PM-1150 4A Expansion Chassis

Preliminary Manual

Plessey
Peripheral
Systems

1.1 INTRODUCTION

This manual provides the information needed to install, operate, maintain and troubleshoot the PM-1150/4A Expansion Chassis manufactured by Plessey Peripheral Systems, Irvine, California.

The material is arranged into four sections as follows:

Section 1 - GENERAL DESCRIPTION. This section contains a brief functional description of the PM-1150/4A and a description of the physical specifications of the expansion chassis.

Section 2 - INSTALLATION. This section explains the requirements and procedures for equipment installation, interface description including electrical interface and interface connections.

Section 3 - THEORY OF OPERATION. Provides information necessary for the operation of the PM-1150/4A Expansion Chassis. Also includes a brief explanation of the power supply unit and the Unibus* operation.

Section 4 - MAINTENANCE AND TROUBLESHOOTING. This section describes maintenance and troubleshooting procedures for the PM-1150/4A Expansion Chassis.

MAINTENANCE DRAWING PACKAGE. Logic diagrams, schematic diagrams, parts list and assemblies required for a complete understanding of the unit.

1.2 GENERAL DESCRIPTION

The PM-1150/4A Expansion Chassis is a general purpose add-on chassis suitable for memories and/or controllers for all DEC PDP-11* processors.

*DEC, Unibus, PDP-11 and Q-bus are registered trademarks of Digital Equipment Corporation.

It can contain up to six single systems unit (SU) backplanes or up to three double SU backplanes in various configurations and includes power supply and forced air cooling for each installed SU.

The PM-1150/4A Expansion Chassis is a stand-alone system requiring only a standard Unibus cable for interfacing with the PDP-11 processor. All interface lines conform to the AC and the DC requirements of the PDP-11 Unibus.

The PM-1150/4A Expansion Chassis uses 10.5 inches of standard 19 inch rack front panel and it is supplied with chassis slides.

1.3 MECHANICAL DESCRIPTION

The PM-1150/4A Expansion Chassis can be installed in a standard 19 inch rack. Rack mount slides **are** provided on each system for easy mounting.

The PM-1150/4A Expansion Chassis interfaces to the PDP-11 processor via a flat Unibus cable. The cable enters via a port at the rear of the chassis and is plugged directly into a Unibus slot in one of the installed SUs. Unibus jumpers are available to continue the Unibus to each SU installed. If the Unibus is to be terminated in the chassis, a DEC M930 or Plessey PM-930 terminator card should be placed in the last Unibus slot of the last SU.

The physical dimensions of the chassis are as follow:

- Height — 10.40 inches
- Width — 16.90 inches, not including rack mount slides
- Length — 23.70 inches
- Weight — 100 pounds, not including memories or controllers
- Overhang — Maximum front overhang, 2.75 inches

1.4 COOLING SYSTEM

The PM-1150/4A contains four fans for forced air cooling. Three fans are installed across the backplanes to provide adequate cooling for the memory cards or the SPC controllers. One fan is installed across the power supply unit to provide cooling for the power supply. A removable air filter is mounted in front of the backplane fans to provide filtering of the air used in the cooling system. Each fan is rated at 120 CFM and is connected to the AC input via the rear panel ON-OFF switch.

1.5 CABLE ACCESS

The Unibus cable, used to interface the PM-1150/4A and PDP-11 processor, is brought into the box via a cable port at the rear of the chassis. The cable then plugs into the first Unibus slot of the first installed SU. The Unibus cable and the SU slots are keyed to guarantee proper orientation. The last Unibus slot will require a termination card if the PM-1150/4A is connected as the last device on the Unibus. Another Unibus cable can be installed if the Unibus is to continue to other devices.

A strain relief is provided on both sides of the interface cable to prevent the cable from unplugging due to pull.

The last Unibus slot (A & B) of the first installed SU and the first Unibus slot (A & B) of the second installed SU is dedicated to a Unibus cable jumper. This is necessary to provide continuation of the bus. A DEC M920 Unibus jumper can be used for Unibus continuation or the Plessey Unibus jumper can be used. With three 9 slot backplanes installed, two Unibus cable jumpers are needed. One from slot 9 of the first backplane to slot 1 of the second backplane and one from slot 9 of the second backplane to slot 1 of the third backplane.

NOTE: For Unibus jumper cable, use 12 inch flat Unibus cable, Plessey Part Number 700144-107.

1.6 COVERS

The PM-1150/4A Expansion Chassis includes top and bottom covers. The top cover removes to allow cable access and installation of the various modules.

The bottom cover removes to expose the mounting access and the wire wrap pins of the backplanes.

