic inverter control module. The logic inverter module output is 30 kHz power that is converted to three logic voltages. The main output is +5.1 V at 120 A. Two regulators on the logic inverter control module convert the 30 kHz power to +15 V and –15 V logic voltages.

The logic inverter control module receives a +5 V REMOTE SENSE signal from the +5 V at the CPU backplane. This signal is applied to the input of sense amplifier E2, the output of which is +2.5 V (nominal). Within the 3524 pulse-width amplifier, the +2.5 V and a reference voltage are applied to an error amplifier. A comparator in the 3524 produces a pulse, the width of which is proportional to the error amplifier output. The comparator output is gated at 30 kHz and applied through drivers to a switching transistor in the logic inverter module.

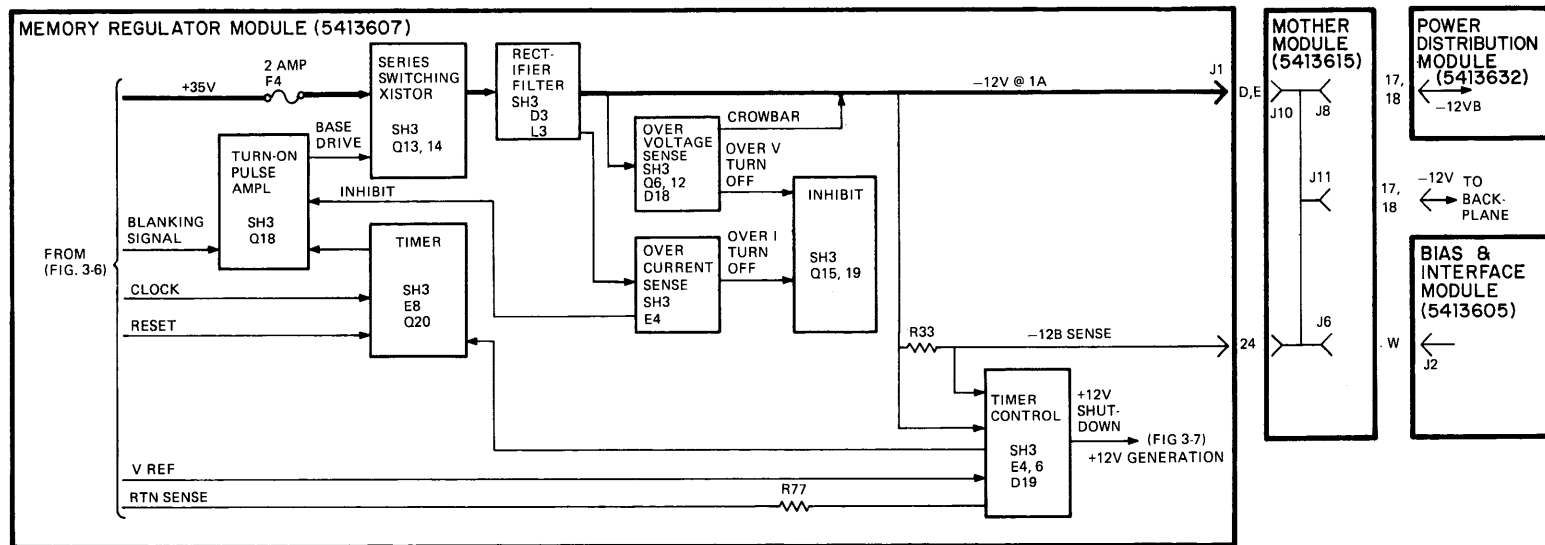
The switching transistors Q2–5 are configured in an H-forward converter circuit that converts +300 V (nominal) to three logic voltage outputs.

*The 5 V, 120 A output must be derated according to the following formula if the ±15 V current exceeds 1 A:

$$I = 120 \text{ A} - 5 [(I - 1) + (I - 1)] \\ (5 \text{ V}) (+15) (-15)$$

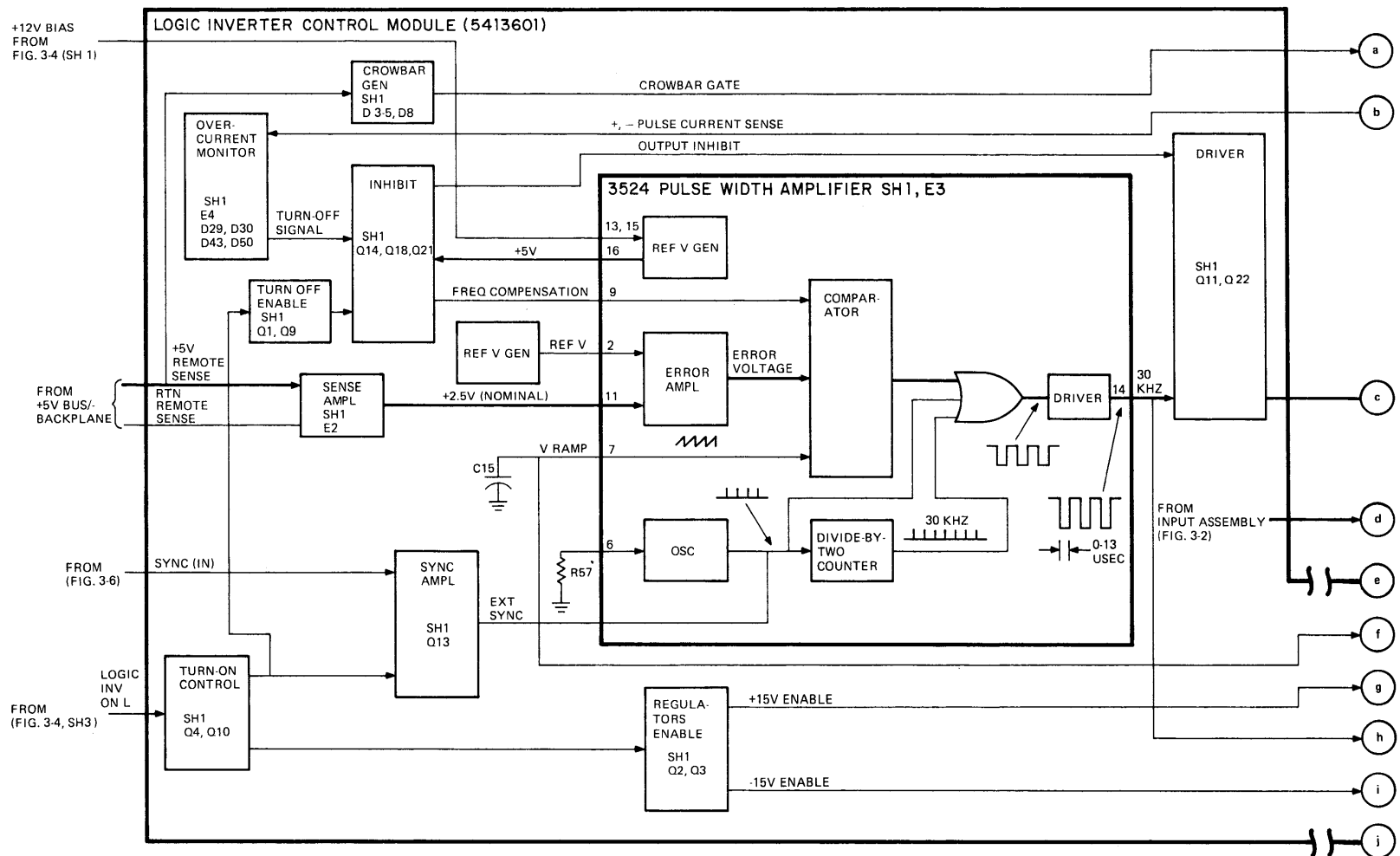
Example: If the +15 V and –15 V are fully loaded to 3 A each, the 5 V output would be derated to 100 A.

$$I = 120 \text{ A} - [(3 - 1) + (3 - 1)] = 100 \text{ A} \\ (5 \text{ V})$$



TK-3509

Figure 3-8 -12 B Regulator, Block Diagram



TK 3502

Figure 3-9 Logic Module Voltage Generation, Functional Diagram
(Sheet 1 of 2)

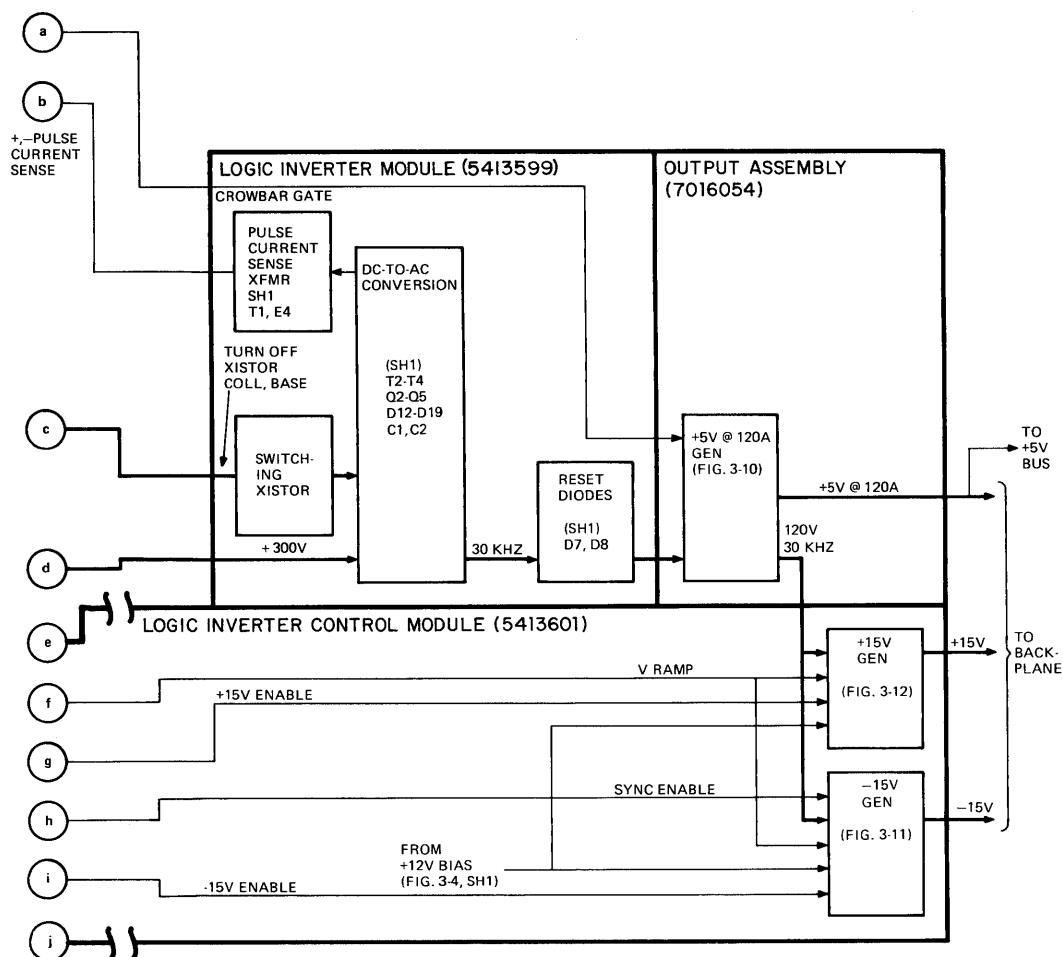
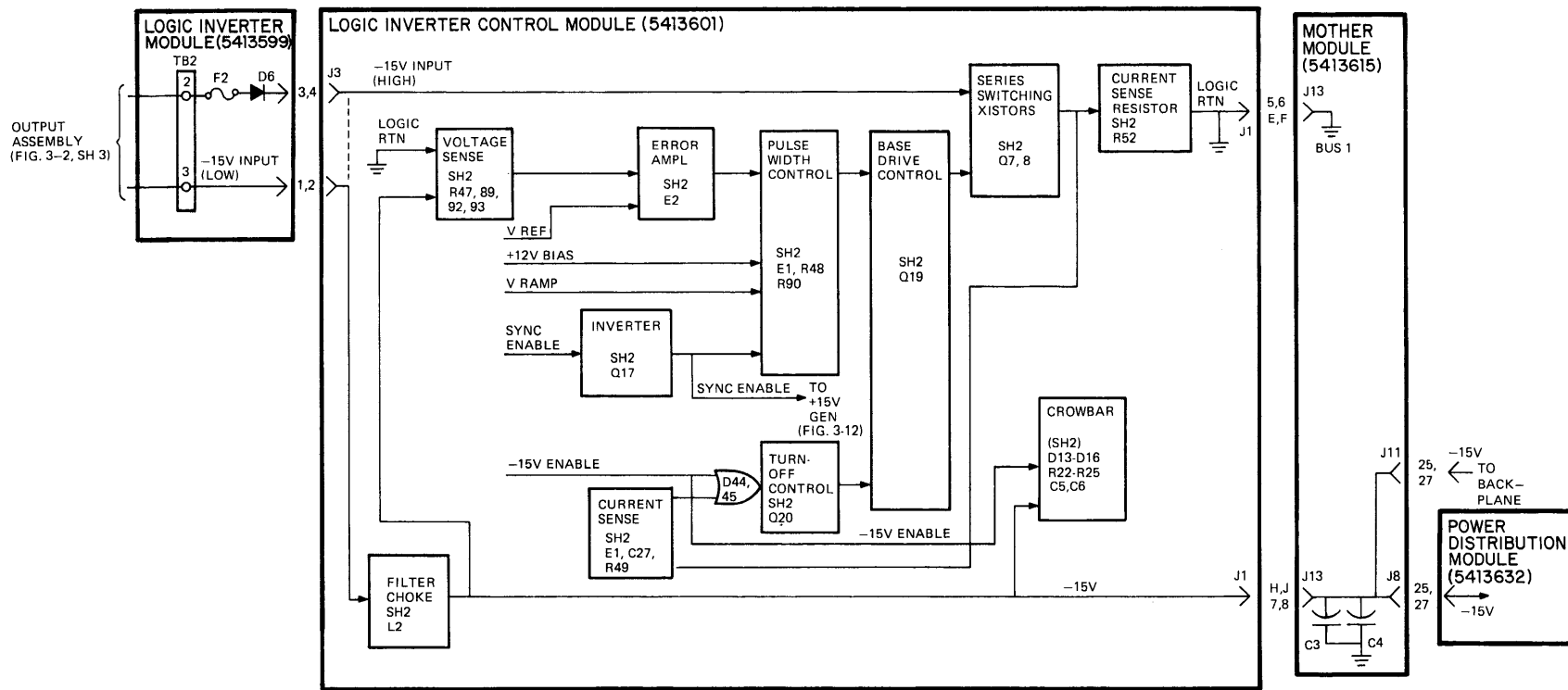


Figure 3-9 Logic Module Voltage Generation, Functional Diagram
(Sheet 2 of 2)

3.2.5.1 +5 V at 120 A Logic Power – The output assembly, shown in Figure 3-2 (sheet 3), provides the transformer coupling, LC filtering, and rectification for the main +5 V at 120 A output. In addition, it consists of a snubber module and crowbar circuit. The input transformer also provides 120 V, 30 kHz to the +15 V and –15 V generation power supply circuits.

3.2.5.2 –15 V Logic Power – The –15 V power for the logic modules is generated by the circuits shown in Figure 3-10. The logic inverter module generates a –15 V output by a series switching transistor that is controlled via a pulse-width modulated negative feedback loop.

The 30 kHz, 120 V from the main inverter module is applied to series switching transistors Q7, Q8. These transistors are controlled by a voltage sense network, error amplifier, pulse-width control, and drive control. The voltage sense network, consisting of R47, R89, R92, and R93, is connected to the –15 V input and the filter choke output. One input to the error amplifier is from the voltage sense network. The other input is a voltage reference. The error amplifier output modulates one input of the pulse-width control consisting of comparator E1, R48, and R90. The other input is a ramp voltage (V RAMP). The comparator produces an output that is proportional to the input error signal, which causes the base drive transistor to turn the series switching transistor on for the required time to maintain the output voltage at –15 V.



TK 3499

Figure 3-10 -15 V Power, Functional Diagram

The -15 V regulator contains overcurrent and overvoltage circuits. They function similar to those in the memory regulator module.

3.2.5.3 $+15\text{ V}$ Power – The logic inverter module generates a $+15\text{ V}$ output, which is similar to the operation of the -15 V circuit. The major functional difference is the location of the filter choke in both circuits. Figure 3-11 is the functional diagram for the $+15\text{ V}$ power.

3.2.6 Fan Voltage Generation

The bias and interface module shown on Figure 3-12 contains a fan voltage generation circuit that generates a 35 V , square-wave power for the fan assembly. The circuit consists of an oscillator, a divide-by-two counter, output control, and output drivers. It functions during normal and standby operation of the power supply and also when the power supply receives power from the battery backup unit.

During normal and standby operation of the power supply, the fan voltage circuit receives a $+35\text{ Vdc}$ input from the memory inverter module. During battery power backup mode, it receives a $+35\text{ Vdc}$ input (MEM BATT IN) from the battery backup unit (H7750).

The $+35\text{ V}$ input is applied to a free-running oscillator (E12) via an R-C network (R34, R32, R40) that establishes the oscillator nominal frequency at 150 Hz (for a nominal $+35\text{ V}$ input). The oscillator output is applied to a divide-by-two counter (E8). The 75-Hz signal output of E8 is then applied to the output control and drivers. The square-wave output of the drivers is applied to the fan assembly.

3.3 872-D, -E POWER CONTROLLER FUNCTIONS

The 872-D, -E power controller unit controls and distributes the AC power to the units within the cabinet. Figure 3-13 is a simplified diagram of the components and circuits within the unit. The 872-D, -E provides three dual switched receptacles that can be remotely controlled, and one dual receptacle that is controlled by the circuit breaker on the 872-D, -E.

The unit includes a line filter FL1, a LOCAL/REMOTE control switch S1, and an ac indicator L1.

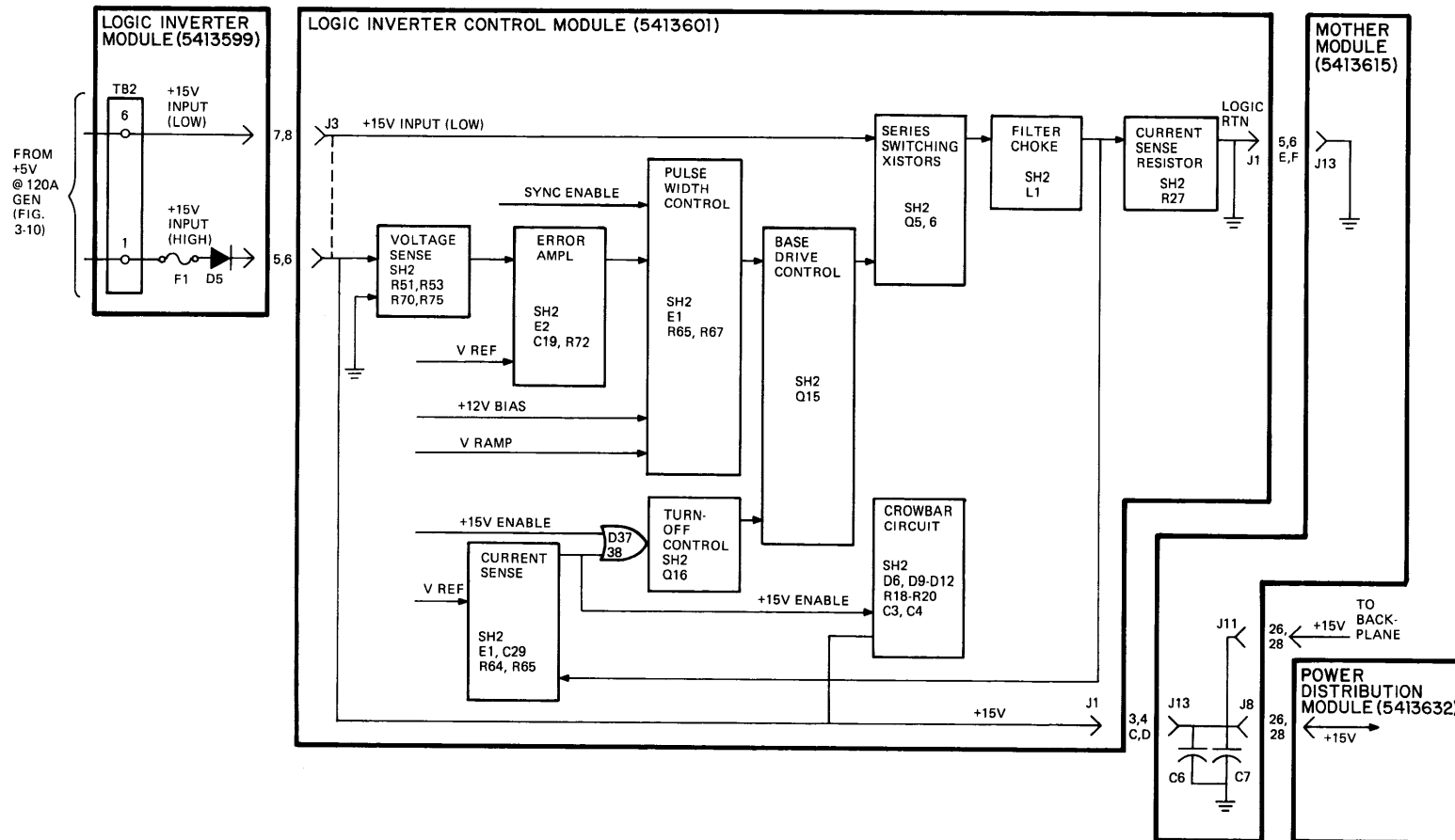
A power control bus connects the 872-D, -E unit to the BA11-A mounting box and to other units in the system. Under normal operation, the LOCAL/REMOTE switch S1 is set to the REMOTE position. Application of ac power to the units connected to the switched receptacles is controlled by the key-switch on the control panel of the BA11-A. When the switch is in the DC OFF position, the ac power is removed by the POWER-REQUEST signal to the ac control board A1. In all other positions of the keyswitch, the ac power will be applied. When an overtemperature condition exists in a unit connected to the power control bus, the SHUTDOWN signal to the ac control board A1 will also runover the ac power from the switched receptacles of the 872-D, -E unit.