The covers, when installed, provides part of the air plenum and they also serve to prevent debris from falling into the modules.

1.7 POWER SPECIFICATIONS

The PM-1150/4A Expansion Chassis includes a power supply that provides power to the installed modules. The supply is a linear regulated supply that is mounted at the rear of the chassis. The power supply specifications follow.

1.7.1 Input Specifications

- Input Voltage 115VAC or 220VAC $\pm$ 10%

- Frequency 48 to 63 Hz

- Line Load 1000 volt-ams maximum, with nominal AC input

The AC input lines are fused on each side, and transient suppression circuits are used to prevent spurious AC signals from propagating through the supply. Conversion from 115VAC to 230VAC input power is made by changing jumpers accessible from the rear of the chassis. A power supply ON-OFF switch is provided at the rear of the chassis.

1.7.2 Output Specifications

Output Voltage	Minimum Current Rating	Maximum Current Rating
+5V	16 Amps	35 Amps
-15V	10 Amps	10 Amps
+15V	2.2 Amps	3.5 Amps

1.7.3 Output Signals

- ACLO Asserted when the AC input voltage drops below 20% of the rated line voltage.

- DCLO Asserted when either +5V, +15V or -15V falls below 5% of the rated voltage.

- LTC A clipped 60Hz logic signal.

1.7.4 Signal Specifications

ACLO and DCLO will perform to the following electrical requirements:

Level	Voltage	Current
True (asserted)	0 - 0.5 VDC	60ma
False	3.5 - 5 VDC	-40ma

If ACLO is asserted by the power supply, the DC output voltages are guaranteed valid for greater than 2ms. After 2ms, DCLO will be asserted. Both ACLO and DCLO signals are designed to "OR" with other similar signals and are located on Pin BF1 (ACLO) and Pin BF2 (DCLO) of the Unibus, respectively.

1.7.5 Interface

The PM-1150/4A Expansion Chassis interfaces with the PDP-11 processor via the Unibus lines. These lines consist of address lines, data

lines, and control lines. DEC specifies the total length of the Unibus cable not to exceed 50 feet. The cable must always be terminated at the end of the line where the last device is connected. Bus termination is achieved with Plessey PM-930 Bus Termination Card, Part Number 700430-100 or DECs M930 card.

The Unibus cable has a total of 56 signals plus 64 grounds. Signals and grounds are alternated to minimize crosstalk.

For power connector pin out refer to Section 4.5.8.

The Unibus cable comes in various lengths. Table 1-1, below, lists and identifies them by their part numbers.

VERSION	LENGTH IN INCHES	VENDOR PART NO.
700144-107	12	253-260-12
-101	24	-24
-102	60	-60
-103	102	-102
-100	114	-114
-104	120	-120
-105	162	-162
700144-106	300	253-260-300

TABLE 1-1: CABLE LENGTHS

Table 1-2 lists the Unibus signals for the PM-1150/4A Expansion Chassis. For more information, refer to Section 3.

NAME	NO. OF LINES	FUNCTION
Address	18	Memory and device selection
Data	16	Information transfer
Control	2	Type of data transfer
Master Sync	1	Timing control for data transfer
Parity	2	Byte parity error indicatation
Bus Request	4	Priority bus control
Bus Grant	1	
Non-Processor Req.	1	DMA
Non-Processor Grant	1	Bus Control
Slave ackowledge	1	
Interrupt	1	
Busy	1	
Initialize	1	Reset System
AC Line Low	1	Power Detection
DC Line Low	1	Power Detection

TABLE 1-2: UNIBUS SIGNALS

2.1 GENERAL INFORMATION

The PM-1150/4A Expansion Chassis is designed to be mounted on slides in a standard 19-inch rack. An 8-foot power cord terminating in a standard UL approved connector is wired to the power supply. A removable air filter is located in the front bezel. All air used in cooling installed modules is drawn through this filter. It should be periodically checked and cleaned.

Installing the PM-1150/4A Expansion Chassis normally involves unpacking it, placing it in a rack and installation of SU backplanes, modules in the backplanes, and Unibus jumpers.

2.2 UNPACKING AND INSPECTION

Remove any packing material and visually inspect for physical damage. Check all hardware attaching the various assemblies.

Inspect the power output plugs. They are located on the bottom of the power supply assembly. If the box is shipped with backplanes already installed, verify that the power cables from the backplanes to the power supply are secured tightly to provide good contact.

2.3 ASSEMBLY PART NUMBERS

The following define the various PM-1150/4A Expansion Chassis assemblies:

- P/N 700635-100 PM-1150/4A Expansion Chassis
- P/N 100058-200 Power Supply, 115VAC
- P/N 700122-101 Air Filter
- P/N 700631-001 Cover
- P/N 700631-001 Bezel
- P/N 700144-XXX Flat Unibus Cable

The PM-1150/4A Expansion Chassis is designed to accept Plessey or DEC system unit (SU) backplanes. The power cables which plug into the output connectors located at the bottom of the power supply assembly are routed to the SU backplanes and attach to these backplanes using Faston receptacles. These power cables are not included with the PM-1150/4A but are included with each SU backplane ordered.

Table 2-1 defines the various Plessey SU backplanes available with the PM-1150/4A Expansion Chassis.

SU BACKPLANE	PART NUMBER	DESCRIPTION
PM-F11	700554-200	9 slot SU backplane designed to accept memories PM-1116, PM-1105 or DEC MM11L-8K or a combination of these.
PM-F11/SPC	700435-200	9 slot SU backplane designed to accept memories or small peripheral controllers with two special slots prewired for DEC-DF11.
PM-D11/SPC1	700578-200	4 slot SU backplane designed to accept memories or small peripheral controllers.
PM-D11/P	700555-200	9 slot SU backplane designed to accept parity memories with the Plessey PM-7259 parity controller.
PM-DC/11	700570-XXX	4 slot SU backplane designed to provide interface for the Plessey Disc Controller.

TABLE 2-1: AVAILABLE PLESSEY SU BACKPLANES

2.4 RACK MOUNTING INSTRUCTIONS

The PM-1150/4A can be mounted in a standard 19-inch rack. Each unit is shipped with rack slides attached and all necessary mounting hardware.

To mount the PM-1150/4A:

1. Remove the left and the right slide brackets from the system box. Pull slide bracket all the way out, then push on the spring bar to release the slide bracket.

2. Mount rear mounting brackets on to the back end of the slide brackets. Use Pan head 10-32 screws.

3. Mount right and left slide brackets, both front and back, on to the rack.

4. Lift the PM-1150/4A and align it with the mounted slide brackets, then slide it into the rack until the spring bars lock in.

2.5 INTERFACE INFORMATION

The PM-1150/4A Expansion Chassis interfaces with the PDP-11 processor via the flat Unibus cable (Plessey Part Number 700144-XXX). The cable enters and exits from the right and left sides on top of the power supply assembly. If the expansion chassis is connected at the end of the Unibus, it must be terminated using either DEC M930 or Plessey PM-930 terminator card. If the Unibus is to be continued to other devices, another Unibus cable must exit from the PM-1150/4A box. All Unibus cables and SU backplane units are keyed and extra care must be taken to make sure that both male and female keys are aligned when installed. However, failure to align the key will not damage the unit; it will cause operational failure only.

The Unibus cable is plugged into slot 1 Unibus connector in the SU backplane which is always on plugs A and B. Also, note that the Plessey PM-G727 Bus Continuity cards that come with each SPC SU backplane are always plugged in slot D with the jumpers facing the pin 2 sides.

Refer to Table 2-2 for the interface pin assignments, and to Table 2-3 for Unibus signals.

PIN NO. I/O INTERFACE	SIGNAL NAME	PIN NO. I/O INTERFACE	SIGNAL NAME
AA1	INITL	AA2	+5V
AB1	INTRL	AB2	GND
AC1	D00L	AC2	GND
AD1	D02L	AD2	D01L
AE1	D04L	AE2	D03L
AF1	D06L	AF2	D05L
AH1	D08L	AH2	D07L
AJ1	D10L	AJ2	D09L
AK1	D12L	AK2	D11L
AL1	D14L	AL2	D13L
AM1	PAL	AM2	D13L
AN1	GND	AN2	PBL
AP1	GND	AP2	BBSYL
AR1	GND	AR2	SACKL
AS1	GND	AS2	NPRL
AT1	GND	AT2	BR7L
AU1	NPGH	AU2	BR6L
AV1	BG7H	AV2	GND
BA1	BG6H	BA2	+5V
BB1	BG5H	BB2	GND
BC1	BR5L	BC2	GND
BD1	GND	BD2	BR4L
BE1	GND	BE2	BG4H
BF1	ACLOL	BF2	DCLOL
BH1	A01L	BH2	A00L
BJ1	A03L	AJ2	A02L
BK1	A05L	BK2	A04L
BL1	A07L	BL2	A06L
BM1	A09L	AM2	A08L
BN1	A11L	BN2	A10L
BP1	A13L	BP2	A12L
BR1	A15L	BR2	A14L
BS1	A17L	BS2	A16L
BT1	GND	BT2	C1L
BU1	SSYNL	BU2	COL
BV1	MSYNL	BV2	GND