When switch S1 is in the LOCAL position, the external power controller bus signals are disabled and the ac power at all receptacles on the 872-D, -E is controlled only by circuit breaker CB1. Circuit schematic (C5) 872-0-2 shows the complete internal wiring of the power controller unit.

3.4 H7750 BATTERY BACKUP FUNCTIONS

The H7750 battery backup units are optional and available in the following voltage configurations.

Model	Voltage
H7750-AA	115 Vac/60 Hz
H7750-AB	230 Vac/60 HZ
H7750-AC	115 Vac/50 Hz
H7750-AD	230 Vac/50 Hz



TK-3612

Figure 3-11 +15 V Power, Functional Diagram

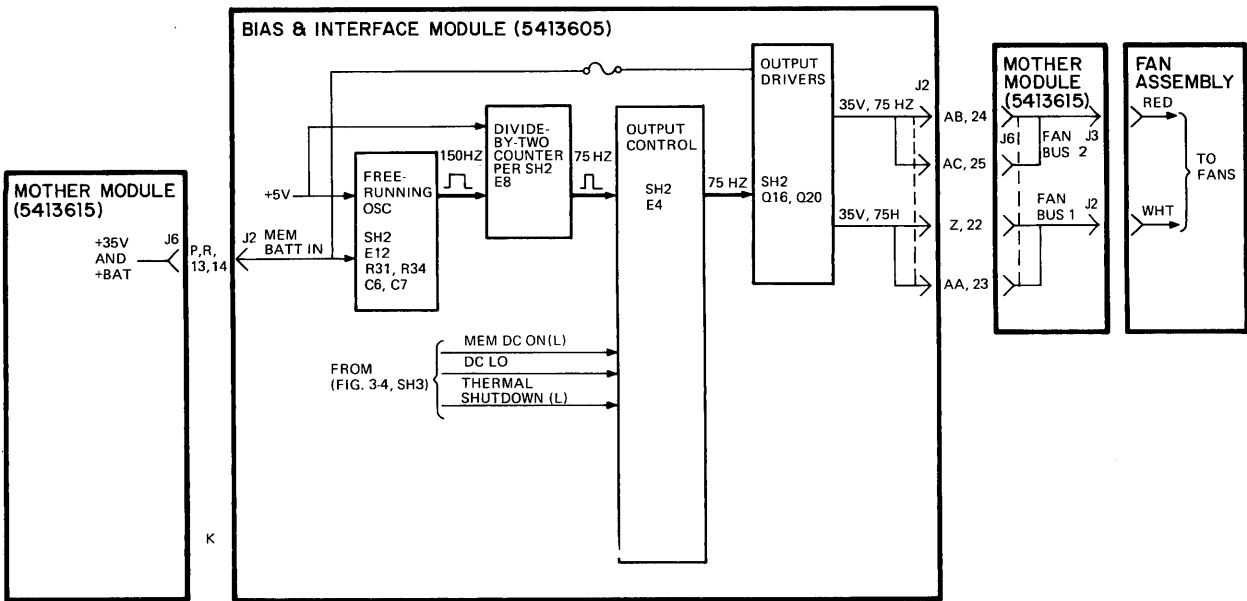


Figure 3-12 Fan Voltage Generation, Functional Diagram

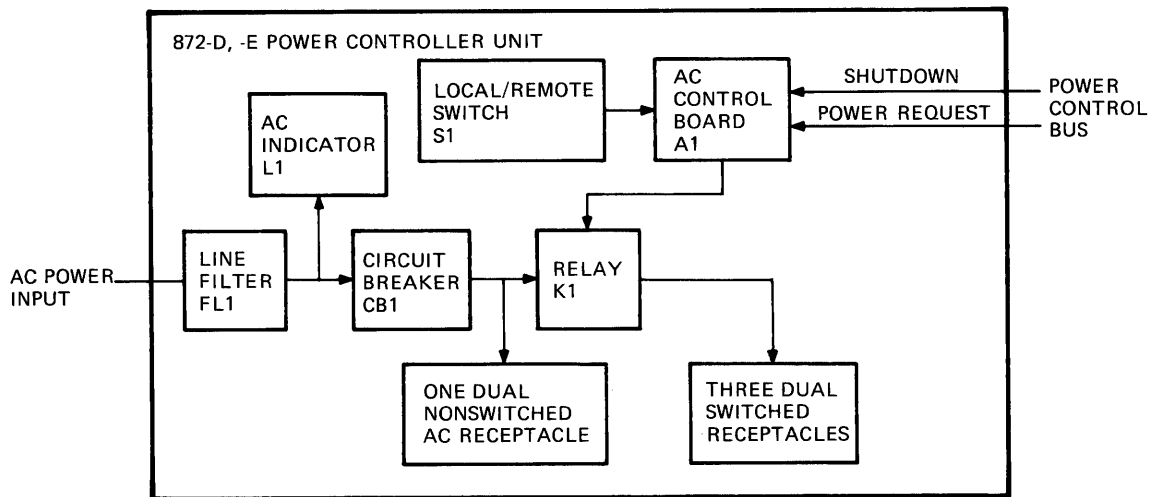


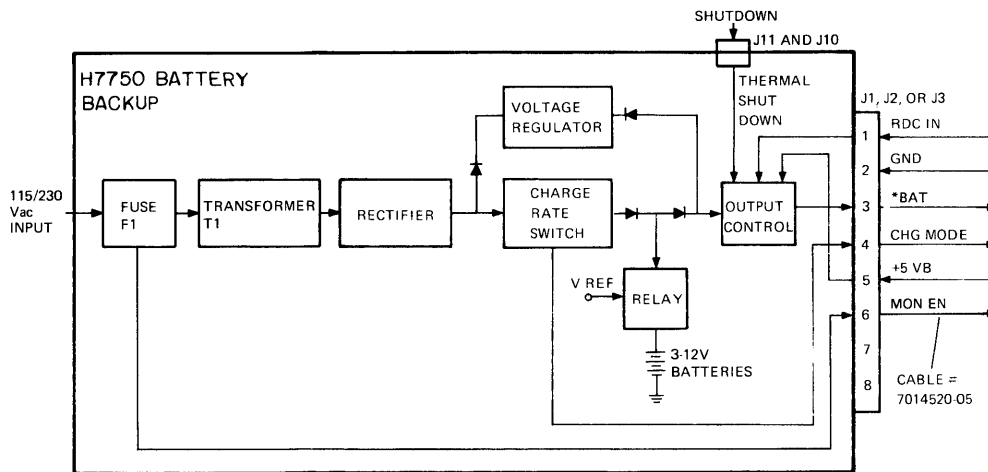
Figure 3-13 872-D, -E Unit, Simplified Diagram

These units can be installed in the cabinet to provide dc refresh power to the MOS memory in the CPU, and to provide power to operate the fans in the event of an ac power failure to the CPU cabinet. The units contain three sealed, 12 Vdc, lead acid batteries connected in series to provide +36 Vdc. The minimum discharge rates are as follows.

Discharge Time	Watts
5 minutes	360
7 minutes	265
10 minutes	175
20 minutes	90

The recharge time is 14 to 16 hours. Terminals on the front of the unit allow external batteries to be connected to increase the operating time.

The +36 Vdc is supplied to the memory regulator module and to the bias and interface module in the H7140-AA, -AB power supply. Figure 3-14 is a simplified diagram of the H7750 unit. It consists of a rectifier circuit, battery charger, voltage regulator, and an output control circuit. An automatic shutoff circuit disconnects the +36 Vdc output in the event of excessive current drain. The condition of the battery is monitored by the CPU on the CHG MODE line and MON ENAB indicates when the battery backup unit is supplying power.



T.K.5703

Figure 3-14 H7750 Unit, Simplified Diagram

The charging circuit controls the battery charging rate. There are two charging rates: the fast rate is approximately 500 MA and the trickle rate is approximately 15 MA. The fast charge rate is initiated during H7750 turn-on and continues until battery voltage increases to +44 V. At +44 V, the fast charging stops and trickle charging starts.

3.4.1 Signals and Voltages

The output control circuit monitors four fault conditions.

1. AC low
2. thermal shutdown
3. no regulator output present
4. battery voltage low

If the +35 V from the memory inverter module becomes less than 20 V, the battery backup unit switches the batteries on.

3.4.2 Battery Backup Operation

The rectifier and regulator supply the charging current and a relay connects the batteries to the charger. The output control circuit connects the batteries to the memory regulator in the H7140 power supply. The rectifier operates from the ac input and supplies a full charging current until the battery voltage reaches approximately 90 percent of its full charge rating. After this level, the charge rate switch supplies a trickle charge to maintain the charge on the batteries. The rate of charging is sensed to develop the charge mode signal to the H7140.

The memory regulator produces +12 V, -12 V, and +5 outputs until the batteries discharge below 27 V. A voltage reference is used by a relay in the H7750 to disconnect the batteries from the regulator and to prevent the batteries from discharging completely. The batteries will also be disconnected by the output control if the +5 B signal from the H7140 memory regulator goes to zero volts or if any thermal switch signals an overtemperature condition.

CHAPTER 4 SERVICE

This chapter provides the information required to evaluate the performance of the BA11-A mounting box, to isolate malfunctions in the power supply and associated devices, and to remove and replace defective units and assemblies.

4.1 POWER CHECKS

The system contains several indicators that can be used to check the ac and dc power to the system. The 872-D, -E power controller unit contains an ac indicator that is lighted when ac power is applied. The control panel of the BA11-A also contains a DC ON indicator that displays the status of the dc voltage from the power supply.

4.1.1 AC Power Distribution

The ac power in the BA11-A system cabinet is distributed from the 872-D, -E power controller, or a similar power controller unit. The 872-D, -E unit contains three dual switched ac receptacles and one dual unswitched receptacle. The ac power to the switched receptacles is controlled by the LOCAL/OFF/REMOTE switch on the control panel of the 872-D, -E unit, or, if the LOCAL/OFF/REMOTE switch is in the REMOTE position, by the keyswitch on the front panel of the mounting box.

4.1.1.1 Initial AC Power Checks – To check the ac power in the system, perform the following checks.

1. Ensure that the keyswitch on the control panel of the mounting box is in the LOCAL or LOC DSBL position.
2. Check that the ac indicator on the control panel of the 872-D, -E unit is lighted.
3. If the indicator is not lighted, check the main ac power outlet to ensure the ac voltage is present.
4. If the indicator is lighted, check that the circuit breaker on the 872-D,-E power controller unit is in the ON (1) position.
5. Check that the LOCAL-ON/OFF/REMOTE-ON switch on the power controller is in the LOCAL-ON or REMOTE-ON position.
6. If in the REMOTE-ON position, set the switch to the LOCAL-ON position.
7. If ac power is not applied, remove connector P1 or P2 from the dc power control bus on the power control unit.
8. If pin 1 of P1 is open to ground, check the continuity of the power control cable between connector P1 and P2.

9. Remove connector P1 from J3 on the rear of the BA11-A mounting box.
10. If pin 1 of J3 is open to ground, the mounting box wiring is defective.
11. If pin 2 of P1 in step 7 is grounded, an overtemperature condition exists in a unit within the system cabinet or peripheral cabinet.

4.1.2 DC Power Distribution

The dc voltages from the power supply are distributed to the CPU backplane and to any optional backplanes in the mounting box. The DC ON indicator on the control panel of the mounting box monitors the dc voltages and provides a visual indication of power failures.

4.1.2.1 Initial DC Power Checks – If a dc power failure is indicated, perform the following checks.

1. Perform steps 1 through 5 of Paragraph 4.1.1.1.
2. Measure the +5 V CPU backplane voltage at the connector end of the flexprint cable shown on Figure 4-1.

CAUTION

When measuring the +5 V bus voltage, do not short the +5 V bus and ground bus together.

3. Measure the remaining backplane voltages at connector P1 of the power flexprint cable shown on Figure 4-1. Table 4-1 indicates the voltage and signal connections on P1.
4. If a dc voltage failure is evident, remove and replace the H7140-AA, -AB power supply as described in Paragraph 4.2.4.

4.2 REMOVAL AND REPLACEMENT PROCEDURES

This section describes the procedures for removing and replacing the main units and assemblies within the BA11-A mounting box.

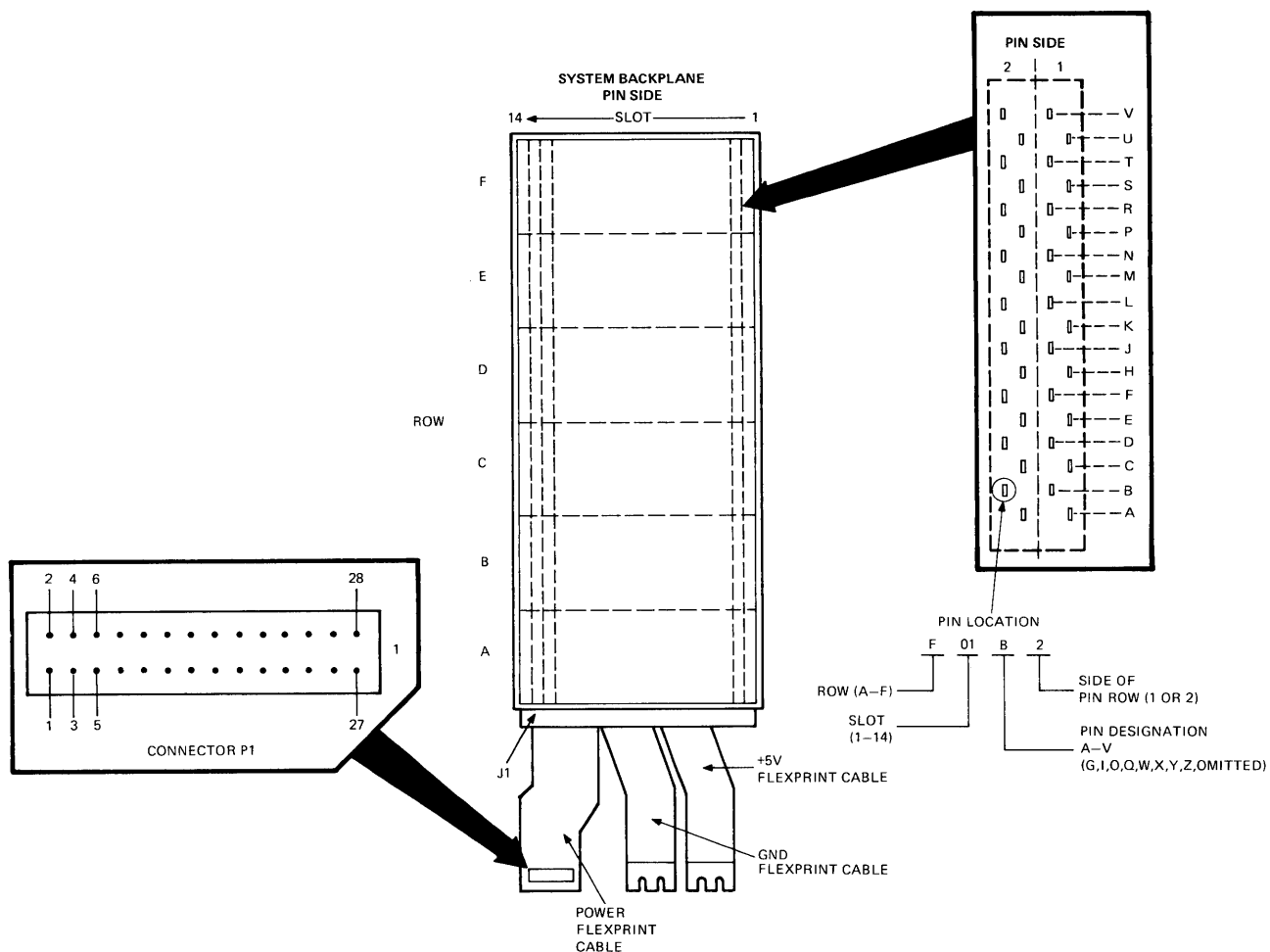
4.2.1 BA11-A Mounting Box in PDP-11X44 or Similar Cabinet

In the PDP-11X44 or similar system cabinet, the BA11-AA, -AB mounting box is located at the top of the system cabinet. To remove or replace the unit, perform the procedures described in subsequent paragraphs.

Two types of release mechanisms are in use to allow the BA11-A mounting box to be raised to the servicing position. The type mechanism the cabinet contains can be identified by the top cover configuration as shown in Figure 4-2. The cabinet with the type A release has filler strips located at the rear of the unit. The cabinet with the type B release has a one-piece top cover.

4.2.1.1 Mounting Box Removal – To remove the BA11-A mounting box from the PDP-11X44 or similar system cabinet, perform the following procedures.

1. Open the rear door of the cabinet. Use a 4.0 mm (5/32 in) hex wrench to release the door fastener.
2. Remove the ac power from the power controller by setting the circuit breaker in the OFF (0) position (Figure 2-7).

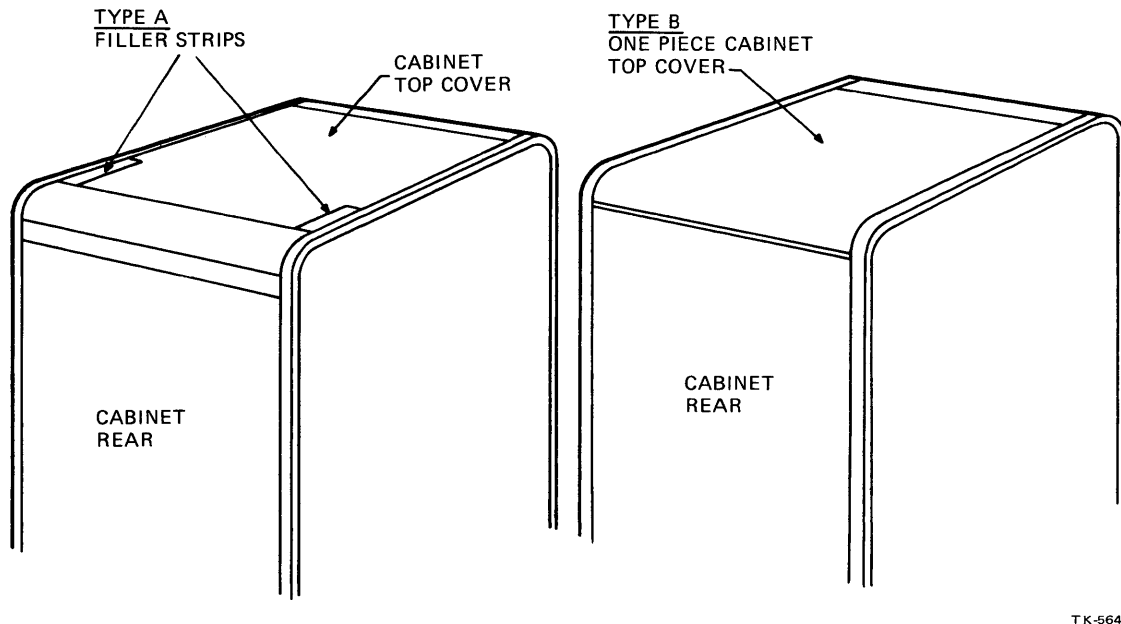


TK-4381

Figure 4-1 Backplane Assembly, Pin Designations

Table 4-1 CPU Backplane Connector P1, Signals and Voltages

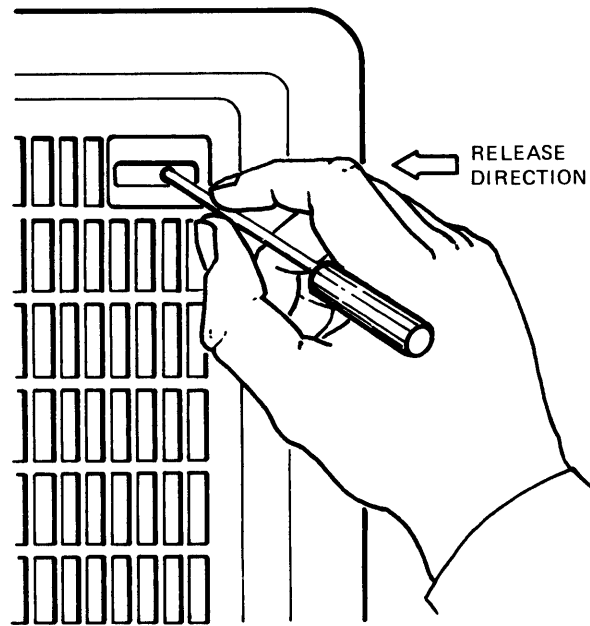
Pin	Function
1-10	+5 B
11-16	+12 VB
17, 18	-12 VB
19	LTC
20	BUS ACLO L
21	BOOT ENAB L
22	BUS dc LO L
23	GND SENSE
24	+5 SENSE
25,27	-15
26,28	+15



TK-5641

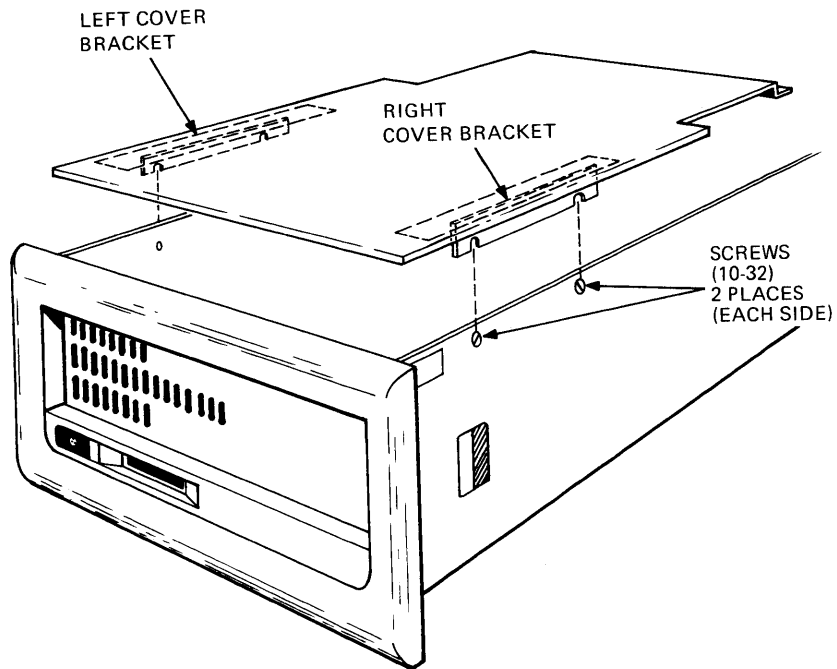
Figure 4-2 Cabinet Type Identification

3. Remove the BA11-A power cord plug from the unswitched receptacle at the rear of the power controller.
4. Cut or release any fasteners that secure the power cord to the cabinet frame.
5. If the release mechanism is type A (see Paragraph 4.2.1), insert the blade of a small screwdriver into the hole behind the slot which is located at the top right side of the front bezel (Figure 4-3).
 - 5a. Release the latch which holds the mounting box by sliding the screwdriver in the direction shown in Figure 4-3.
 - 5b. Raise the front of the mounting box until the unit is at an angle of approximately 45° with the top of the cabinet.
 - 5c. Loosen the four (10-32) screws that hold the cover brackets to the left and right sides of the mounting box (Figure 4-4). Do not remove the screws.
 - 5d. Remove the top cover assembly.
 - 5e. Lower the front of the mounting box until it is in the normal position and the latch engages.
6. If the release mechanism is type B, remove the screw (10-32) that secures the top cover ground lead to the rear cabinet frame (Figure 4-5).
 - 6a. Use a slot head screwdriver to release the two captive screws that secure the rear of the top cover to the cabinet.
 - 6b. Raise the rear of the top cover to release the pins from the spring latch at the front of the cover.



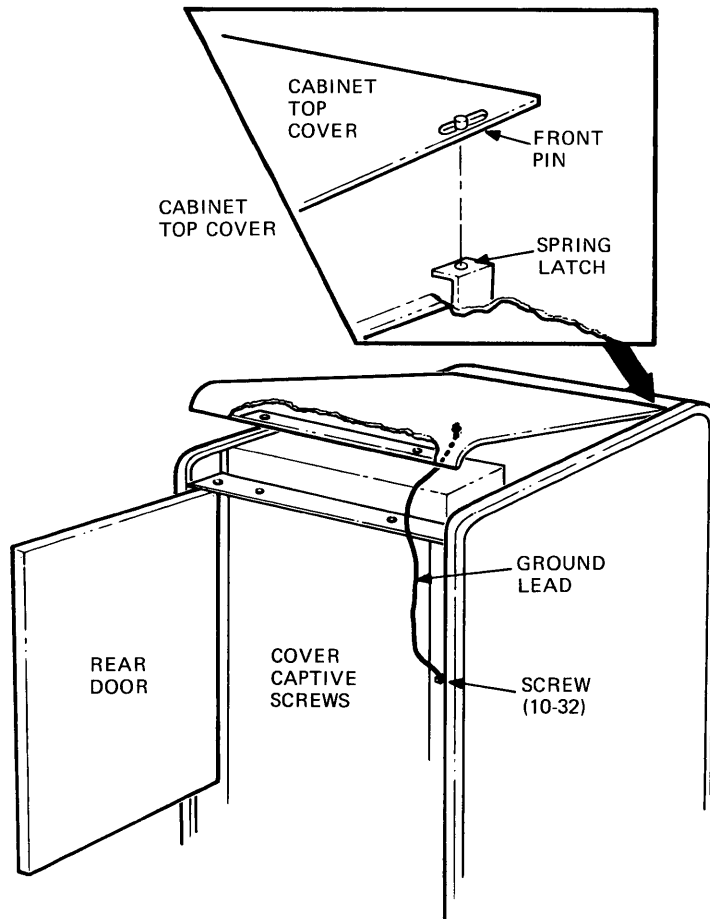
TK-3458

Figure 4-3 Mounting Box Release Lever, System Cabinet



TK-4396

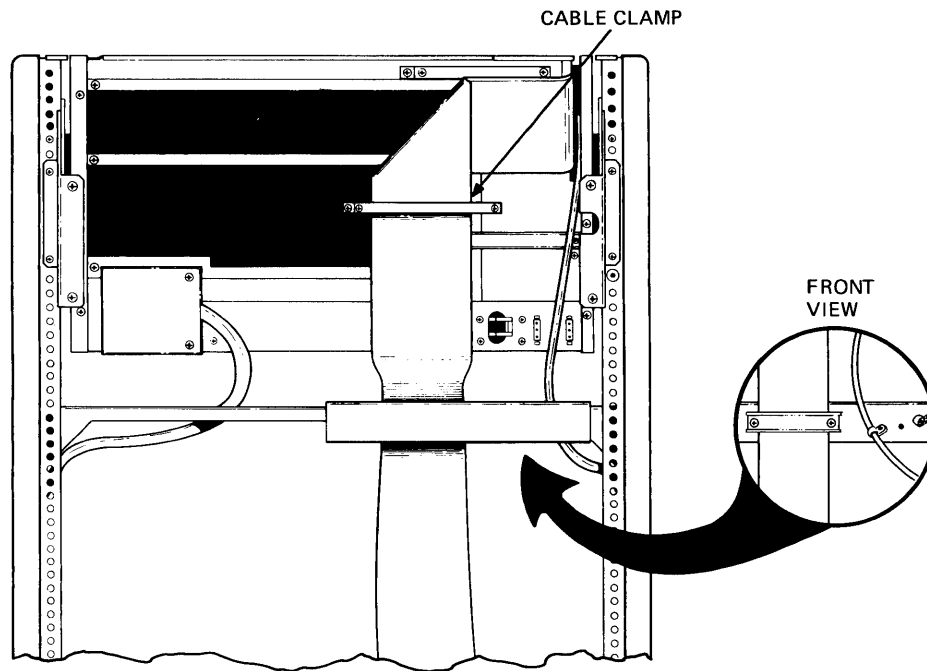
Figure 4-4 Top Cover Mounting (Type A)



TK-5639

Figure 4-5 Top Cover Mounting (Type B)

- 6c. Remove the top cover.
7. Disconnect the UNIBUS and the I/O cable connectors attached to the modules within the unit.
8. At the rear of the BA11-A box, remove and retain the two 1/4 inch nuts that secure the cable clamp bar to the power supply (Figure 4-6).
9. Remove the cables from the cable trough in the BA11-A box and feed the cables toward the rear of the cabinet and away from the mounting box.
10. If the release mechanism is type A, release the latch and raise the front of the mounting box.
11. If the release mechanism is type B, locate the left and right slide latches on the angle brackets attached to each side of the BA11-A unit (Figure 4-7).
- 11a. Slide the latches in the direction shown to release the latch from the holding pin.



TK-5728

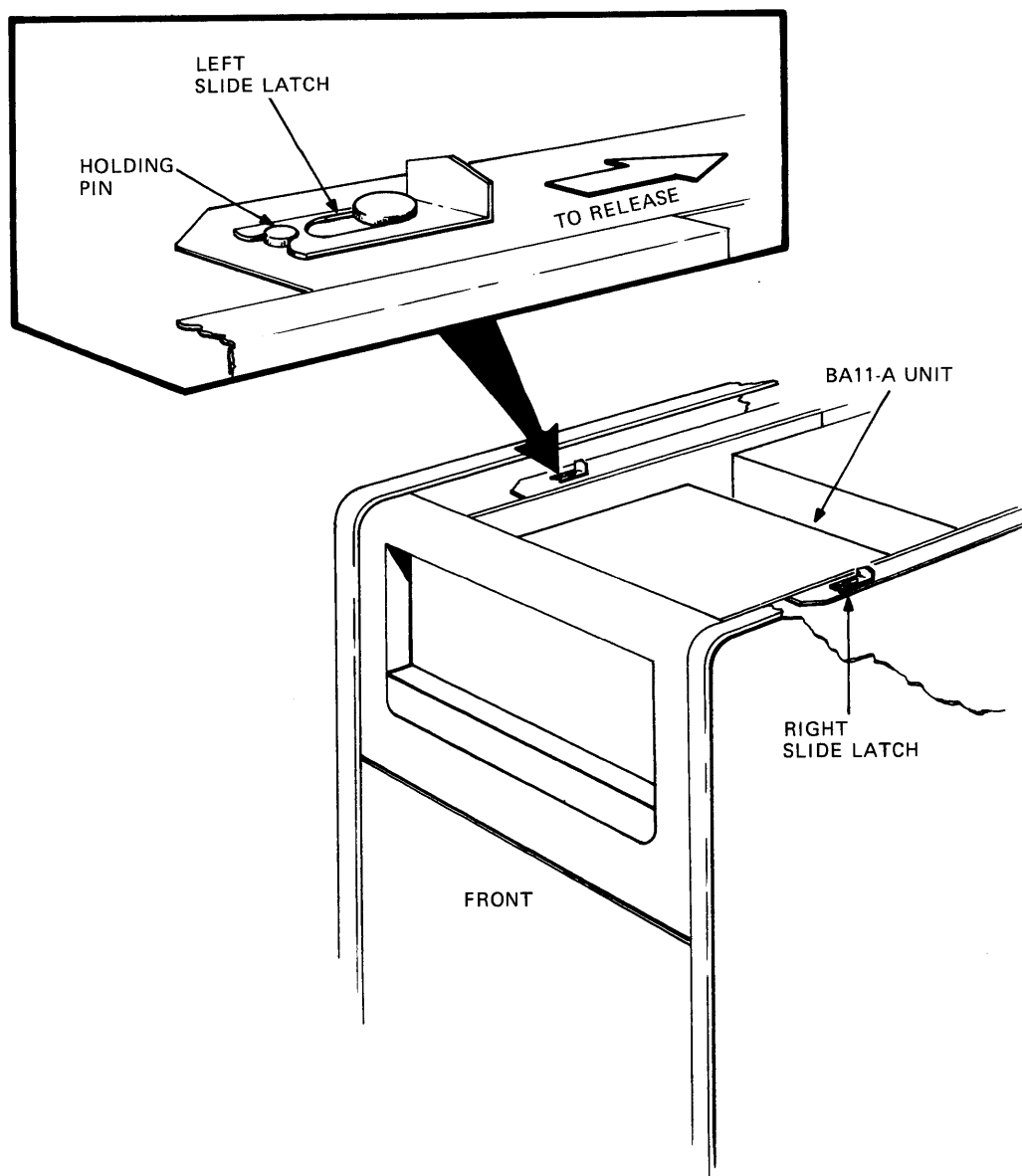
Figure 4-6 BA11-A Unit Cable Clamps

12. Raise the front of the mounting box to the maintenance position and raise the safety lever to hold the mounting box (Figure 4-8).

WARNING

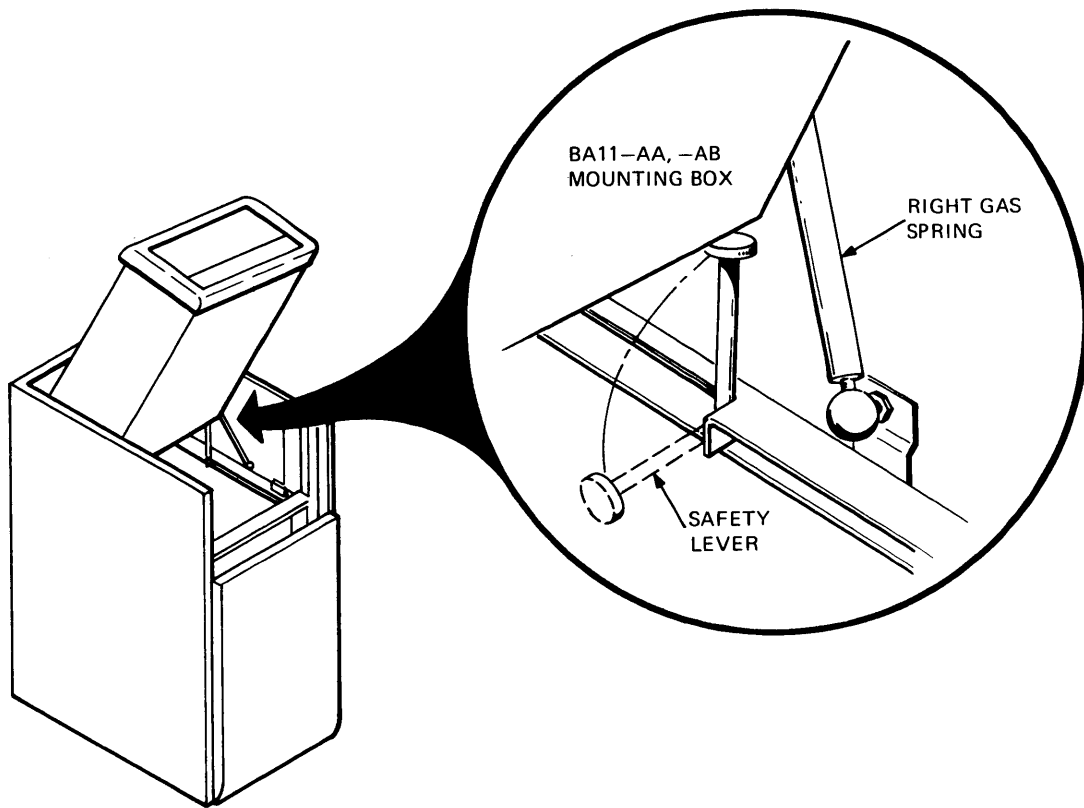
When the gas springs are removed, the safety lever can not support the weight of the BA11-A mounting box. The box should be supported by a field service person while servicing is continued.

13. Remove the retaining clip from the piston ball connectors of the gas spring on the left and right interface bracket (Figure 4-9). Use needle-nose pliers to facilitate the clip removal.
14. Remove the retaining clip from the body ball connector of the gas spring on the right side of the cabinet.
15. Support the mounting box.
16. Remove the ball connectors from the studs on the right side of the cabinet by inserting a screwdriver blade between the ball connector and the ball stud mounting surface.
17. Remove the ball connectors from the studs on the left side of the cabinet using the procedure described in step 15.
18. At the rear of the cabinet, remove the four (10-32) screws and washers that secure the pivot bracket to the cabinet frame on the left and right side of the cabinet (Figure 4-9). These screws can not be reached once the box is lowered.



TK-5638

Figure 4-7 BA11-A Type B Box Slide Latch Locations



TK-4397

Figure 4-8 System Cabinet Safety Lever

19. At the front of the cabinet, while supporting the weight of the box, release the safety lever and lower the mounting box to its normal position (Figure 4-8).

CAUTION

When the gas springs have been removed, the mounting box is not properly supported.

20. At the rear of the cabinet, remove and retain the two (10-32) screws and washers on the left and right side of the cabinet that secure the pivot bracket to the mounting box (Figure 4-9).
21. Grasp the bottom of the mounting box at the front and rear and gently slide the box toward the front of the cabinet. Lift the back of the mounting box and slide the box forward and away from the cabinet frame.

CAUTION

Removal of the mounting box requires two people due to its weight, one person lifting from the left side and one person lifting from the right side of the cabinet.

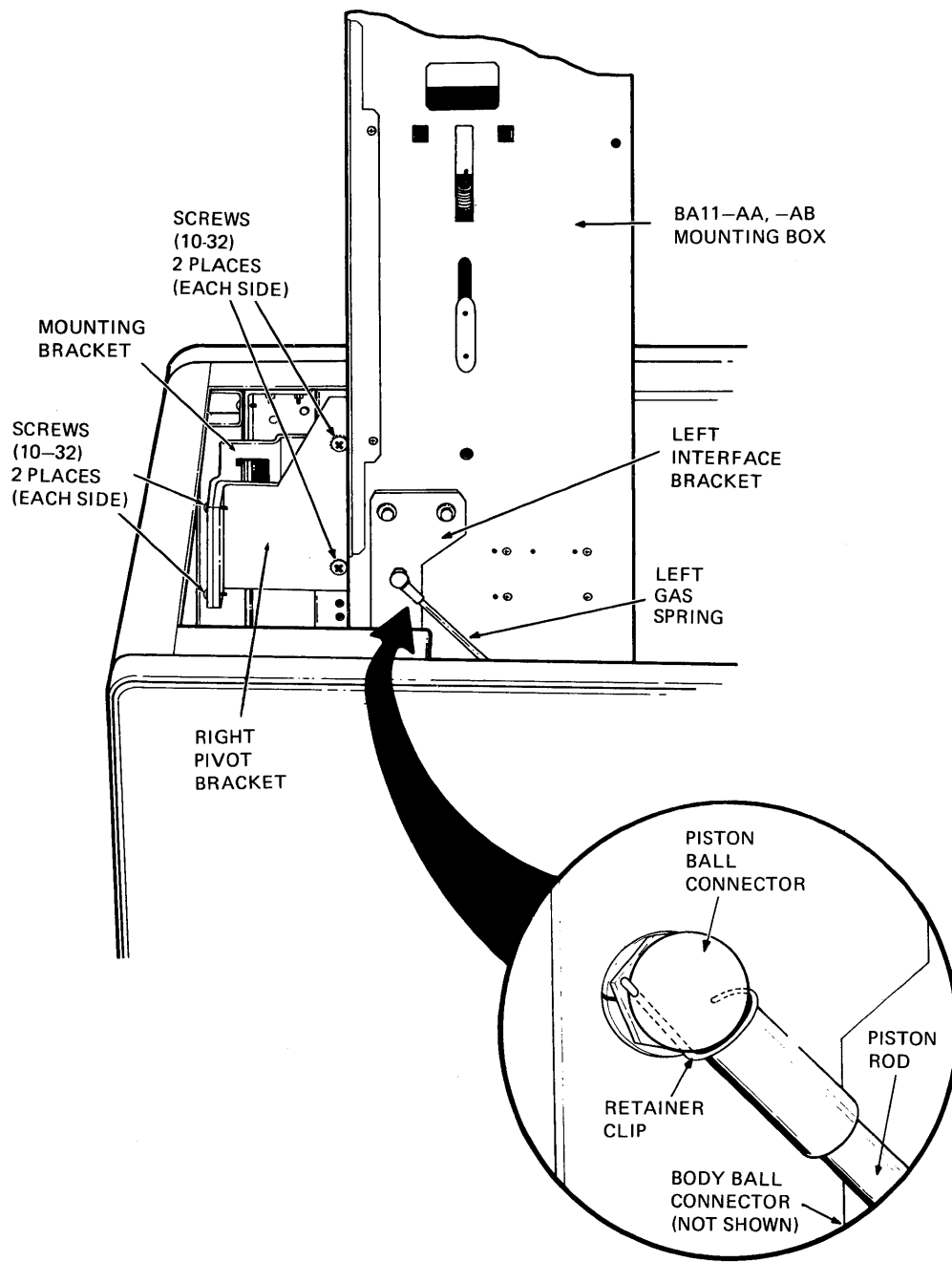
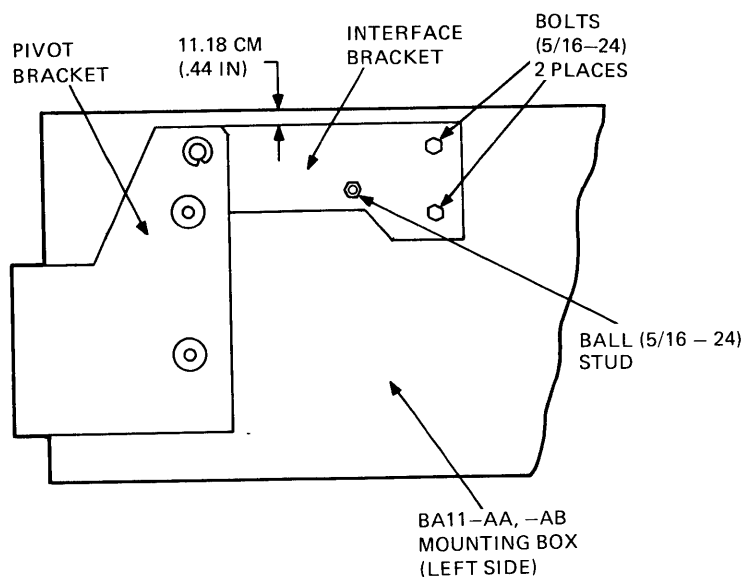


Figure 4-9 System Cabinet, Mounting Box Hardware

4.2.1.2 Interface Bracket Removal/Installation – If the mounting box to be installed does not have the interface and pivot bracket mounted on each side, remove the brackets from the box to be replaced and install, using the following procedures.

1. Using a 1/2-inch open or box-end wrench, remove and retain the two (5/16 - 24) bolts and the (5/16 - 24) ball stud located on the interface brackets at the left and right side of the mounting box (Figure 4-10).
2. Remove the two bracket assemblies and, using the hardware previously removed, install on the left and right side of the replacement mounting box. Do not tighten bolts.
3. Align the top of the interface brackets to be parallel with the top of the mounting box and at the dimension shown in Figure 4-10.
4. Tighten the two (5/16 - 24) bolts and the ball studs at each interface bracket.



TK-4398

Figure 4-10 Interface Bracket Mounting

4.2.1.3 Mounting Box Replacement – To install the BA11-A mounting box into the PDP-11X44, or similar system cabinet, perform the following procedures.

1. Grasp the bottom of the mounting box at the front and rear and position the box on the support rails with the front of the unit extending away from the front of the system cabinet.