TABLE 2-2: INTERFACE PIN ASSIGNMENTS

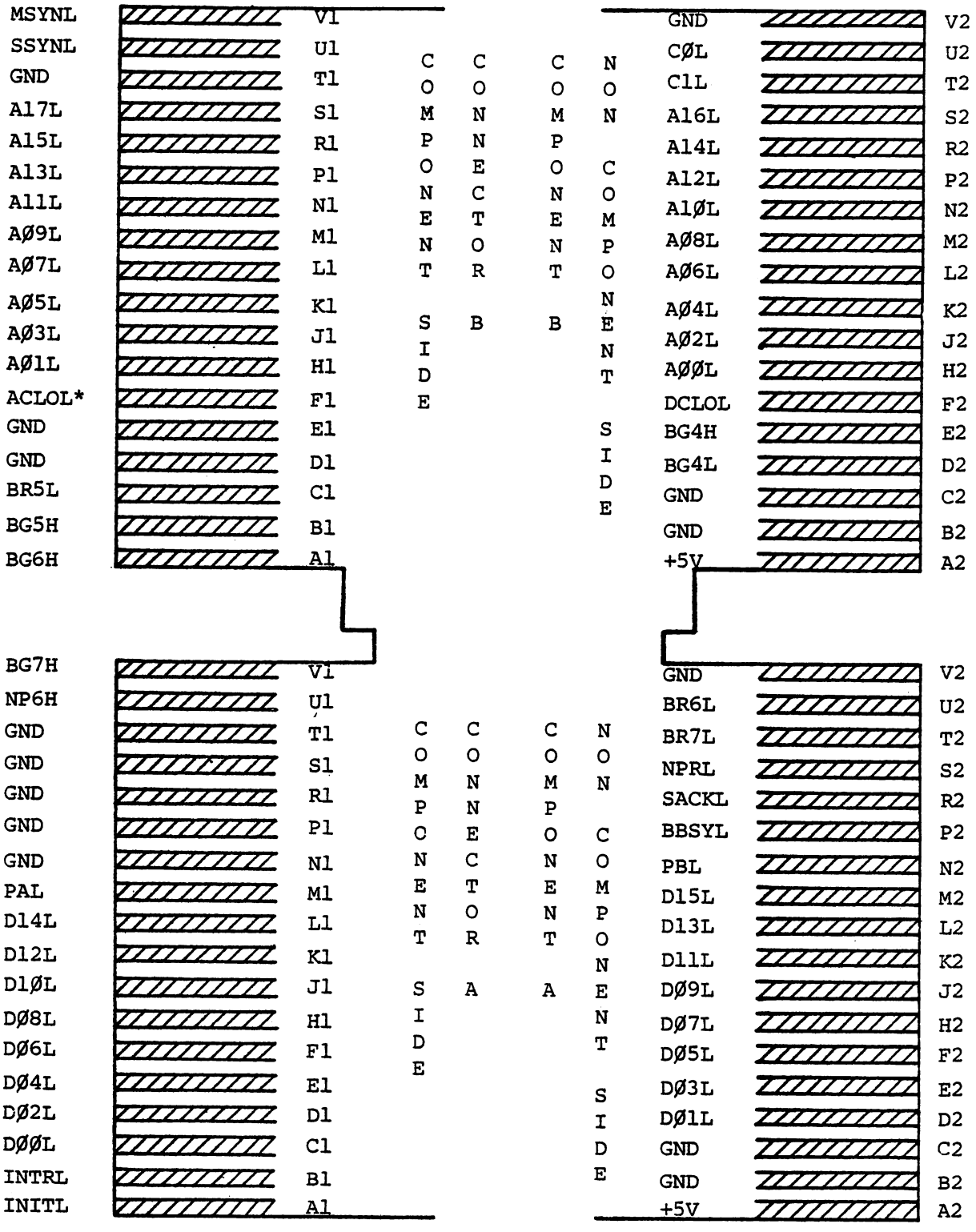

TABLE 2-3: UNIBUS SIGNALS

3.1 INTRODUCTION

The PM-1150/4A Expansion Chassis is a stand-alone system. It needs only a Unibus cable to interface with the PDP-11 processors.

The front panel contains a removable air filter to provide clean air for cooling units that are plugged into the SU backplanes.

The back panel includes an ON-OFF power switch, two AC fuses, one for each side of the AC line, and a terminal strip with jumpers to provide changing from 115VAC to 220VAC operation or visa versa. When changing AC input voltages the AC fuses also must be changed at the same time. Refer to Section 4.5.5 for further information.