CAUTION

Installation of the mounting box requires two people due to its weight, one person lifting from the left side and one person lifting from the right side of the cabinet.

2. Slide the mounting box toward the rear of the unit while lifting the rear of the box to clear the ball stud.
3. At the rear of the cabinet, install the two (10-32) screws and washers removed in step 20 of Paragraph 4.2.1.1 in the angle part of the left and right pivot bracket (Figure 4-9). Do not tighten the screws.

WARNING

When the gas springs are removed, the safety lever can not support the weight of the BA11-A mounting box. The box should be supported by a field service person while servicing is continued.

4. Raise the front of the mounting box to the position shown in Figure 4-8 and raise the safety lever to hold the mounting box in position.
5. Replace the two (10-32) pivot bracket screws and washers, removed in step 18 of Paragraph 4.2.1.1 into the left and right cabinet frame (Figure 4-9).

NOTE

It may be necessary to shift the position of the mounting box in a direction that will cause the holes of the interface bracket to be properly aligned with cabinet frame holes.

6. Tighten the screws installed in step 5.
7. Replace both gas springs removed in Paragraph 4.2.1.1 by snapping the lower ball connectors on first and then the upper ball connectors.
8. Install the four retaining clips removed in Paragraph 4.2.1.1.
9. Release the safety lever and lower the mounting box to its normal operating position.
10. If the release mechanism is type A (see Paragraph 4.2.1), the latch will engage when the front of the unit is in the normal operating position.
11. If the release mechanism is type B, press down on the front of the unit and push the slide latches, released in step 11b of Paragraph 4.2.1.1, forward to engage the holding pins.
12. Route the cables removed in step 9 of Paragraph 4.2.1.1 through the cable trough.
13. Insert the cable connectors removed in step 11 of Paragraph 4.2.1.1. into the modules.
14. Install the cable clamp removed in step 18 of Paragraph 4.2.1.1.

15. If the release mechanism is type A, perform steps 5 through 5b of Paragraph 4.2.1.1.
- 15a. Install the top cover assembly onto the mounting box and tighten the screws that were loosened in step 5d of Paragraph 4.2.1.1.
- 15b. Lower the front of the unit to its normal operating position until the latch engages.
16. Replace the top cover of the cabinet, with the type B mechanism, by inserting the pins located at the front of the top cover into the spring latches (Figure 4-5).
- 16a. Lower the rear of the top cover and fasten the captive screws released in step 6b of Paragraph 4.2.1.1.
- 16b. Attach the ground lead removed in step 6a of Paragraph 4.2.1.1.
17. Replace the BA11-A power cord plug into the unswitched receptacle of the power controller unit.
18. Set the circuit breaker of the power controller unit to the ON (1) position.
19. Close the rear door of the cabinet and set the door fastener, using a 3.9 mm (5/32 in) wrench, so the door is locked.

4.2.2 BA11-A Mounting Box on Slides

When replacing a BA11-A mounting box that is installed on slides, the index plates attached to the side of the box may be removed and installed onto the replacement unit.

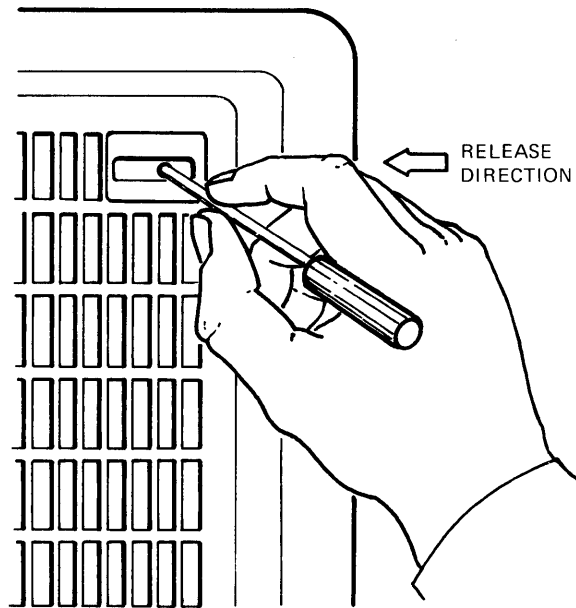
4.2.2.1 BA11-A Slide Mounting Unit Removal – To remove the mounting box, perform the following procedures.

1. Remove the ac power from the power controller by setting the ac circuit breaker to the OFF (0) position (Figure 2-7).
2. Remove the BA11-A ac power cord plug from the unswitched receptacle of the power controller.
3. Cut or release the fasteners or clamps used to secure the ac power cord to the cabinet frame.
4. At the rear of the BA11-A mounting box, remove the cable clamp bars that secure the external cables to the unit. Each clamp is held by two 1/4 inch nuts (Figure 4-6).
5. Insert a small screwdriver blade into the slot in the top right side of the front bezel (Figure 4-11).

6. Release the latch that holds the mounting box by sliding the screwdriver to the left (Figure 4-11).
7. Pull the front of the mounting box until it is fully extended and the slide hold levers are engaged (Figure 4-12).
8. Remove and retain the four (6-32) screws that secure the top cover to the mounting box.
9. Remove the top cover.
10. Remove the UNIBUS cable connector from the backplane, the I/O cables attached to the console interface module (M7090), and all other cable connectors in the modules.
11. Route the cables away from the mounting box.
12. Remove and retain the three (8-32) screws that attach the left and right index plate to the slide assembly (Figure 4-13).
13. Remove the mounting box from the slides by lifting the unit until the alignment tabs on the index plates are free from the slide mounting bracket.

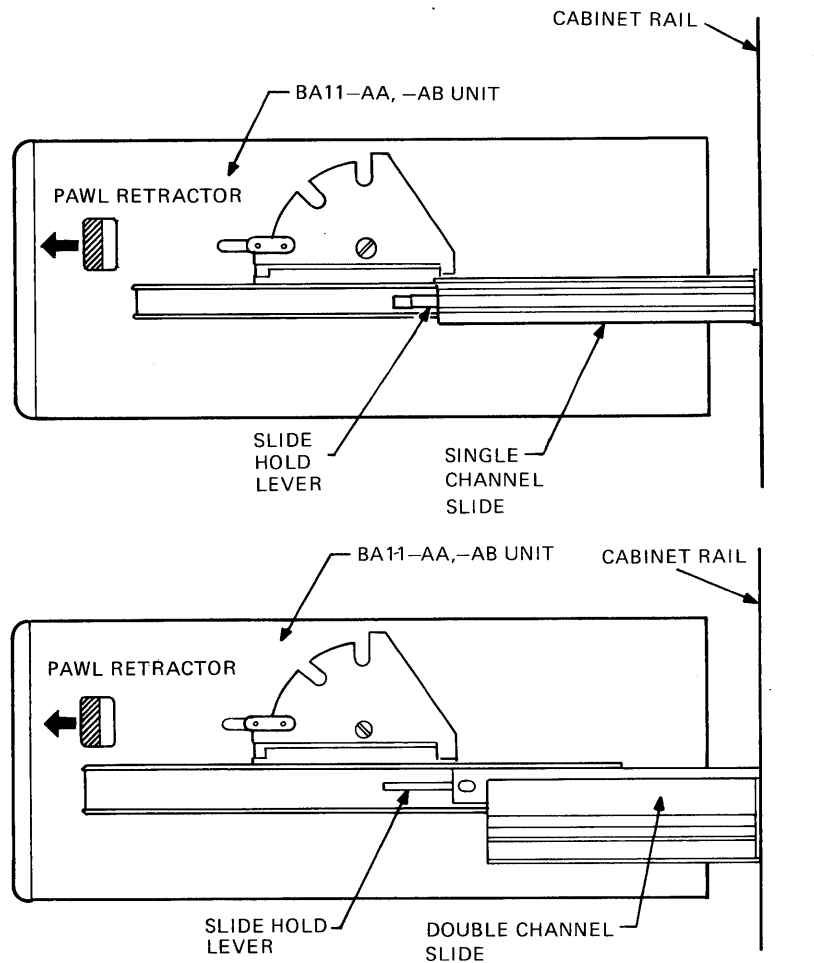
CAUTION

Removal of the mounting box requires two people due to its weight, one person lifting from the left side and one person lifting from the right side of the cabinet.



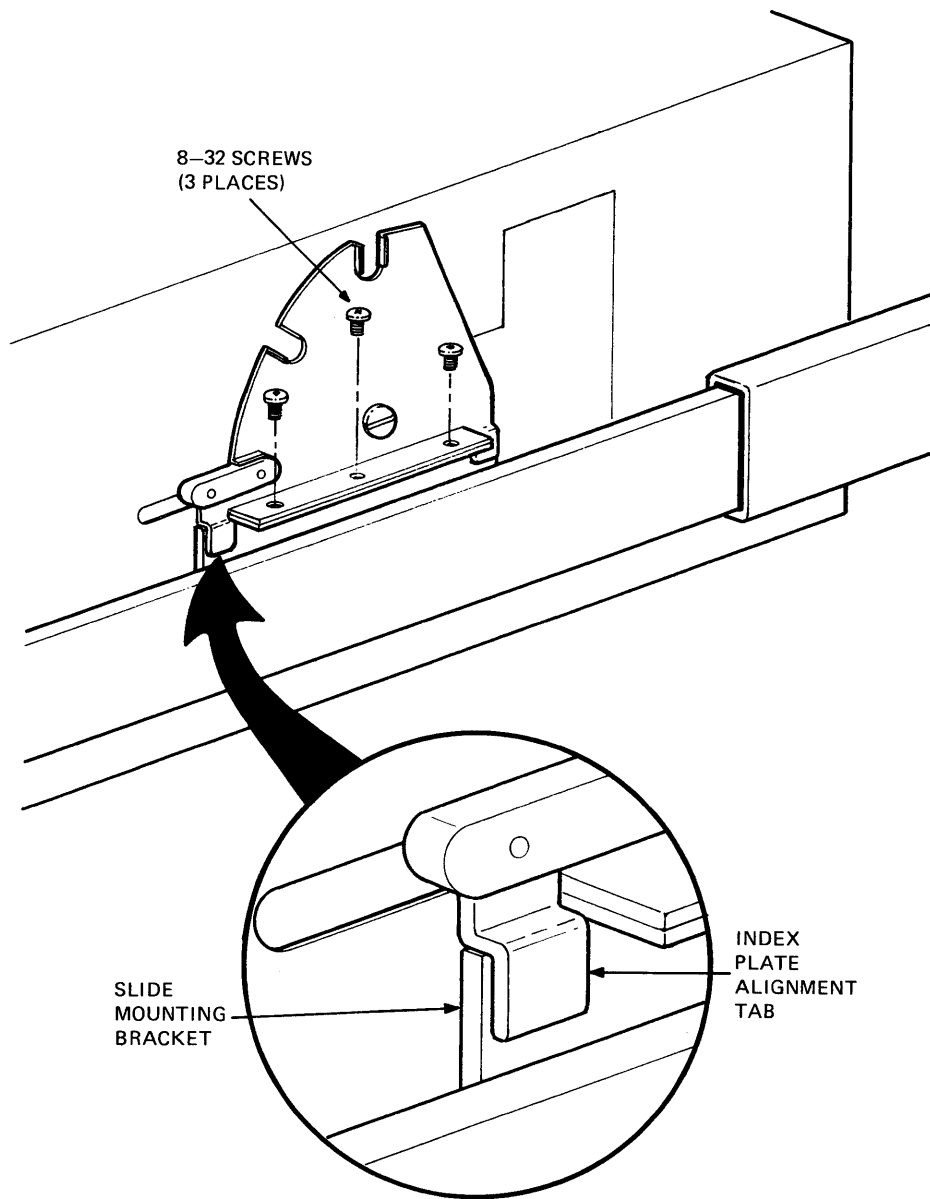
TK-3458

Figure 4-11 Mounting Box Release Lever Slide Mounted Unit



TK-4393

Figure 4-12 Slide Hold Levers

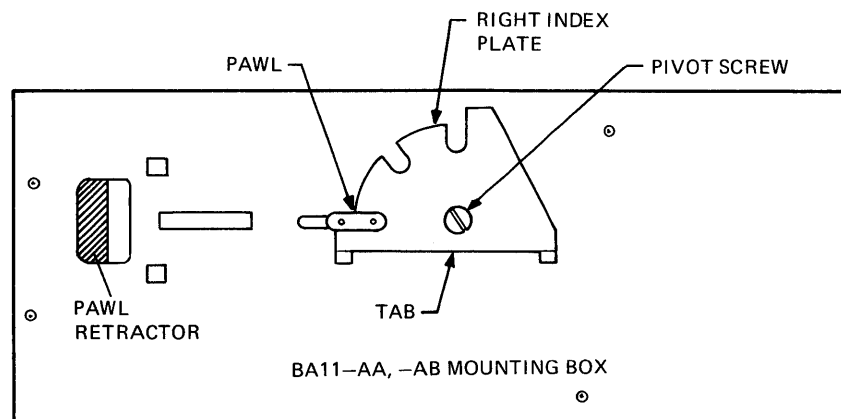


TK-3486

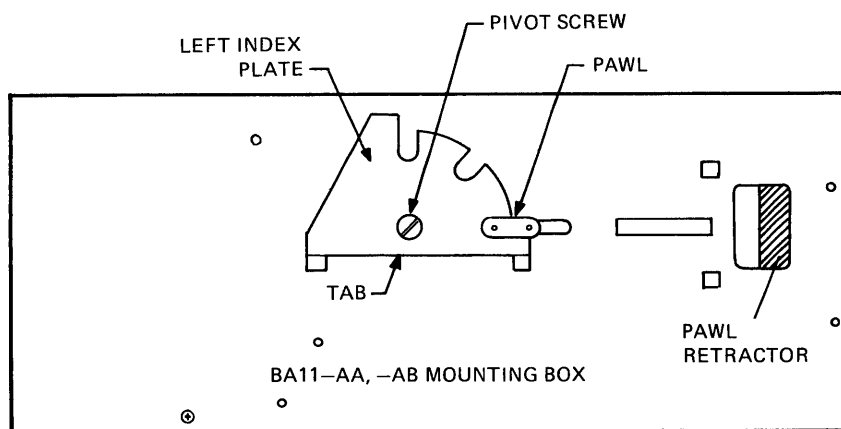
Figure 4-13 Slide to Index Plate Mounting

4.2.2.2 Index Plate Installation – If the mounting box to be installed does not contain a left and right index plate, the index plates must be removed and replaced.

1. Remove and retain the pivot screws that secure the left and right index plate to the side of the mounting box (Figure 4-14).
2. Remove the index plates.
3. Position the right index plate on the pawl. The index plate tab will protrude away from the mounting box.
4. Insert the pivot screw and tighten.
5. Perform steps 3 and 4, using the left index plate.
6. Ensure that the index plate rotates freely when the pawl retractor is released.



RIGHT SIDE VIEW



LEFT SIDE VIEW

TK-4392

Figure 4-14 Index Plate Mounting

4.2.2.3 BA11-A Slide Mounting Unit, Replacement – To install the mounting box to the slides, perform the following procedures.

1. Extend the left and right slide channel to their maximum position at the front of the cabinet. When fully extended, the slide hold lever will be engaged (Figure 4-12).
2. Carefully lift the mounting box over and above the extended slides and set the index plate over the slide mounting bracket on each side of the box (Figure 4-13). The index plate alignment tabs will engage the sides of the slide mounting bracket.

NOTE

When the slides are fully extended, it may be necessary to force the ends of the slides in toward the sides of the mounting box during installation.

3. Insert three (8-32) screws through the left index plate tab and into the threaded holes of the slide mounting bracket. Tighten the screws.
4. Perform step 3 for the right index plate.
5. Replace the cables that were removed in step 10 of Paragraph 4.2.2.1.
6. Replace the top cover that was removed in step 9, using the hardware removed in step 8 of Paragraph 4.2.2.1.
7. Replace the cable clamp bars that were removed in step 4 of Paragraph 4.2.2.1.
8. Replace the fasteners or clamps that were removed in step 3 of Paragraph 4.2.2.1.
9. Install the power cord plug that was removed in step 2 of Paragraph 4.2.2.1.
10. Set the ac circuit breaker on the power controller to the ON (1) position.
11. Release the slide hold levers on each slide channel and push the mounting box into the cabinet until the latch engages (Figure 4-12).

4.2.3 Fan Assembly Removal and Replacement

The fan assembly is installed on the right side of the BA11-AA, -AB mounting box and can easily be removed for servicing. The assembly contains three fans that can be individually removed and replaced. To remove and replace the assembly, perform the following procedures.

1. In a system cabinet perform steps 1 and 2 of Paragraph 4.2.1.1.
2. If the release mechanism is type A (see Paragraph 4.2.1), perform steps 5a, 5b, and 12 of Paragraph 4.2.1.1.
- 2a. If the release mechanism is type B, perform steps 6a through 6c, 11a, 11b and 12 of Paragraph 4.2.1.1.
3. If the BA11-A is slide mounted, perform steps 1 and 5 through 7 of Paragraph 4.2.2.1.
- 3a. Release the pawl retractor on each side of the mounting box (Figure 4-14) and tilt the box 90° to the maintenance position (Figure 4-15).

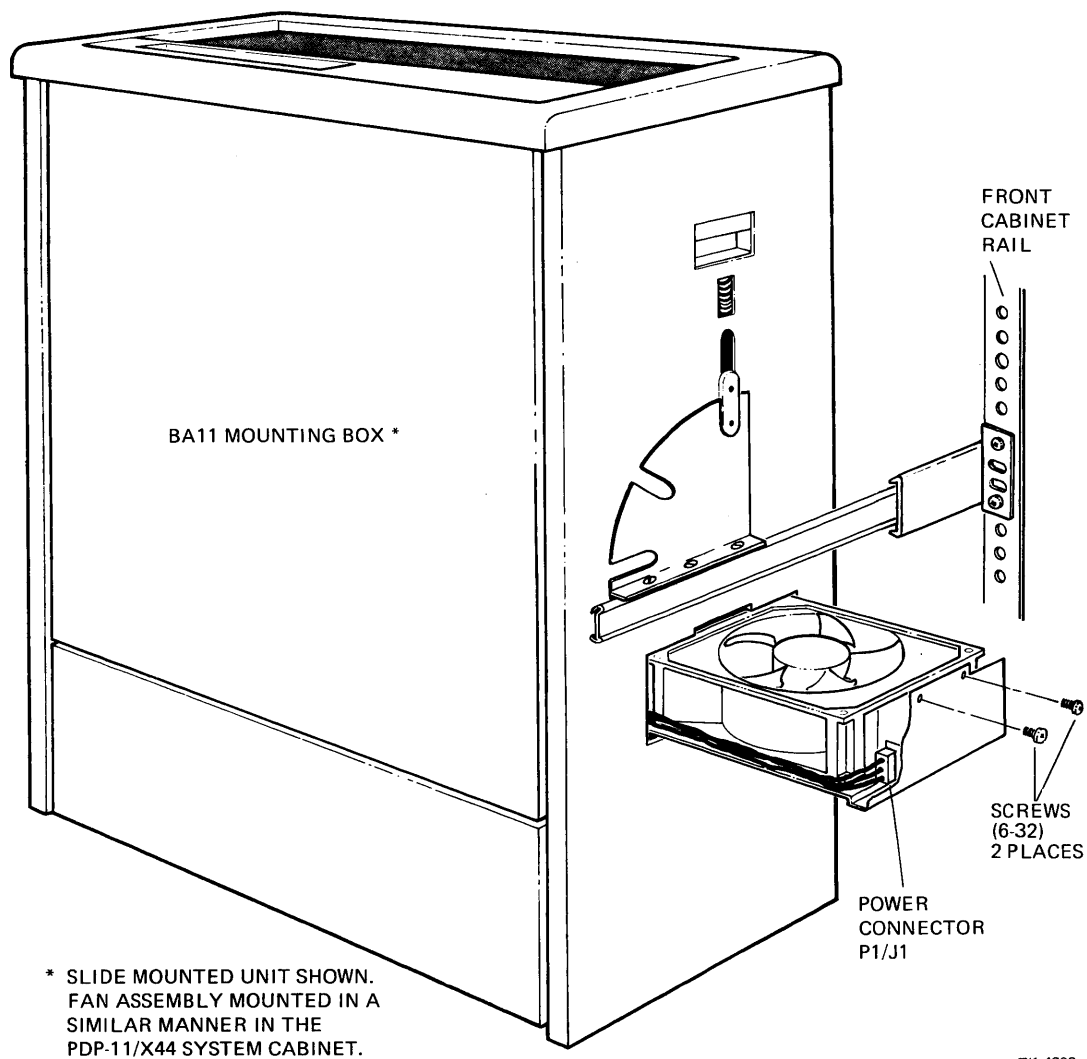


Figure 4-15 Fan Assembly Removal

4. Remove the two (6-32) screws that secure the fan assembly into the side of the box.
5. Slide the fan assembly away from the side of the box approximately 5 cm (2 in) and disconnect connector P1 from J1.
6. Continue to slide the assembly away from the box.

NOTE

Any of the three fans can be replaced by disconnecting the power plug on the fan and removing the four (6-32) mounting screws that secure the fans to the slide. Use only the specified replacement fan and mount the new fan to the assembly, using the hardware removed.