3.2 POWER SUPPLY DESCRIPTION

The power supply is located at the back of the expansion chassis. It interfaces with the SU backplane through a nine-pin female connector. There are a total of six output connectors in parallel. Each SU backplane is supplied with a power cable and a male connector that interfaces with one of the six female connectors which are located at the bottom of the power supply unit.

The power supply is short circuit protected; therefore, any accidental shorts of any output voltages will not cause circuit or component damage in the power supply.

The power supply protects both AC input lines with two SLO BLO fuses mounted next to the power ON switch. They are rated at 8A for 115VAC input and 4A for 220VAC input.

3.3 PDP-11 UNIBUS

The PM-1150/4A Expansion Chassis interfaces with the PDP-11 processors via the Unibus. The Unibus is a single common set of single wires that connects the processor, memory and all peripherals. Address, data and control information are transmitted and received on its 56 lines.

Communication between two devices on the Unibus is in a master-slave relationship.

The device that controls the bus is called the bus master and the device that communicates with the bus master is called the slave.

A device that wishes to become a bus master initiates a Bus Request command. There are five Bus Request lines. They are listed in the order of their priorities, as follow: a) non-processor (NPR), b) bus request 7 (BR7), c) bus request 6 (BR6), d) bus request 5 (BR5), and bus request 4 (BR4).

When more than one device is connected to the same bus request line, the device that is electrically nearer the processor has a higher priority than the device further away.

The processor priority is set under program control. Any request on a priority level the same or less than the one to which the processor is set is ignored.

When a bus request is made on the bus request line, or when bus request is made on the non-processor request line, the processor responds with a bus grant signal (BG), or with a non-processor grant signal (NPG). The device in return asserts selection acknowledge (SACK). If SACK is not received with 5-10μ sec, a time out occurs and the bus grant is cleared automatically by the processor.

The device has to wait until bus busy (BBSY) bus grant and slave sync (SSYN) are cleared at the end of the previous data transfer.

Then BBSY, BG and SSYN are cleared and the device has control of the bus. It asserts BBSY and interrupt (INTR). Note that interrupt can be made only if the bus control has been gained through the bus request lines (BR7-BR4).

A non-processor request must not use interrupt. Each device has its own interrupt vector. The first 1000 (octal) locations in the address map are reserved for trap and interrupt vectors.

Locations 0 through 37 are used for trap vectors for internal processor use only. Locations 4 through 57 are reserved for use as system software communication words, and the remaining locations are used for device interrupt vector.

3.4 PRIORITY CHAIN INTERRUPT

The PDP-11 uses electrical chaining of devices to assign another level of priority within each priority line. This priority is highest for the device next to the processor and it is diminished in the order of their electrical distance from the processor.

Each priority grant line (BG4-BG7) enters and exits each device starting with the device next to the processor. Whenever a bus grant line is asserted, the signal first goes to the first device near the processor; if this device was not requesting the bus, it will pass the bus grant line on to the second device. If the first device was requesting the bus, it will block bus grant line from going into the second device and so on down the line.

Whenever boards are installed or removed from the PM-1150/4A it is necessary to keep the program priority chains uninterrupted.

The program priority bus grant lines enter each board slot at one pin and exit at another pin as shown in Table 3-1.

PRIORITY LINE	SU BACKPLANE PIN NO.
BUS GRANT 7 IN	DK2
BUS GRANT 7 OUT	DL2
BUS GRANT 6 IN	DM2
BUS GRANT 6 OUT	DN2
BUS GRANT 5 IN	DP2
BUS GRANT 5 OUT	DR2
BUS GRANT 4 IN	DS2
BUS GRANT 4 OUT	DT2

TABLE 3-1: PRIORITY BUS GRANT LINES ENTER/EXIT PINS

On SU backplanes designed to accept interrupting devices, a bus continuity card must be installed whenever a slot is not used. Plessey PM-G727 or DEC G727 card should be installed in slot D with the jumpers facing side 2 of the backplane connectors. Also, extra care must be taken to ensure that all pins are properly aligned. If no bus continuity card is readily available, Table 3-1 may be used to install jumper wires onto the pin side of the SU backplane connector. Each bus grant IN line is jumpered to each bus grant OUT line (BG4-BG7) for a total of four jumpers for each unused slot.

3.5 POWER FAIL SEQUENCE

The PDP-11 power fail sequence uses Unibus lines ACLO and DCLO as follows:

- ACLO AC Line Low. This signal comes from the power supply anticipating signal which starts with the power fail trap sequence. It is also used in the peripheral devices to terminate operation in the event of a power loss.

When ACLO is cleared, the power-up instruction sequence in the processor begins. The programmer must make sure that the trap vector is loaded with a pointer to the power fail routine.