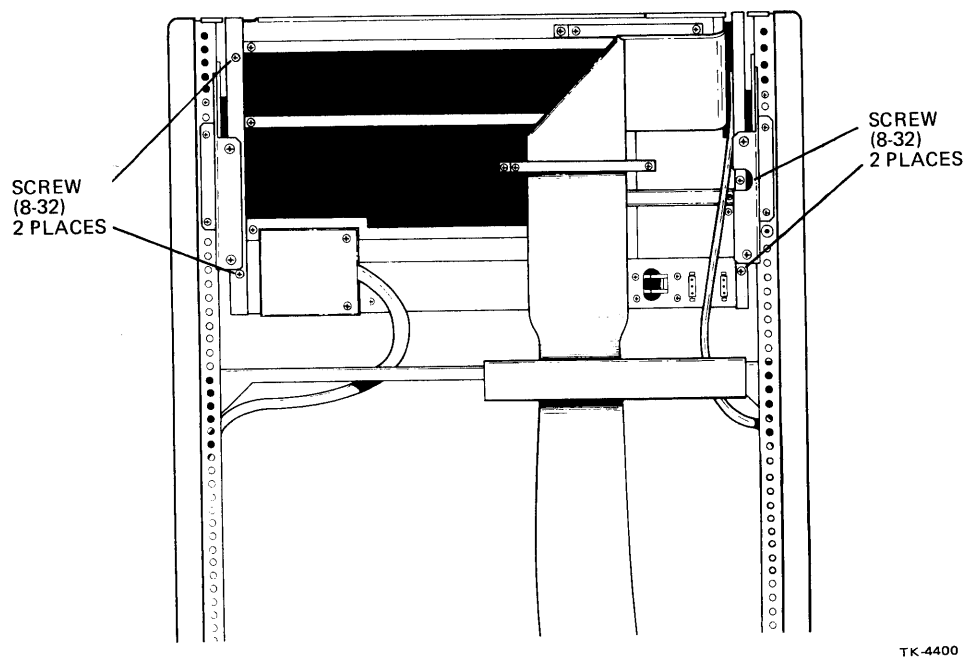
7. To replace the fan assembly, slide this assembly into the side of the mounting box, replace the plug removed in step 4 and the screws removed in step 3.
8. In a system cabinet with a type A release mechanism, perform steps 12 and 13 of Paragraph 4.2.1.3.
- 8a. In a system cabinet with a type B release mechanism, perform steps 12, 14, 19a and 19b of Paragraph 4.2.1.3.
- 8b. Perform steps 22 and 21 of paragraph 4.2.1.3.
9. If the BA11-A is slide mounted, release the pawl retractor (Figure 4-14) and tilt the box to its normal operating position.
- 9a. Perform steps 11 and 10 of Paragraph 4.2.2.3.

4.2.4 H7140 Power Supply Unit

The H7140 power supply unit is located at the rear of the BA11-A mounting box. To remove and replace the unit, perform the procedures in the following paragraphs.

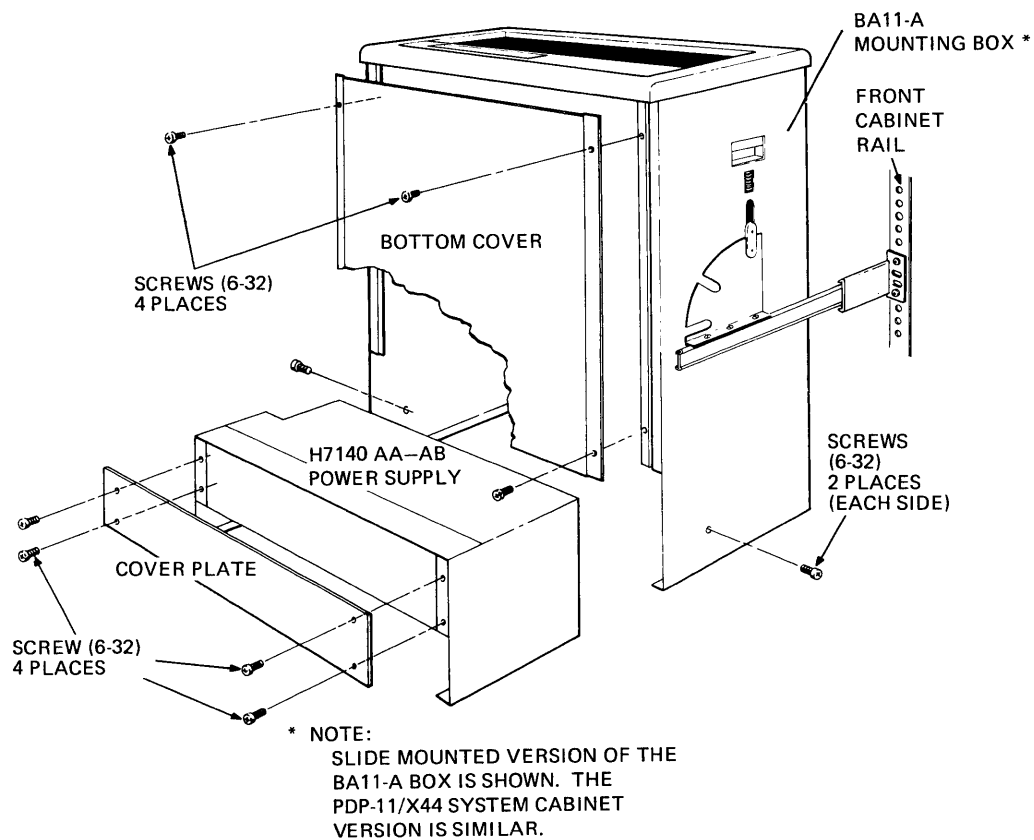
4.2.4.1 Power Supply Unit Removal – To remove the power supply, perform the following procedures.

1. In the system cabinet, perform steps 2 through 4 and 8 of Paragraph 4.2.1.1.
- 1a. If the release mechanism is type A (see Paragraph 4.2.1), perform steps 5a through 5f of Paragraph 4.2.1.1.
- 1b. If the release mechanism is type B, perform steps 6a through 6d, 11a and 11b of Paragraph 4.2.1.1.
2. If the BA11-A is slide mounted, perform steps 1 through 9 of Paragraph 4.2.2.1.
3. Remove the I/O and bus cables from the cable trough at the left side of the power supply and route the cables over the top of the power supply.
4. Remove and retain the two (8-32) screws located in each of the two chassis angles at the rear of the mounting box (Figure 4-16).
5. If the BA11-A is slide mounted, release the pawl retractor (Figure 4-14) on each side of the box and tilt the box 90° to the maintenance position (Figure 4-15).
6. In the system cabinet, raise the front of the mounting box to the position shown in Figure 4-8 and raise the safety lever to hold the mounting box in position.
7. Remove and retain the four (6-32) screws that secure the bottom cover to the mounting box (Figure 4-17). Remove the cover.
8. Remove and retain the four (6-32) screws that secure the cover plate to the bottom of the power supply assembly. Remove the cover.
9. Remove and retain the (10-32) screw that secures the ground lead to the ground bus (Figure 4-18).



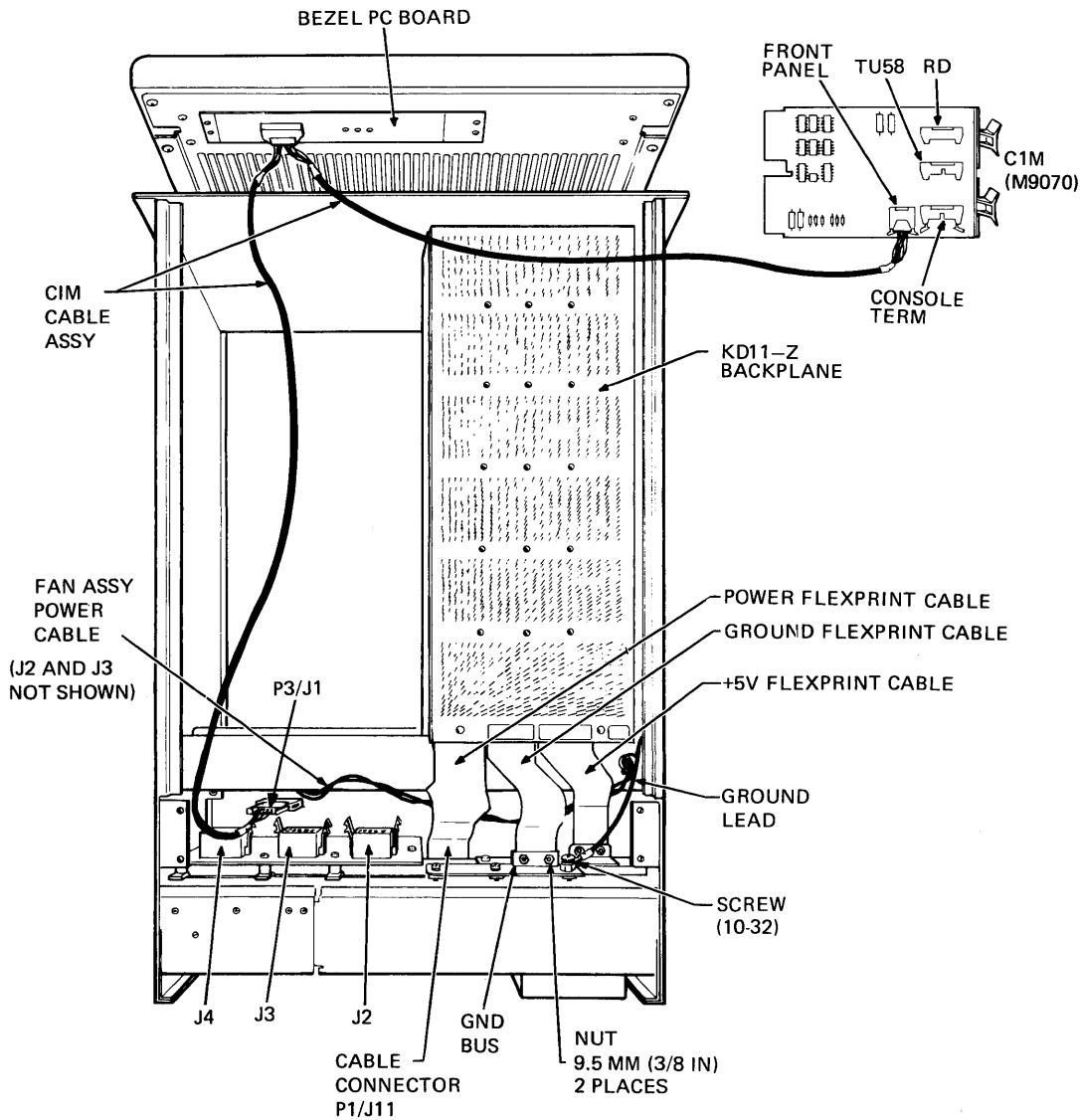
TK-4400

Figure 4-16 Power Supply Unit, Rear Mounting Screws



TK-4401

Figure 4-17 Power Supply Unit Removal



TK-3641

Figure 4-18 Mounting Box, Power Cable Connections

10. Loosen the two 3/8 in nuts on the clamp that holds the ground Flexprint cable to the ground bus bar.
11. Loosen the two 3/8 in nuts on the clamp that holds the +5 V Flexprint cable to the +5 V bus bar.
12. Slide the ground and +5 V Flexprint cables away from the clamps and bend up toward the backplane.
13. Remove the power Flexprint connector P1 from the power supply connector J11 and bend up toward the backplane.

14. Remove connector P3 of the CIM cable assembly from connector J1 of the power supply. Move the tabs on each side of J1 outward, to release P3 (Figure 4-18).
15. Remove the 3/8 in nut that secures the ground lead of connector P3 to the chassis ground stud (Figure 4-19).

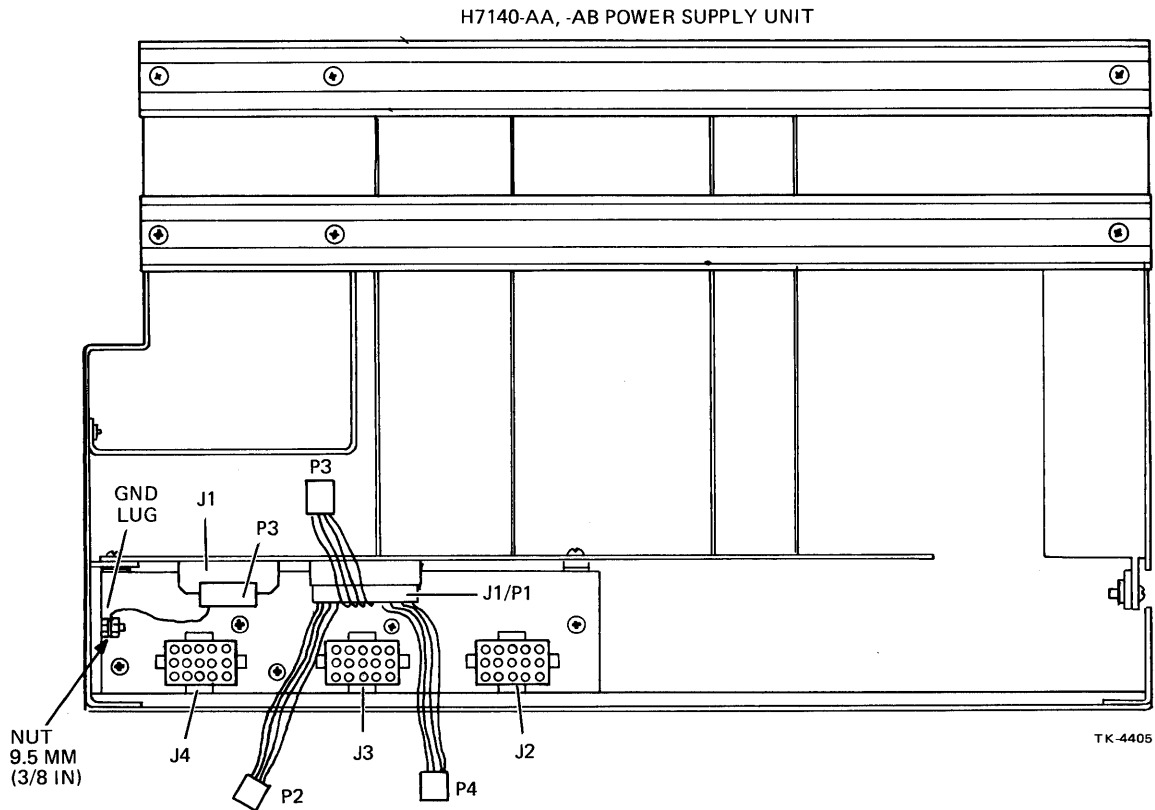


Figure 4-19 Power Distribution Panel Connectors and Cable Assembly

16. If one or more additional backplanes are mounted in the box, remove the connectors attached to J2, J3 and J4 of the power distribution board. Remove the backplane connectors from P2, P3, and P4 of the power distribution harness.
17. In a slide mounted installation, remove and retain the (8-32) screw located on each side of the mounting box, toward the rear (Figure 4-17).
18. In a system cabinet installation, remove the side panels of the cabinet.
- 18a. Release the safety lever and lower the mounting box so that the (8-32) screws located on each side of the mounting box toward the rear are accessible (Figure 4-17).
- 18b. Remove and retain the two (8-32) screws described in step 18a.

CAUTION

The H7140 power supply assembly will tend to slide forward when the screws in step 18 are removed.

19. Slide the power supply assembly forward approximately 5.0 cm (2.0 in) and disconnect the fan assembly power cable shown in Figure 4-18 from connectors J2 and J3 (not shown) on the power supply PC board.
20. Slide the power supply assembly from the mounting box and away from the cabinet.

4.2.4.2 Power Supply Unit Replacement

1. With the mounting box in the maintenance position, ensure that the I/O and bus cables will not interfere with the power supply installation.
2. Slide the power supply into the mounting box chassis until it is approximately 5.0 cm (2.0 in) from being completely in position (Figure 4-17).
3. Connect the fan assembly power cable terminals removed in step 19 of Paragraph 4.2.4.1.
4. In the system cabinet, replace the screws (8-32) removed in step 18a and 18b of Paragraph 4.2.4.1.
- 4a. Raise the mounting box to the maintenance position and raise the safety lever (Figure 4-8).
- 4b. Replace the side panels removed in step 18 of Paragraph 4.2.4.1.
5. If the BA11-A is slide mounted, replace the screws (8-32) removed in step 17.
6. Replace the backplane connectors removed in step 16 of Paragraph 4.2.4.1.
7. Replace the ground lead removed in step 15 of Paragraph 4.2.4.1.
8. Replace connector P3 removed in step 14 of Paragraph 4.2.4.1.
9. Replace the power Flexprint cable connector removed in step 13 of Paragraph 4.2.4.1.
10. Replace the +5 V and ground Flexprint cables removed in steps 10 through 12 of Paragraph 4.2.4.1.
11. Replace the ground lead removed in step 9 of Paragraph 4.2.4.1.
12. Replace the cover plate removed in step 8 of Paragraph 4.2.4.1.
13. Replace the bottom cover removed in step 7 of Paragraph 4.2.4.1.
14. In the system cabinet, release the safety lever and lower the mounting box to the normal operating position.
- 14a. If the release mechanism is type A (see Paragraph 4.2.1), the latch will engage when the front of the unit is pressed down.
- 14b. If the release mechanism is type B, press down on the front of the box and push the slide latches forward to engage with the holding pins on the left and right side of the mounting box (Figure 4-5).

15. If the mounting box is installed on slides, release the pawl retractor and tilt the box to its normal operating position (Figure 4-12).
16. Replace the screws removed in step 4 of Paragraph 4.2.4.1.
17. Replace the I/O and bus cables removed in step 3 of Paragraph 4.2.4.1.
18. If the mounting box is installed on slides, install the top cover removed in steps 8 and 9 of Paragraph 4.2.2.1.
- 18a. Release the slide hold lever on each slide rail and push the mounting box into the cabinet until the front latch engages (Figure 4-12).
19. Replace the cable clamp bar removed in step 8 of Paragraph 4.2.1.1.
20. In the system cabinet, if the release mechanism is type A (see Paragraph 4.2.1), replace the top cover as described in steps 15a through 15c of Paragraph 4.2.1.3.
21. In the system cabinet, if the release mechanism is type B, replace the top cover as described in steps 16a through 16c of Paragraph 4.2.1.3.
22. In the system cabinet, connect the ac power as described in steps 17 through 19 of Paragraph 4.2.1.3.
23. If the BA11-A unit is slide mounted, perform steps 9 and 10 of Paragraph 4.2.2.3.

4.2.5 CPU Backplane Assembly

The CPU backplane is mounted on the right side of the BA11-A mounting box. Perform the following procedures to remove and replace the assembly.

4.2.5.1 Backplane Assembly Removal – Perform the following procedures to remove the backplane.

1. In the system cabinet, perform steps 1 through 3 of Paragraph 4.2.1.1 to remove the ac power from the unit.
- 1a. If the release mechanism is type A (see Paragraph 4.2.1), perform steps 5a through 5f of Paragraph 4.2.1.1 to remove the top cover of the cabinet.
- 1b. If the release mechanism is type B, perform steps 6a through 6d of Paragraph 4.2.1.1 to remove the top cover of the cabinet.
2. If the mounting box is installed on slides, perform steps 1 and 2 of Paragraph 4.2.2.1 to remove the ac power.
- 2a. Perform steps 5 through 9 of Paragraph 4.2.2.1 to remove the top cover of the mounting box.
3. Remove the I/O and bus cables from the modules in the CPU backplane.
4. Remove the modules from the CPU backplane.

NOTE

Observe the module locations so that they can be replaced into the CPU backplane in the same positions.

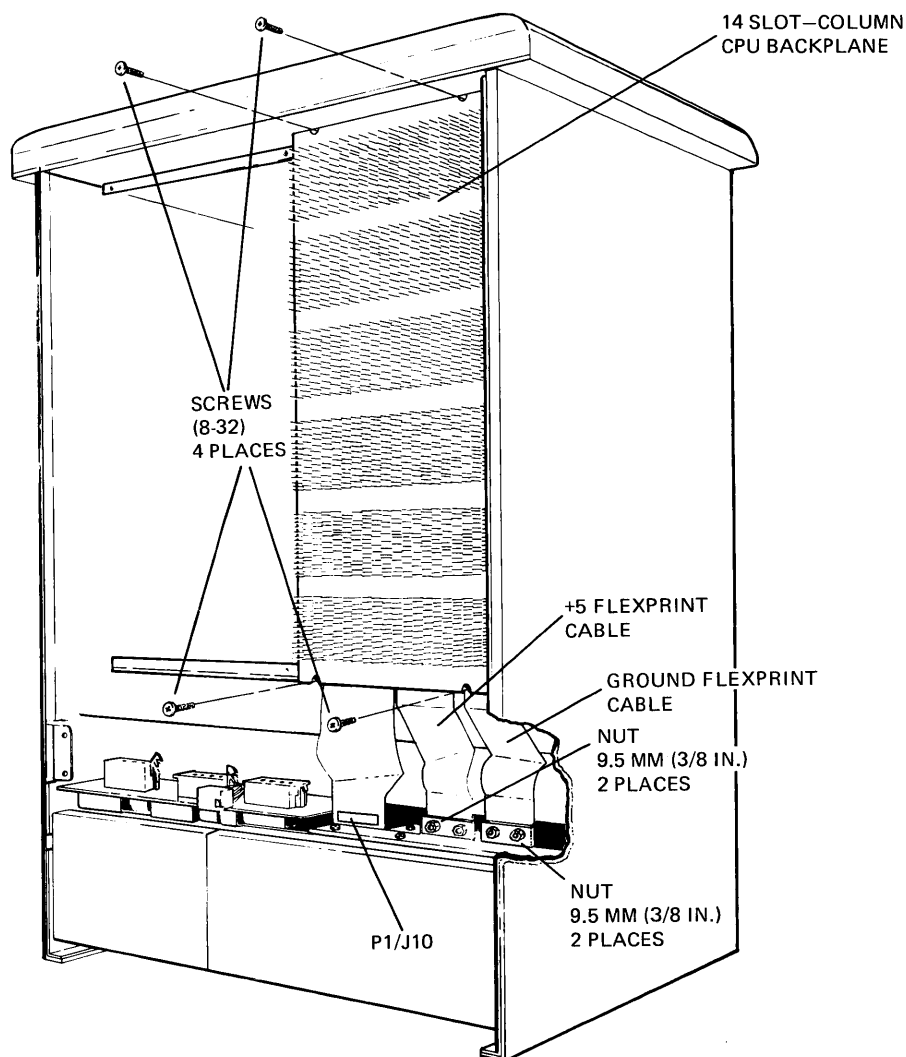
5. In the system cabinet, if the release mechanism is type A, press the release lever and raise the front of the mounting box.
6. In the system cabinet, if the release mechanism is type B, locate the left and right slide latches on the angle brackets attached to each side of the BA11-A (Figure 4-7).
- 6a. Slide the latches toward the rear of the unit to release the holding pins.
7. In the system cabinet, raise the front of the mounting box to the maintenance position and raise the safety lever to hold the box in position.
8. If the mounting box is installed on slides, perform steps 5 through 7 of Paragraph 4.2.2.1.
- 8a. Release the pawl retractor on each side of the mounting box and tilt the box to 90° to the maintenance position.
9. Perform steps 7 through 13 of Paragraph 4.2.4.1.
10. Remove and retain four (8-32) screws used to secure the CPU backplane onto the mounting rails (Figure 4-20).
11. Remove the CPU backplane assembly.