- DCLO — DC Line Low. This signal which comes from the power supply remains clear as long as DC voltages are withing specified limits. If an out of tolerance condition occurs, DCLO is asserted by the power supply.

The ACLO and DCLO power timing sequence is shown in Figure 3-1.

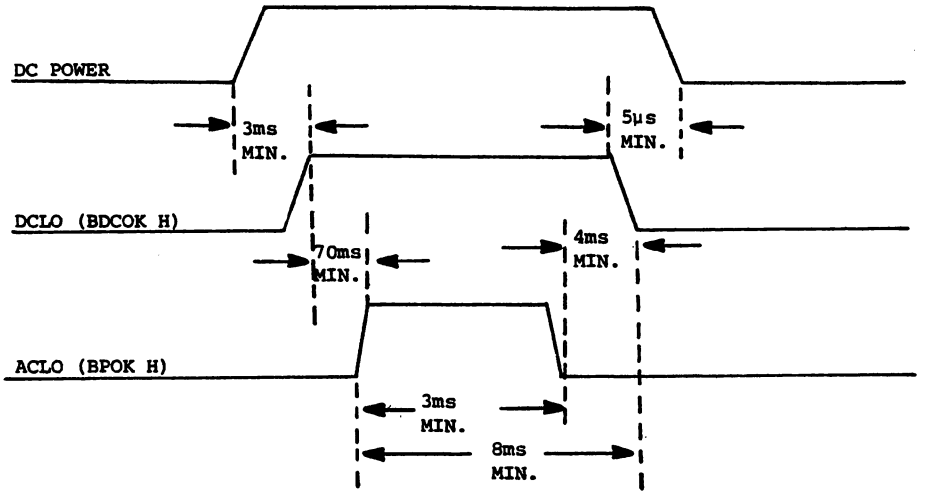

FIGURE 3-1: POWER TIMING SEQUENCE

4.1 AIR FILTER CLEANING

The air filter is located on the front panel and should be removed at least once every 300 operating hours for cleaning.

To remove the air filter unscrew only the top and bottom Phillips 10-32 screws. There are two on each side for a total of four screws.

CAUTION

Do not unscrew the middle screws, as they hold the fan assembly.

After the air filter is removed, tap the filter with its bottom side down to loosen accumulated particles. Then reverse and flush under running water. After cleaning, shake out excess water and reinstall when dry.

4.2 GENERAL REPAIRS

If a failure in the PM-1150/4A Expansion Chassis occurs, steps should be taken to locate the source of failure.

The failure might be caused by the electro-mechanical portion of the system, cables, power supply, or in the SU backplanes. It also may be caused by a malfunction in one of the boards connected to the SU backplane. A memory or controller type failure may be further defined as follows:

- Operational failures, which are caused by faulty reference control, input logic, or timing.
- Partial data word failures which are caused by either a faulty drive or SYNC switch, or a faulty stack in the memory or logic control circuits in the memory or in the controller.

It is very strongly recommended that all assemblies requiring repair be returned to the factory for rework. All return units should be accompanied with as much detail as possible describing the failure mode.

4.3 PROCEDURE FOR LOCATING A FAULTY CARD

The information contained in this section is designed to help locate a malfunction in a specific card, whether a memory or controller card, in the SU backplane unit. It is strongly recommended that the faulty card be sent back to the factory for repair. This will ensure that the unit will be retested to meet its specification before being used again.

The most common and useful method to locate a failure, providing there is more than one card available, is to "walk" the error. This is accomplished by interchanging the cards and observing the error mode again. If the error moved when the cards were swapped, it is very likely that the memory card is faulty. If the error did not move, the malfunction is probably somewhere else.

If the error disappears when swapping the cards, this indicates either misaligned connector contacts or dirty contact or a loose connection on the card. LPS instant contact cleaner or alcohol have been approved for cleaning contacts. When printed circuit contacts must be cleaned, hold the card so that the contacts are pointed down. Thoroughly saturate contact area. While the contacts are still wet, scrub with a soft natural bristle brush.

CAUTION

Do not spray pressurized air directly inside the memory card toward the core matrices.

When baseplate connector contacts require cleaning, remove printed circuit board, then clean and rewet the contact area. Insert and withdraw the board several times or until contacts seem clean. Rewet the contacts and the connector and using a soft cloth wipe any residue from the board contacts. Repeat this sequence if necessary. Use only alcohol on baseplate connectors.

CAUTION

Insertion of objects other than printed circuit boards may destroy contact surface or pressure characteristics.

4.3.1 Locating Fault (Where there is no faulty card)

1. Check all cables in and out of the PM-1150/4A Expansion Chassis. Make sure that all lines are intact, not broken or shorted to each other.