4.2.5.2 Backplane Assembly Replacement – Perform the following procedures to install the backplane assembly.

1. Install the CPU backplane using the four (8-32) screws removed in step 10 of Paragraph 4.2.5.1. Do not tighten the screws.
2. In the system cabinet, release the safety lever and lower the front of the mounting box.
- 2a. If the release mechanism is type A (see Paragraph 4.2.1), the latch will engage when the box is in the normal operating position.
- 2b. If the release mechanism is type B, press down on the front of the unit and slide the left and right latches toward the front to engage the holding pins (Figure 4-7).
3. If the mounting box is installed on slides, release the pawl retractors on each side and rotate the box to the normal operating position (Figure 4-12).
4. Insert a hex-height module into the card guides that are aligned with the first and last slots at each side of the backplane (Figure 4-21).

NOTE

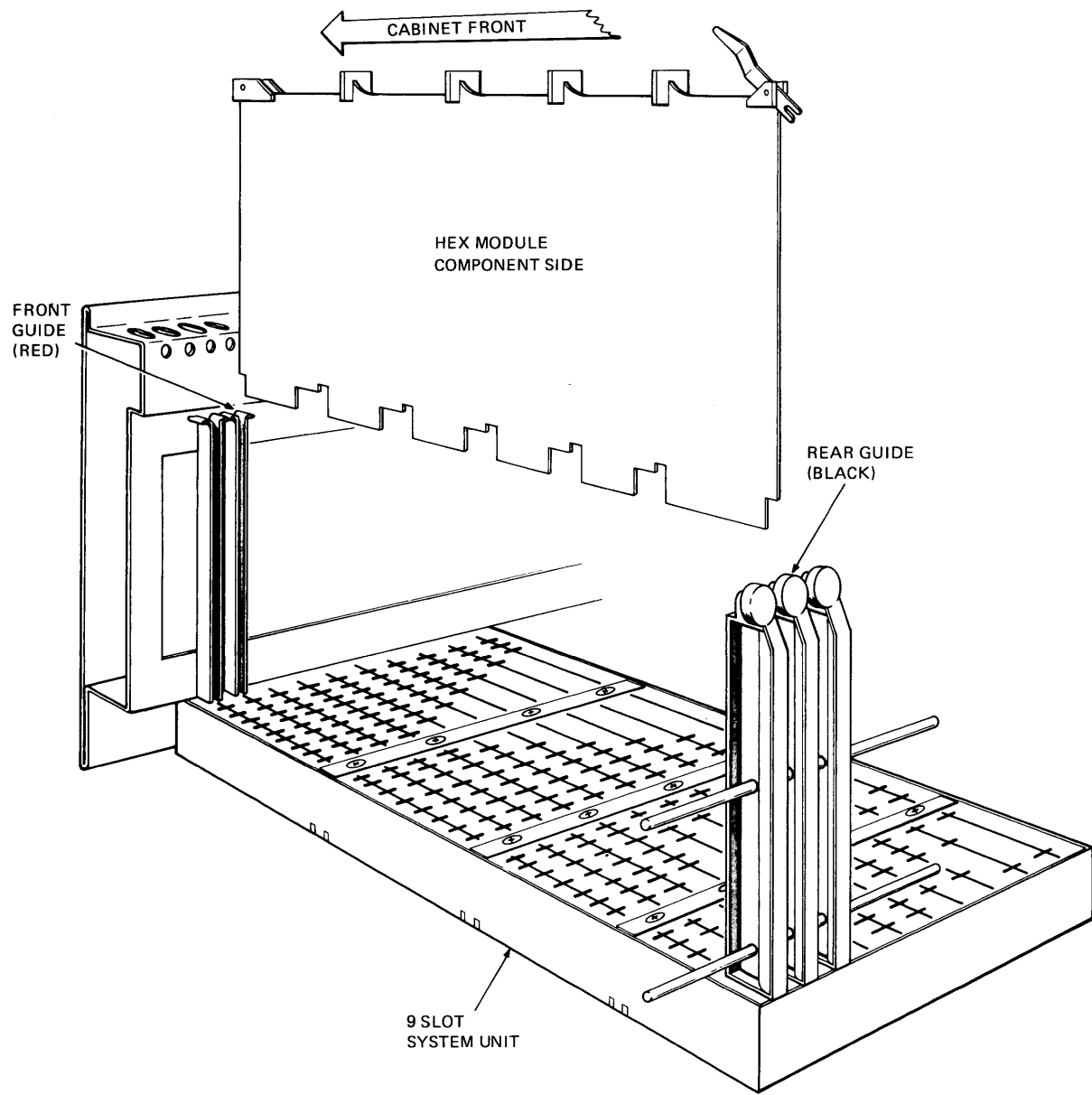
The backplane assembly can be shifted in position to enable the module connectors to be properly aligned with the module slots.



TK-5018

Figure 4-20 CPU Backplane Assembly Mounting

5. Raise the mounting box to the maintenance position as described in steps 5 or 6 and step 7 of Paragraph 4.2.5.1.
6. Tighten the screws (8-32) installed in step 1.
7. Replace the Flexprint cables and ground lead that was removed in steps 6 and 7.
8. Replace the cover plate and bottom cover of the mounting box that was removed in steps 8 and 7 of Paragraph 4.2.4.1.
9. Lower the mounting box to its normal operating position as described in steps 2, 2a, 2b or 3.
10. Remove the hex-height modules used to align the backplane.
11. Replace the modules that were removed in step 4 of Paragraph 4.5.4.1.



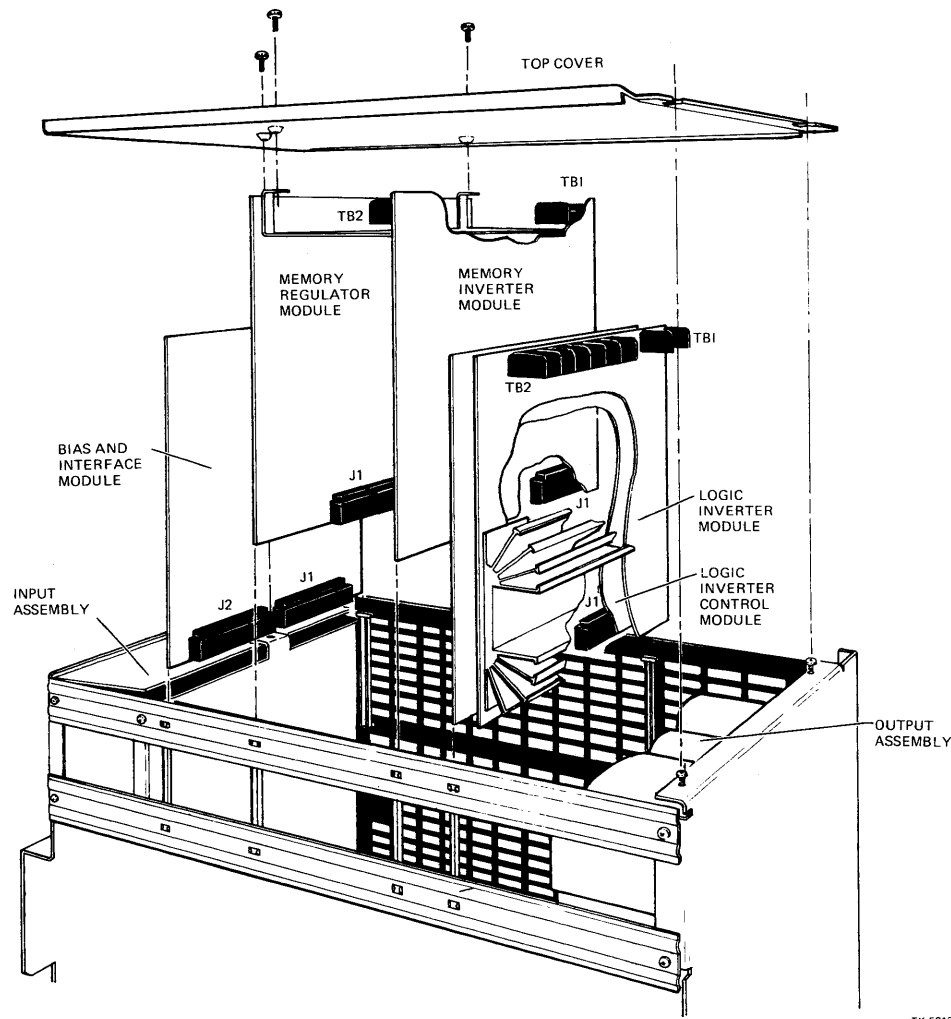
TK-4404

Figure 4-21 Backplane Assembly Alignment

12. Replace the I/O and bus cables that were removed in step 3 of Paragraph 4.2.4.1.
13. In the system cabinet, perform steps 21 or 23 of Paragraph 4.2.4.2 to replace the top cover of the cabinet.
14. If the mounting box is installed on slides, replace the top cover that was removed in step 2a.
15. Restore the ac power to the unit that was removed in steps 1 and 2 of Paragraph 4.2.1.1.

4.3 POWER SUPPLY UNIT, COMPONENT LOCATIONS

The H7140-AA, -AB power supply contains an input assembly, three removable module assemblies, and an output assembly as shown on Figure 4-22. The power supply also contains a mother module and a power distribution module. Signals and voltages are distributed between the module assemblies by the mother module. The power distribution module distributes the signals and voltages to the backplanes.



TK-5013

Figure 4-22 H7140 Unit Module and Assembly Locations

4.3.1 Input Assembly

Figure 4-23 shows the components associated with the input assembly. This assembly is not removable as a unit.

4.3.2 Bias and Interface Components

The interface and control circuits, the bias circuits, and the fan square-wave voltage circuits are located on the bias and interface module and on the mother module.

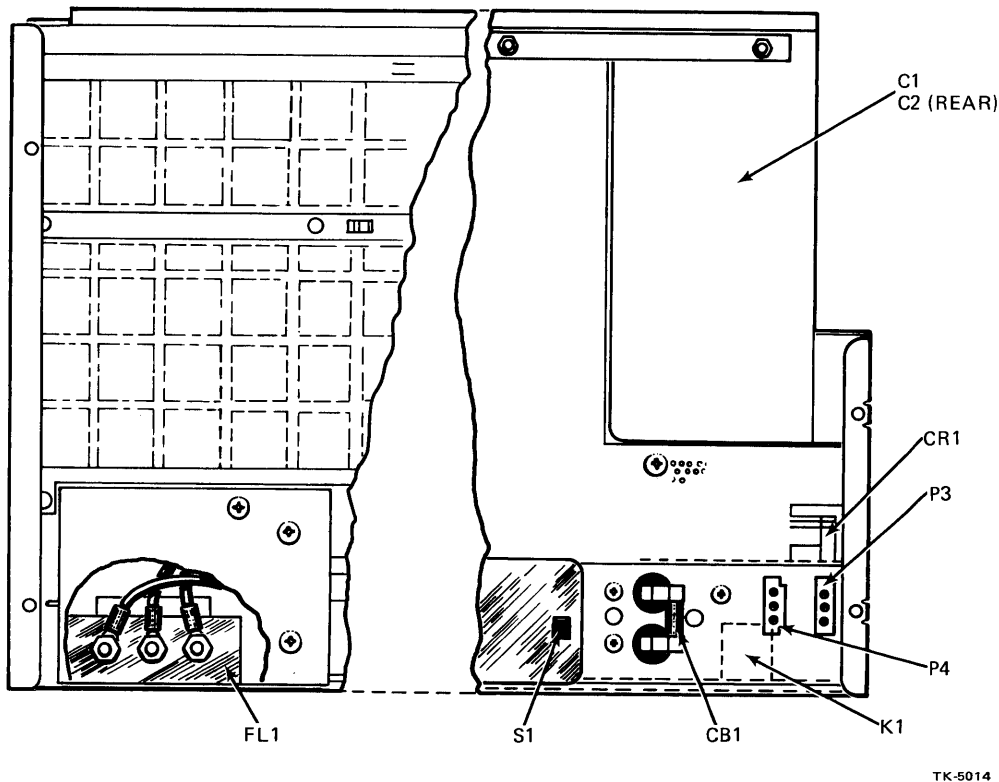


Figure 4-23 Input Assembly, Component Locations

4.3.2.1 Bias and Interface Module – The main components associated with the interface and control logic are shown in Figure 4-24. The +12 V and –15 V bias voltages are developed by circuit components shown in Figure 4-25 and by components located on the mother module. The fan voltage components are shown in Figure 4-26.

4.3.2.2 Mother Module – The mother module contains the PC wiring and connectors to electrically connect the modules and assemblies of the power supply. The module also contains components used in developing the +12 V and –15 V bias voltages and the +15 V and –15 V for the logic modules. These components are shown in Figure 4-27.

4.3.3 Memory Voltage Assembly

The memory voltage assembly, shown in Figure 4-28, develops the voltages required by the system memory modules. The assembly consists of the memory inverter module and the memory regulator module, which are connected together by a mounting bracket.

4.3.3.1 Memory Inverter Module – Figure 4-29 shows the main components associated with the functions on the memory inverter module. This module develops the +35 V used as the source for the memory voltages generated on the memory regulator module. Transformer T3, which connects to the memory inverter module, is mounted on the bracket shown in Figure 4-28.

4.3.3.2 Memory Regulator Module – The memory regulator module contains the +5 B regulator, the +12 B regulator and the –12 B regulator. Figure 4-30 shows the location of the main components on the module used to produce the +5 B voltage. Figure 4-31 shows the main components used to generate the +12 B voltage. Figure 4-32 shows the main components associated with the generation of the –12 B voltage.

4.3.4 Logic Voltage Assembly

The logic voltage assembly produces the voltage required by the logic modules in the backplane. The assembly shown on Figure 4-33 consists of the logic inverter control module and the logic inverter module. These modules operate with the components of the output assembly to develop the +5 V, +15 V and -15 V.

4.3.4.1 Logic Inverter Control Module – Figure 4-34 shows the components associated with the reference voltage generation and the voltage sensing.

Figure 4-35 shows the components used to develop the +15 V and the -15 V on the logic inverter control module.

4.3.4.2 Logic Inverter Module – Figure 4-36 shows the component locations on the logic inverter module.

4.3.5 Output Assembly

The output assembly contains the high voltage transformer T1 and the rectifier components that generate the +5 V output. Figure 4-37 shows the location of the components. The snubber module is located below the transformer T1 and choke L1 and contains the components shown in Figure 4-38.

4.3.6 Power Distribution Module

Figure 4-39 shows the components and connectors on the power distribution module. Connector P1 of the power distribution cable assembly (DIGITAL No. 7016887) attaches connector J1 on this module. Figure 4-40 shows the cable assembly wiring.

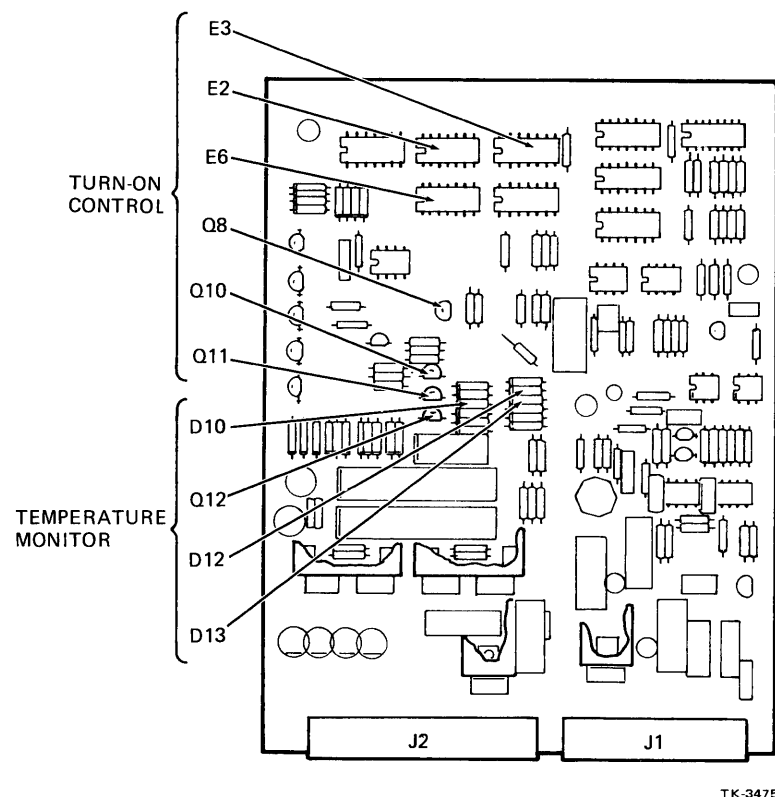


Figure 4-24 Bias and Interface Module, Interface and Control Components (Sheet 1 of 3)

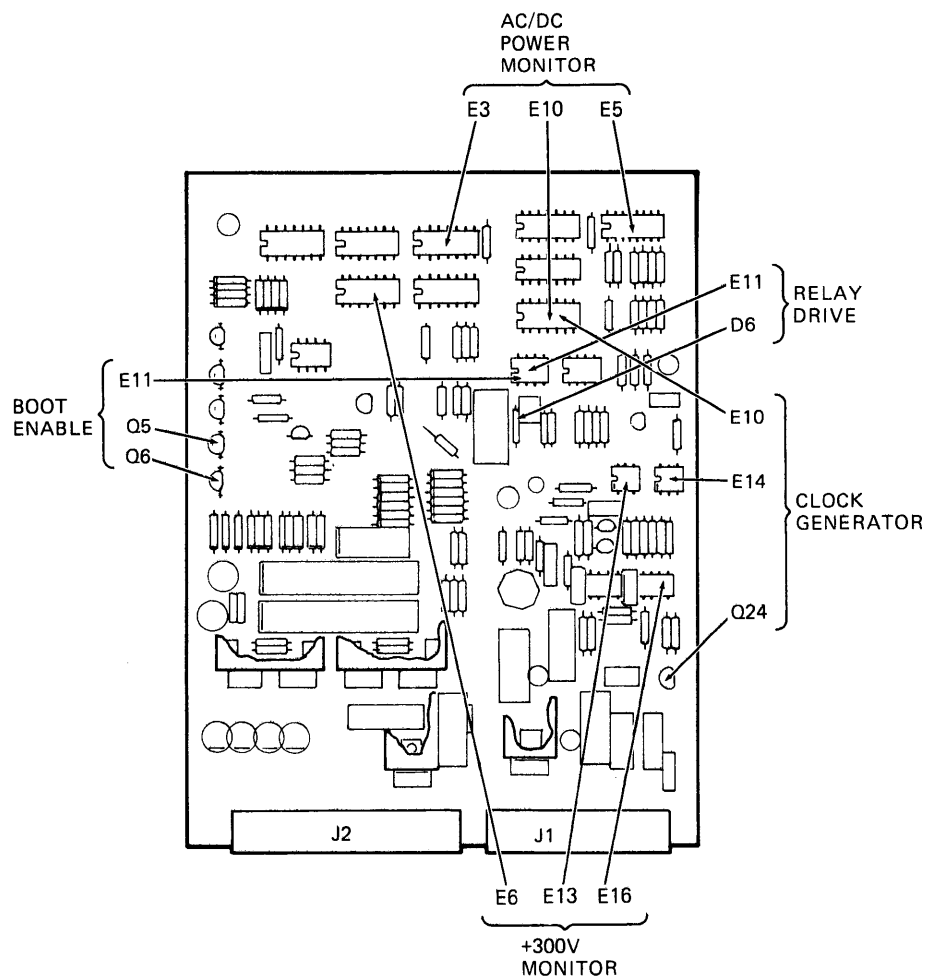
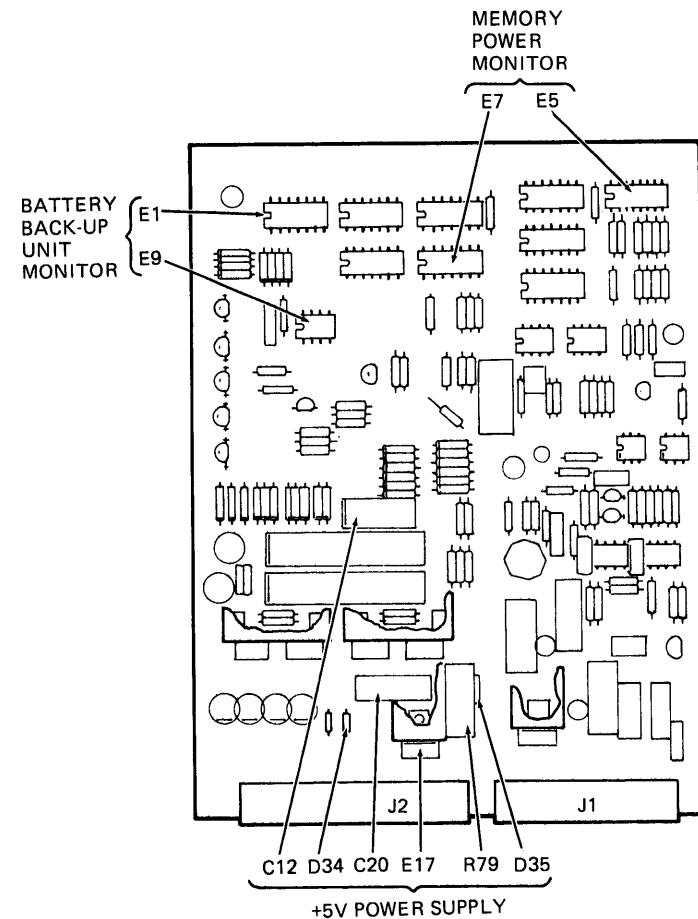
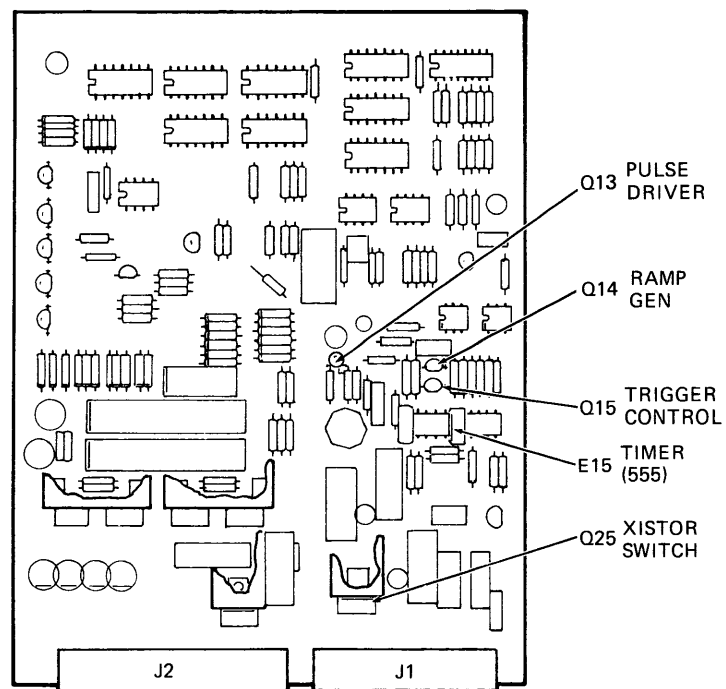


Figure 4-24 Bias and Interface Module, Interface and Control Components (Sheet 2 of 3)



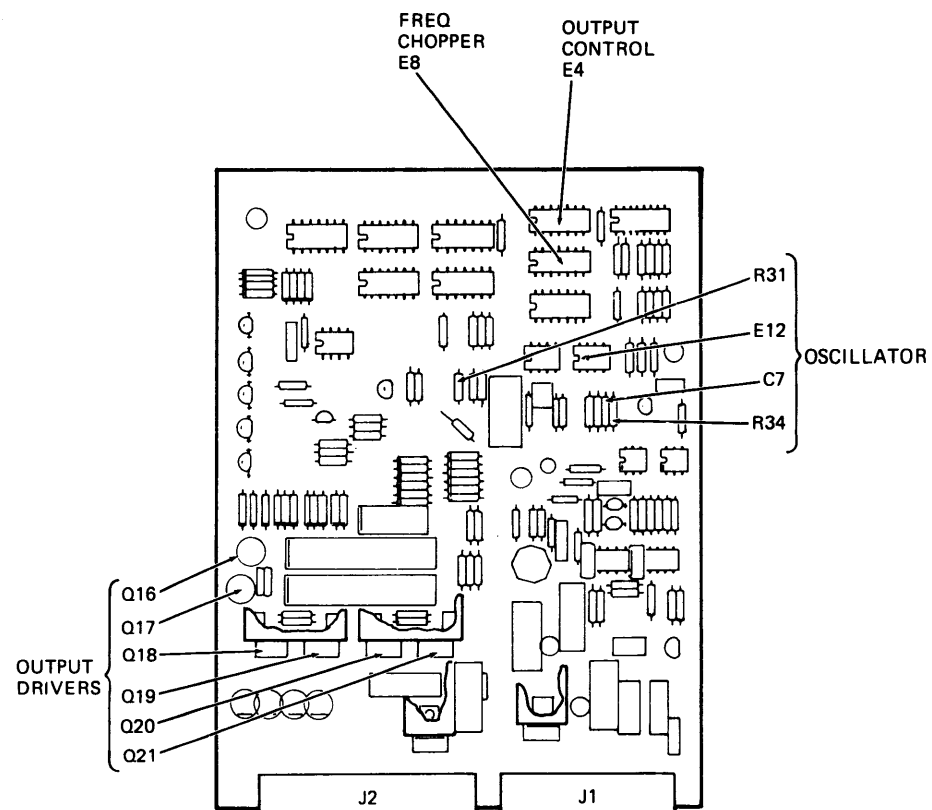
TK-3482

Figure 4-24 Bias and Interface Module, Interface and Control Components (Sheet 3 of 3)



TK-3474

Figure 4-25 Bias and Interface Module,
Bias Voltage Components



TK-3476

Figure 4-26 Bias and Interface Module, Fan Voltage Components

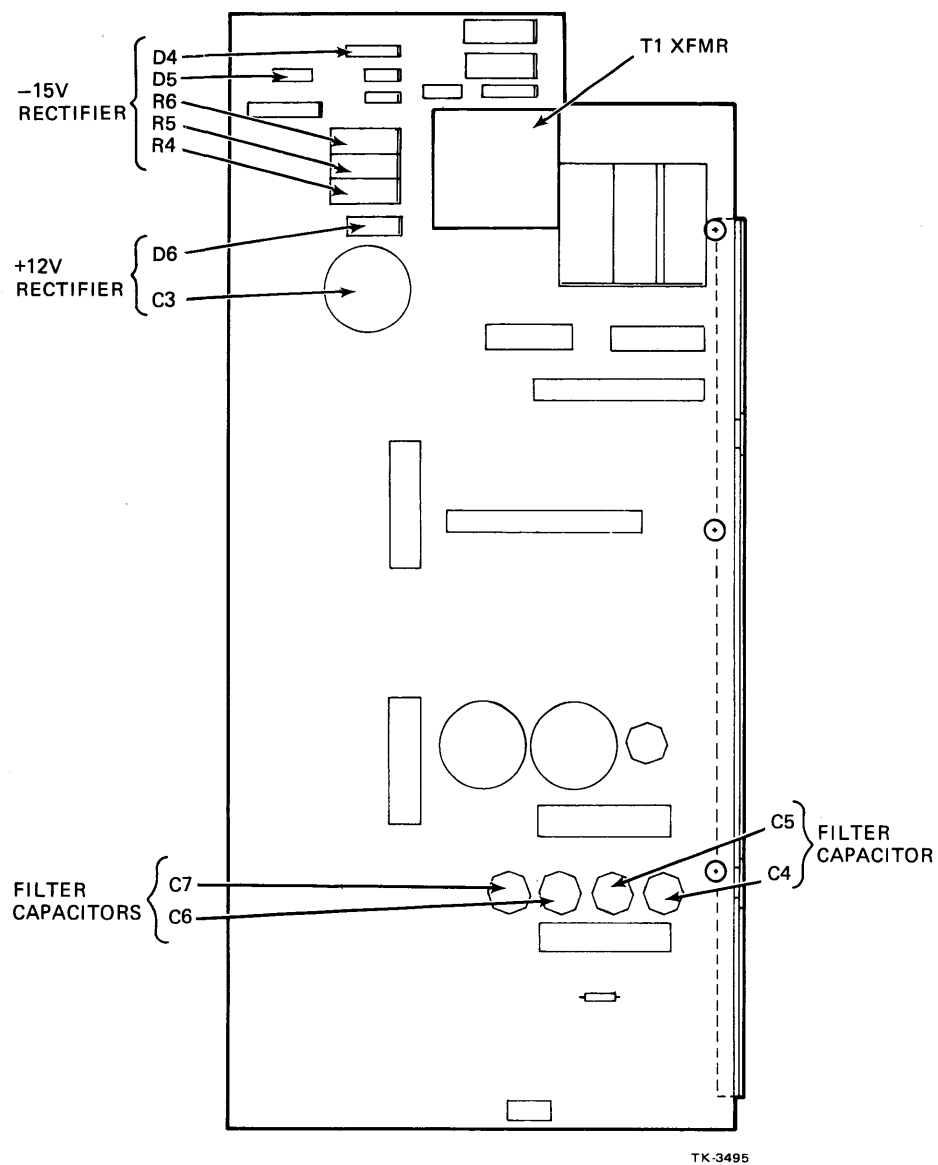


Figure 4-27 Mother Module Components

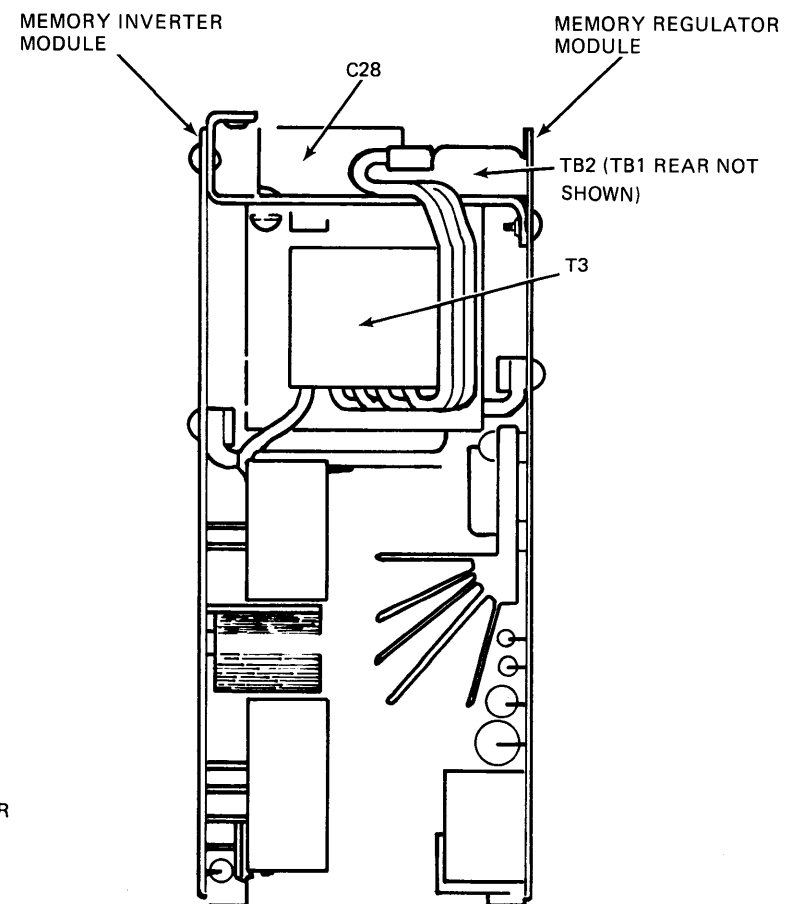
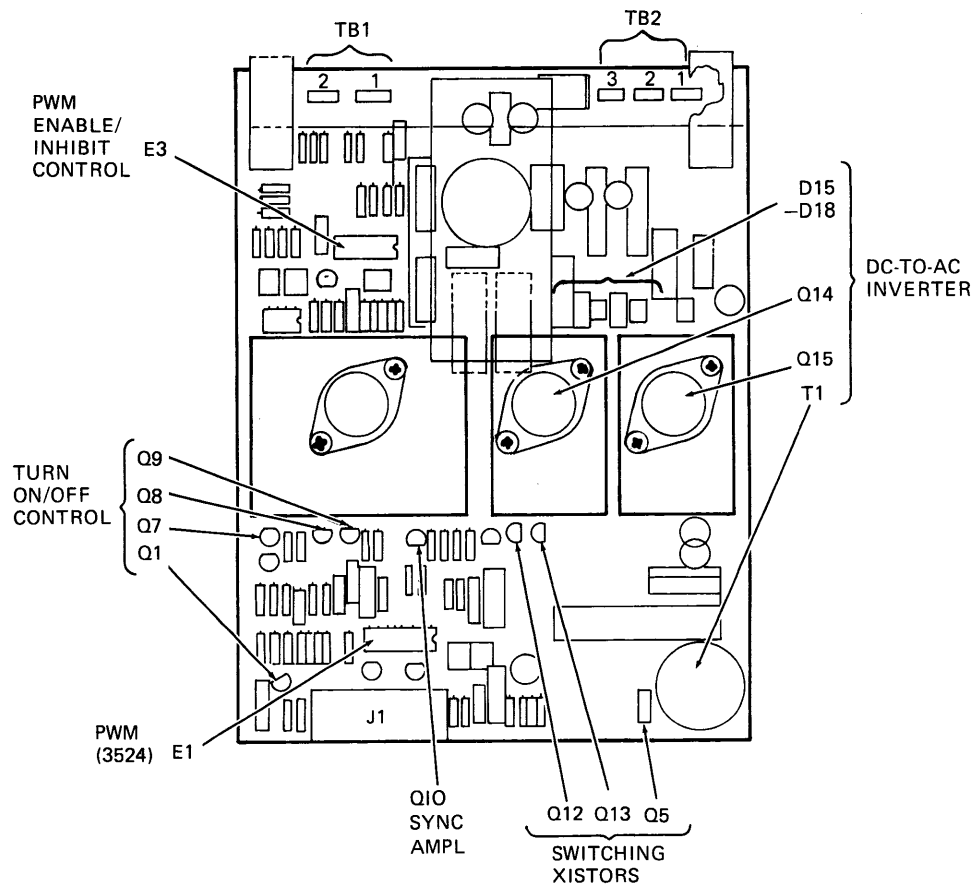
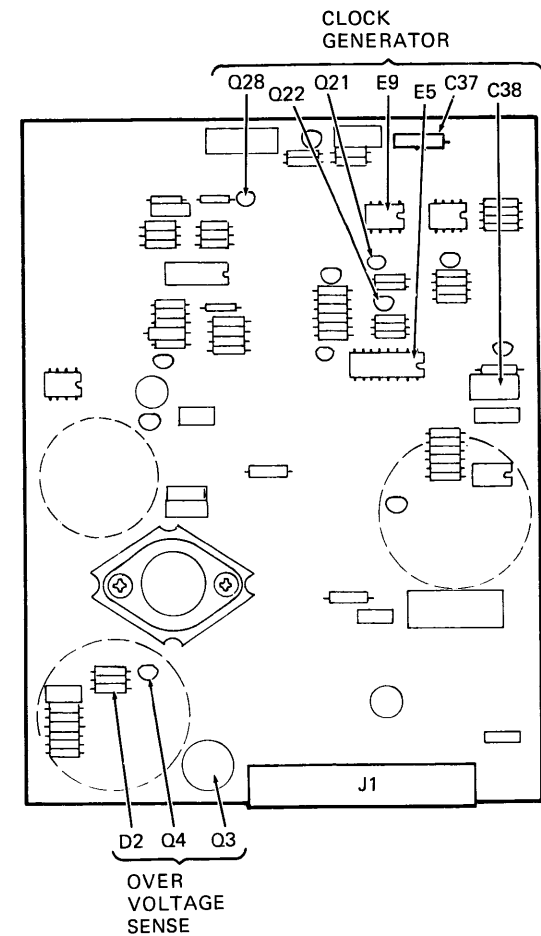


Figure 4-28 Memory Voltage Assembly Components



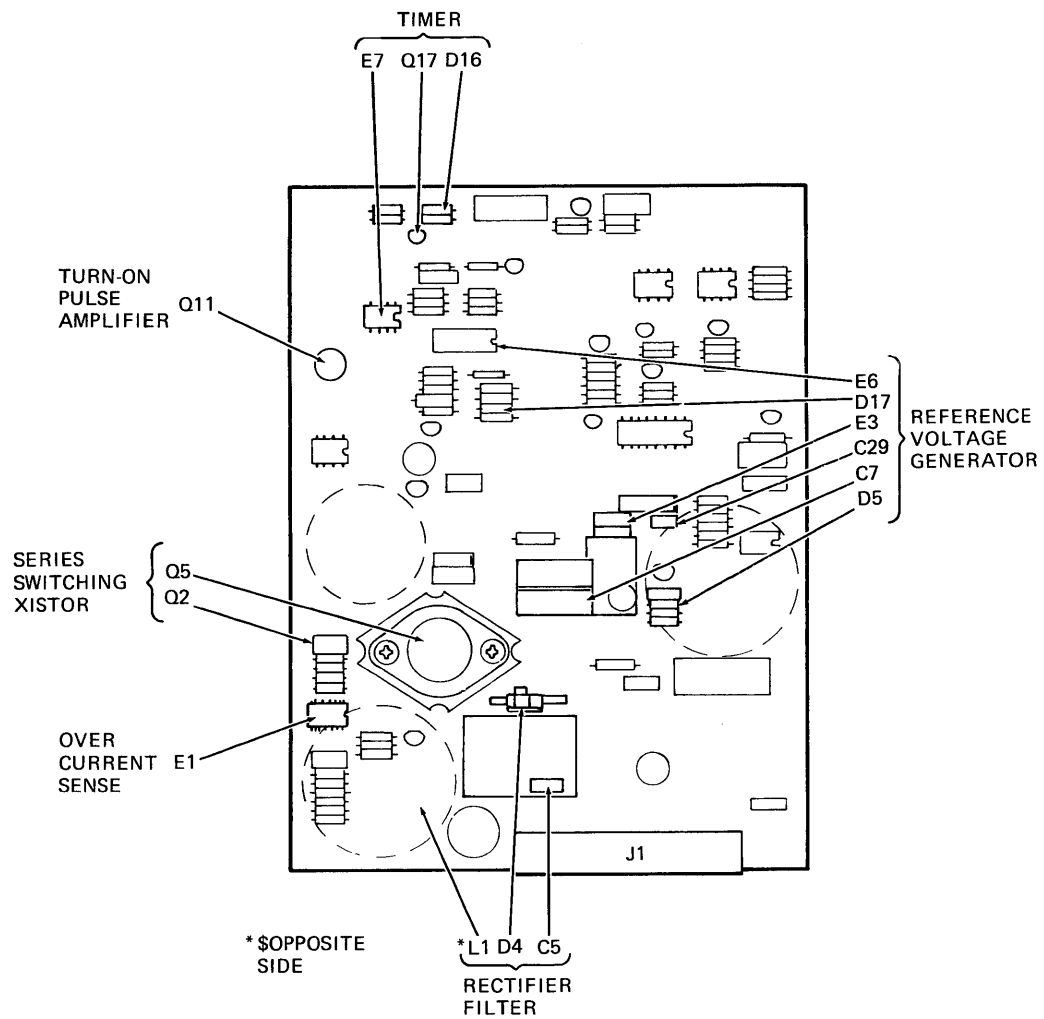
TK-3466

Figure 4-29 Memory Inverter Module Components



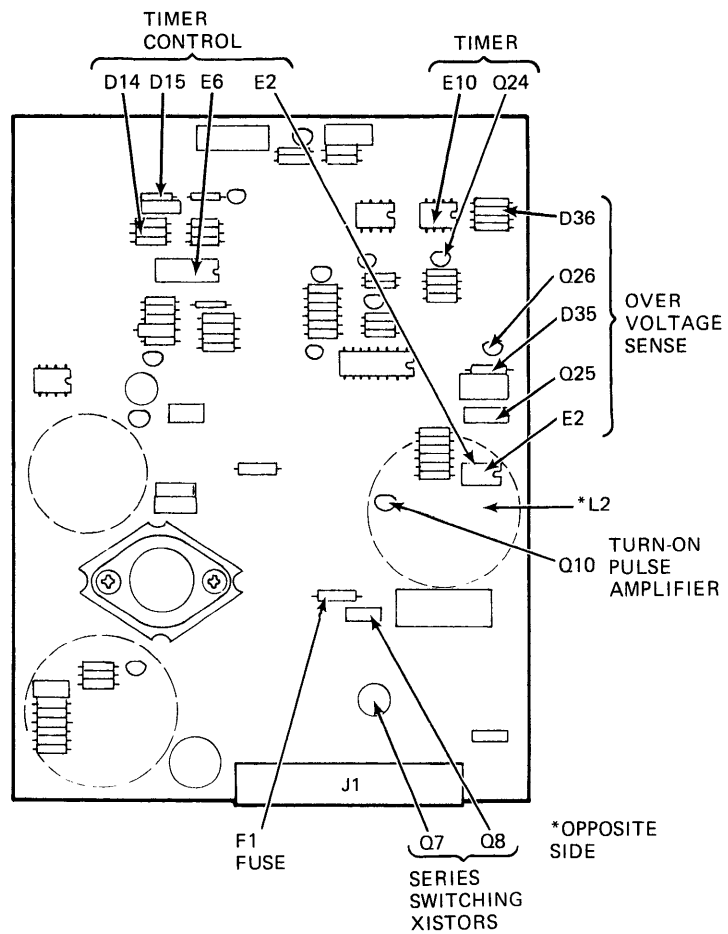
TK-3492

Figure 4-30 Memory Regulator Module,
+5 B Components
(Sheet 1 of 2)