2. Check all DC voltages to the cards on the SU backplane.

3. Check all terminations for the last device on the Unibus.

4. Inspect visually to ensure no physical damage to the PM-1150/4A has occurred, or to the memory cards or controller cards themselves.

5. Inspect all plugs for misaligned pins, dirty contacts, or broken wires. Make sure that all the cards' plug connectors are aligned properly.

CAUTION

It is very important to verify that all connections, including the male and female power plugs, are properly aligned.

4.4 ADDRESS CONVERSION - DECIMAL TO OCTAL

Table 4-1 should be used to aid in determining the faulty card for address related failure.

OCTAL EQUIVALENT	DECIMAL (APPROXIMATION)
200000	32K
174000	31K
160000	28K
140000	24K
120000	20K
100000	16K
060000	12K
040000	8K
020000	4K

TABLE 4-1: OCTAL/DECIMAL ADDRESS CONVERSION

4.5 POWER SUPPLY

4.5.1 Maintenance Procedure

Periodic maintenance should consist only of careful visual inspections accompanied by cleaning. Particular attention should be devoted to cleaning the heat sink area around the semi-conductors so that accumulations of dust and dust-retaining films are removed.

The visual inspection should include checking for loose connections and for discolored parts and wires. If the supply is operating properly, the visual inspection should be performed without the use of tools for prying and moving parts and harnesses for inspection. The safest procedure is to clean with compressed air and soft brushes.

Troubleshooting, if required, should be attempted only by technically qualified persons. Generally, if replacement of a plug-in part will not correct the problem, returning the supply to the factory for repair will prove to be the least expensive and most expedient procedure.

4.5.2 Power Supply Identification

All power supply adjustments are done on the printed circuit board located on top of the power supply. The adjustments for trip points on ACLO and DCLO are set at the factory and should not need adjustment in the field.

Remove the top cover of the PM-1150/4A Expansion Chassis and inspect the regulator board to identify the type of power supply. If the regulator board has an "M" identification, as shown in Figure 4-1, follow the adjustment procedures in Section 4.5.5.

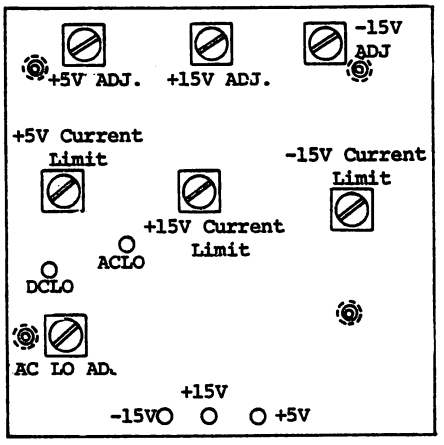

FIGURE 4-1: POWER SUPPLY "M" IDENTIFICATION

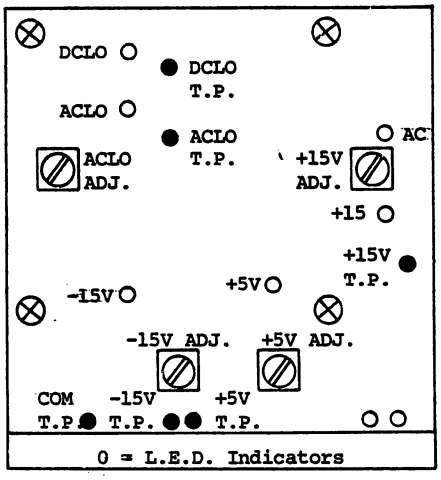

FIGURE 4-2: POWER SUPPLY "S" IDENTIFICATION

4.5.3 Power Supply (Type "M") Adjustments

- +5V is adjusted with the pot marked +5V REG located at top center, left side of the board. Clockwise movement will increase output voltage.

- -15V is adjusted with the pot marked +15V REG located top center, right side of the board. Clockwise movement will increase output voltage.

- +15V is adjusted with the pot marked +15V REG located at top left side of the board. Clockwise movement will increase output voltage.

For ACLO adjustment, the pot is located at the right center of the board. It is factory adjusted. It is asserted (0V) when the input AC voltage drops below 105VAC on the 115VAC version, and below 210VAC on the 220VAC version.

Should the ACLO signal need adjustment, use the following procedure:

1. Plug the PM-1150/4A through an AC variac to the AC input.

2. Under full load condition, vary the AC input voltage and monitor ACLO on the SU backplane.

3. Adjust ACLO pot so that ACLO signal drops from +5V to 0V when AC input reaches 105VAC. The AC variac should initially be set to 115VAC output and then the output decreased to the trip point.