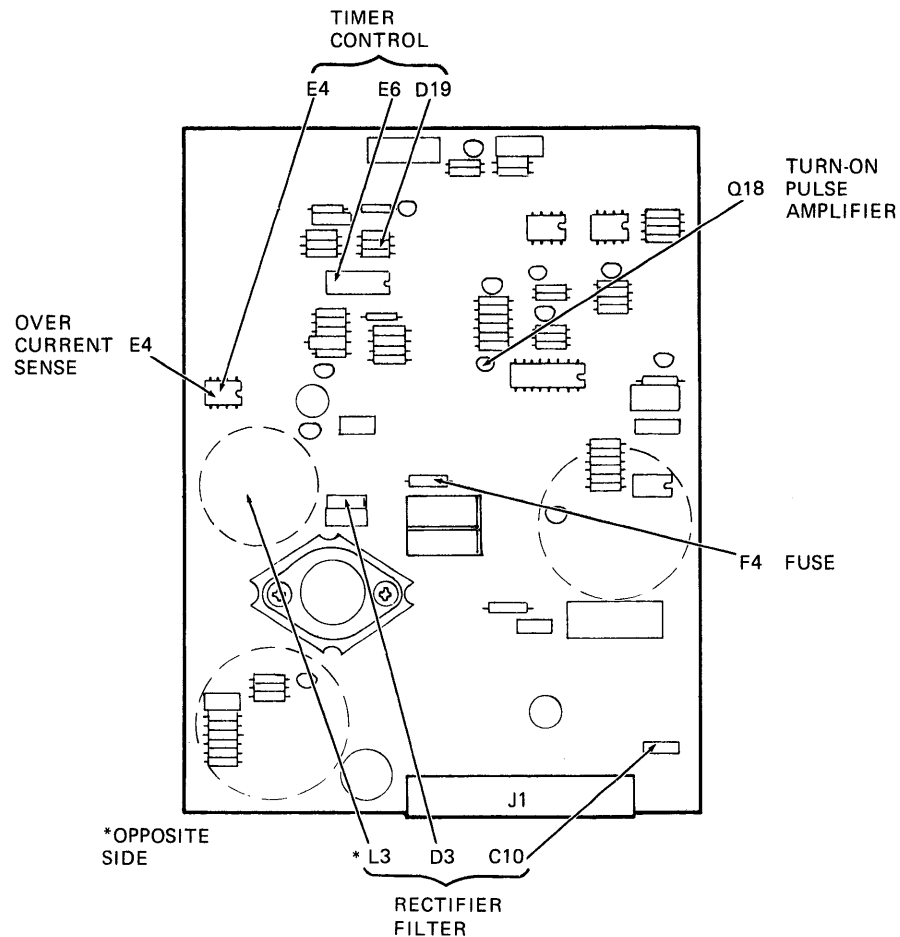
TK-3462

Figure 4-30 Memory Regulator Module, +5 B Components
(Sheet 2 of 2)



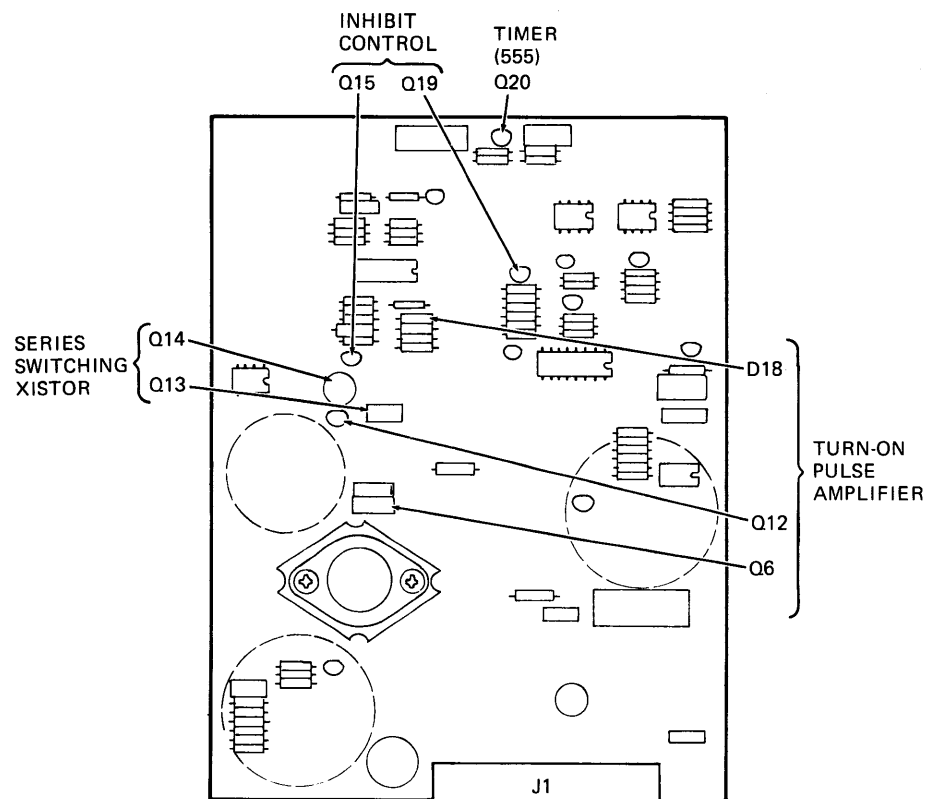
TK-3484

Figure 4-31 Memory Regulator Module,
+12 B Component Locations



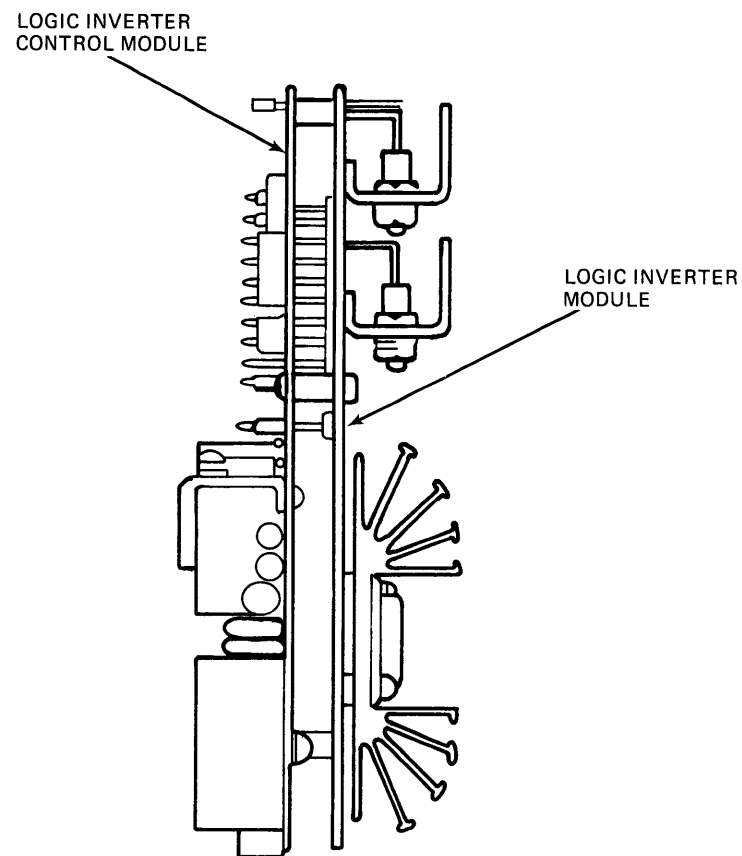
TK-3472

Figure 4-32 Memory Regulator Module, -12 B Components
(Sheet 1 of 2)



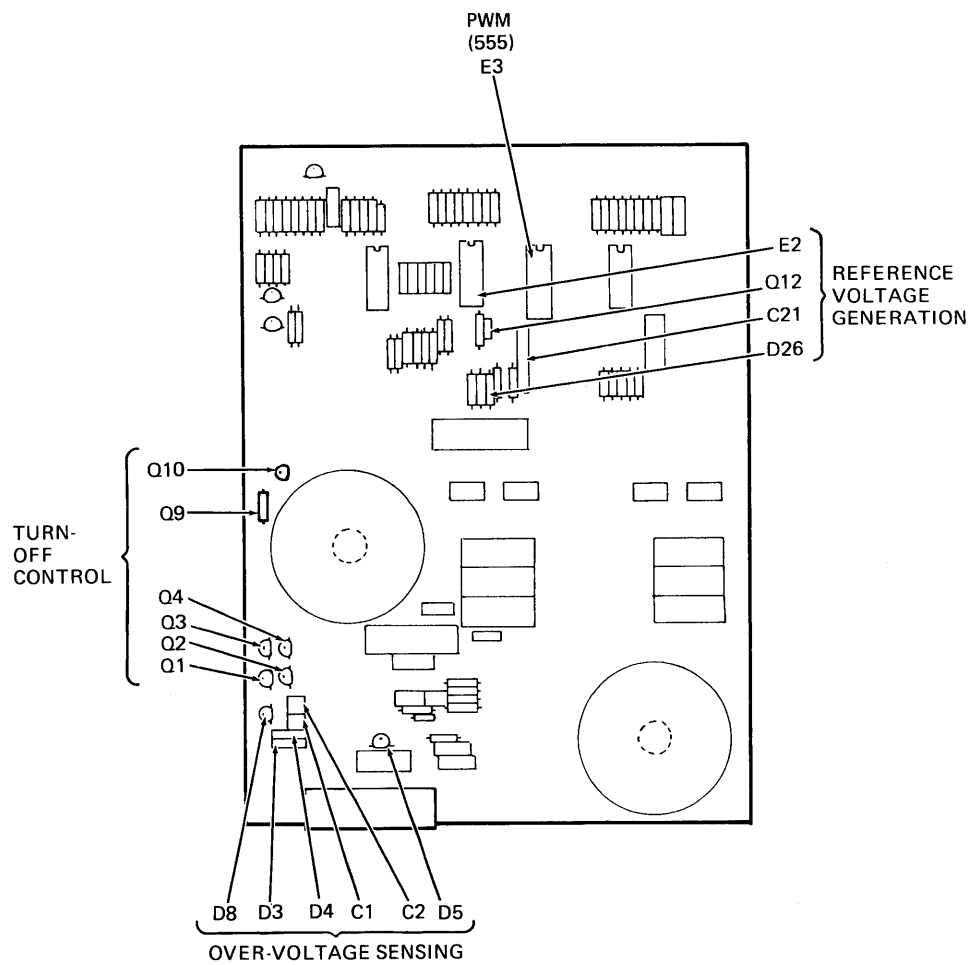
TK-3491

Figure 4-32 Memory Regulator Module, -12 B Components
(Sheet 2 of 2)



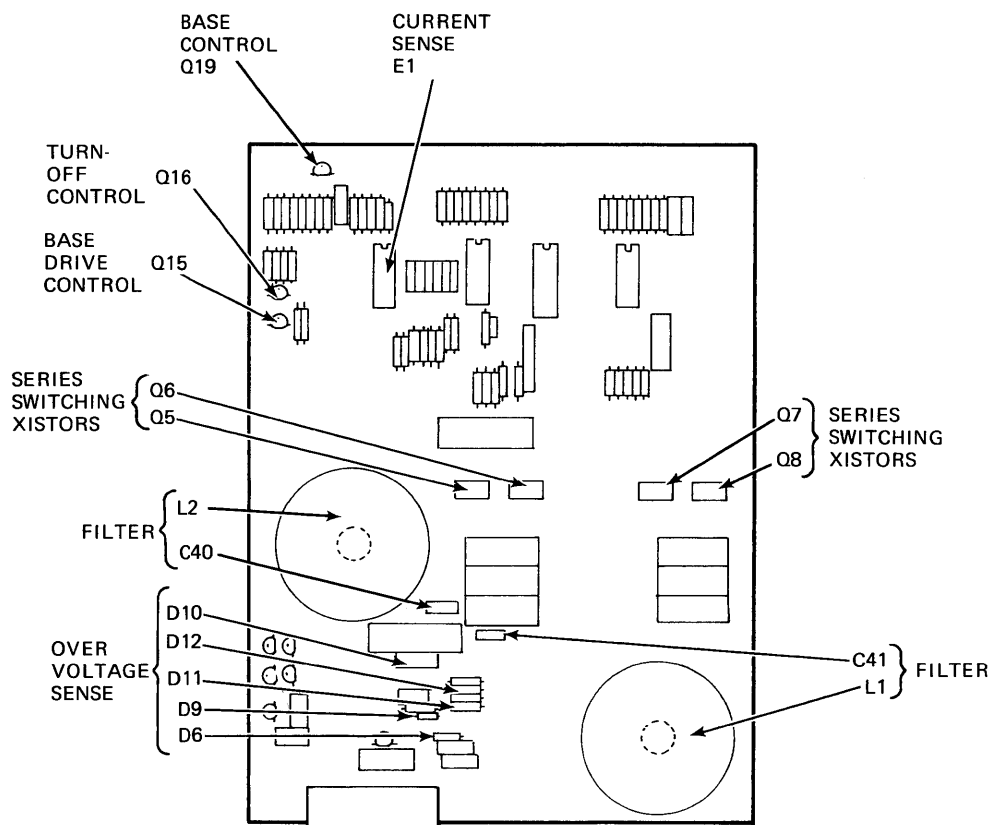
TK-5016

Figure 4-33 Logic Inverter Assembly Components



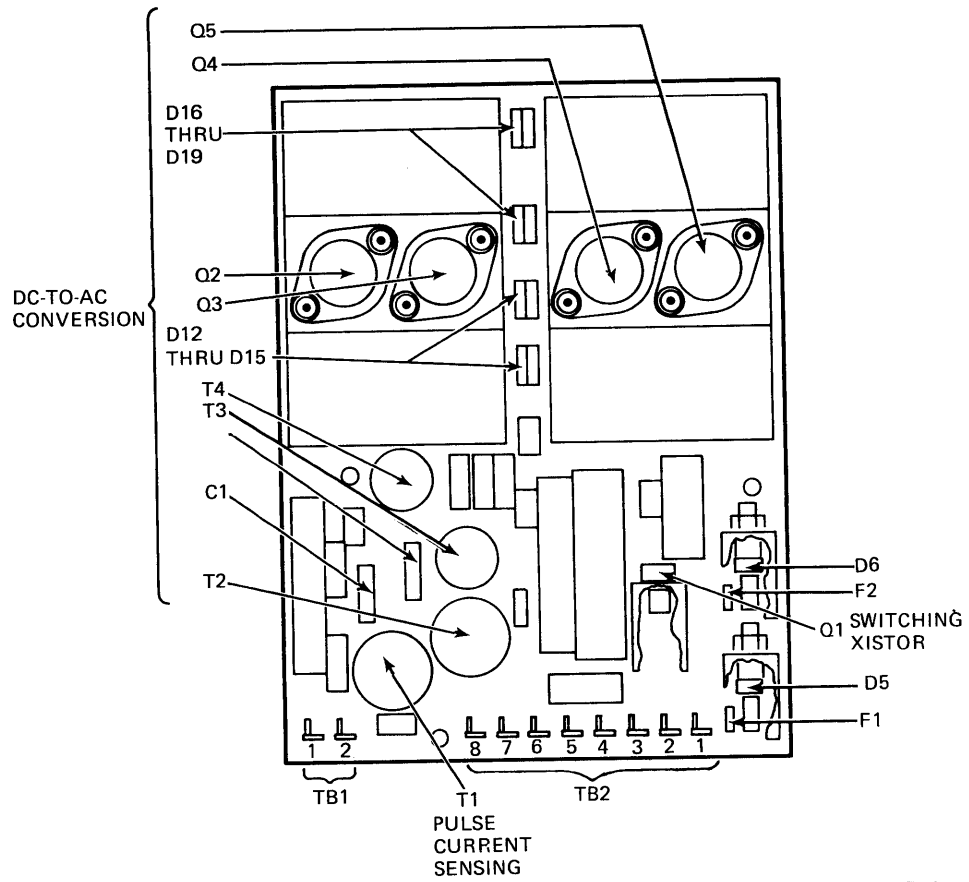
TK-3460

Figure 4-34 Logic Inverter Control Module, Voltage Reference and Sensing Components



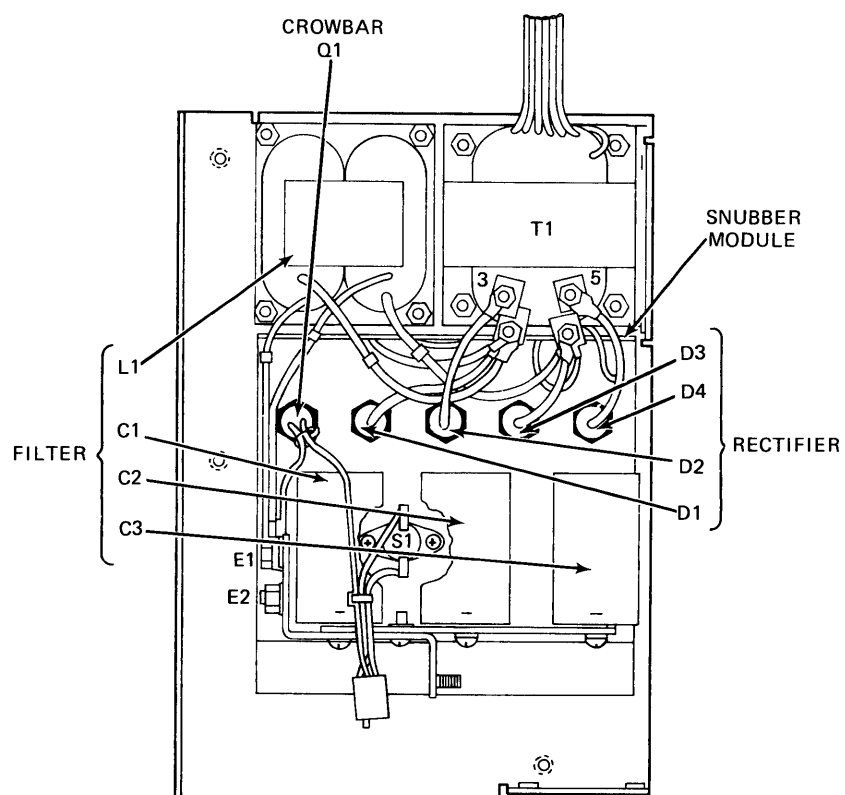
TK-3465

Figure 4-35 Logic Inverter Control Module, -15 V and +15 V Components



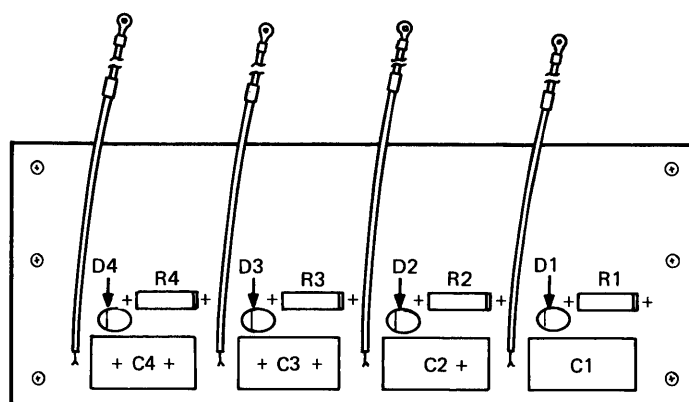
TK-3481

Figure 4-36 Logic Inverter Module Components



TK-3461

Figure 4-37 Output Assembly Components



TK-3464

Figure 4-38 Snubber Module Components

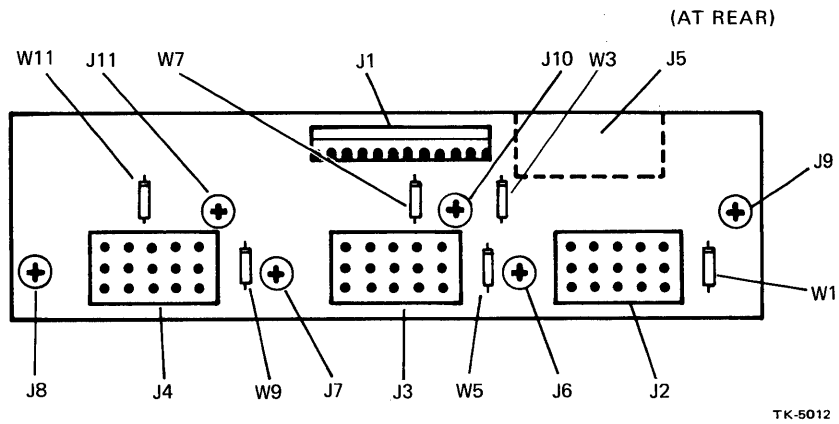


Figure 4-39 Power Distribution Module Components

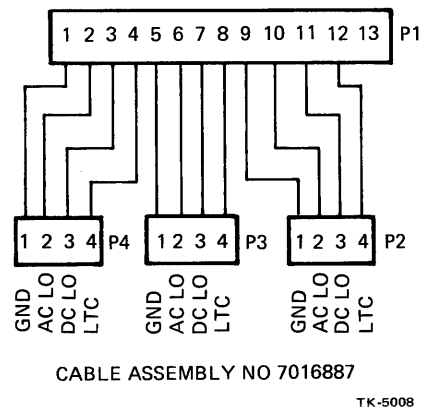


Figure 4-40 Power Distribution Cable Assembly Wiring

Your comments and suggestions will help us in our continuous effort to improve the quality and usefulness of our publications.

What is your general reaction to this manual? In your judgment is it complete, accurate, well organized, well written, etc.? Is it easy to use? _____

What features are most useful? _____

What faults or errors have you found in the manual? _____

Does this manual satisfy the need you think it was intended to satisfy? _____

Does it satisfy *your* needs? _____ Why? _____

☐ Please send me the current copy of the *Technical Documentation Catalog*, which contains information on the remainder of DIGITAL's technical documentation.

Name _____ Street _____

Title _____ City _____

Company _____ State/Country _____

Department _____ Zip _____

Additional copies of this document are available from:

Digital Equipment Corporation
444 Whitney Street
Northboro, MA 01532
Attention: Printing and Circulating Service (NR2/M15)
Customer Services Section

Order No. EK-BA11A-TM

Fold Here

Do Not Tear — Fold Here and Staple

digital



No Postage
Necessary
if Mailed in the
United States

BUSINESS REPLY MAIL

FIRST CLASS

PERMIT NO. 33

MAYNARD, MA.

POSTAGE WILL BE PAID BY ADDRESSEE

Digital Equipment Corporation
Educational Services Development and Publishing
1925 Andover Street (TW/B01)
Tewksbury, MA 01867