4. After adjustment is done, verify that the ACLO is asserted at approximately 105VAC.

For DCLO adjustment, the pots for the -15V, +5V and +15V are located at the bottom of the power supply printed circuit board. The DCLO should be asserted whenever the following conditions occur:

- Whenever the +5V supply drops below 4.75 $\pm$ 0.25%.

- Whenever the +15V or -15V drops below 12.5V $\pm$ 1%. DCLO is factory adjusted and need not be reset. However, should the DCLO signal need adjustment, use the following procedure:

    1. Plug the PM-1150/4A through an AC variac to the AC input and set it to nominal AC input.

    2. Set the three DCLO pots to their maximum counter-clockwise position.

    3. Monitor the DCLO signal and the +5V output. Then turn AC variac downwards until the +5V output drops to less than 4.75V. Leave the AC variac at that point then slowly turn the +5V DCLO pot counter-clockwise until the DCLO signal is just.

5. Repeat step #3 for the -15V supply except that the output voltage should drop below 13.5V.

6. Vary the AC variac until the DCLO line is asserted. Check the +5V, -15V and +15V output voltages and verify that at least one of the voltages is outside of its allowed tolerance.

4.5.4 Power Supply (Type "S") Adjustments

- +5V is adjusted with the pot marked located at the lower right side of the board.
- -15V is adjusted with the pot located at the lower center of the board.
- +15V is adjusted with the pot located at the right side of the board.

For ACLO adjustment, the pot is located at the left side of the board. It is asserted (0V) when the AC voltage crops below 105VAC on 115VAC versions and below 210VAC on the 230VAC versions. This adjustment is factory set. However, should it need adjusting use the following procedure:

1. Plug the PM-1150/4A through an AC variac to the AC input.

2. Under full load condition, vary the AC voltage and monitor ACLO on the SU backplane.

3. Adjust the ACLO pot so that the ACLO signal drops from +5V to 0V when AC input reaches 105VAC. The variac should initially be set to 115VAC output and then slowly decreased to the trip point.

4. After adjustments verify ACLO is asserted, at the proper point by lowering the voltage from 115VAC again.

DCLO is factory adjusted and set, and should require no further adjusting.

4.5.5. Power Supply Fusing Information

The PM-1150/4A power supply has two fuses (one in series with each leg) to protect from AC input overloads. They are located at the back of the unit.

These two fuses are located next to the power ON-OFF switch and are both rated as follow:

- For 115VAC input use 8A SLO-BLO Buss Part Number MDA8.
- For 220VAC input use 4A SLO-BLO Buss Part Number MDA4.

4.5.6 Power Supply Dismounting Instructions

The power supply is bolted to the PM-1150/4A chassis with a total of six screws located at the bottom of the chassis.

Instructions from removing the power supply are as follow:

1. Set the chassis on its bottom with the top cover removed.
2. Slide the chassis until the six screws on the bottom of the power supply are accessable.
3. Unscrew the six screws. First the four 1/4-20 and then the other two 10-32 screws.
4. Disconnect the two plugs for the power supply fan and system cooling fans from the chassis power supply cooling fan card system unit cooling fans connected to the PM-1150/4A chassis via a two pin connector. One wire is black and the other white.
5. Slowly, and very carefully, pull out the power supply unit from the PM-1150/4A chassis. Push power cord through the chassis to remove the power supply.

4.5.7 Power Supply Test Points Information

The PM-1150/4A power supply printed circuit board includes the points located as shown in Figure 4-1 or Figure 4-2.

4.5.8 Power Supply Output Plugs

Power supply output voltages are supplied via six output female plugs. All six plugs are connected in parallel and are located at the bottom of the power supply next to the power transformer. Each plug is numbered from 1 through 9 as shown in Figure 4-3.

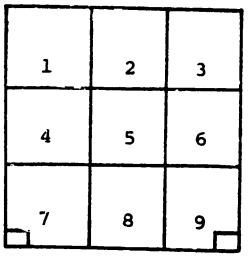

FIGURE 4-3: PIN ASSIGNMENTS (VIEWED FROM CABLE END)

The power supply output plugs pin assignment list, as shown in Figure 4-3, conforms to the 9-pin DEC power connector pinout. Refer to Table 4-2.

PIN NUMBER	SIGNAL	NORMAL COLOR USED ON BACKPLANE
1	DCLO	VIOLET or WHITE
2	ACLO	YELLOW or WHITE
3	-15V	BLUE
4	GROUND	BLACK
5	GROUND	BLACK
6	NOT USED	
7	LTC	BROWN or WHITE
8	+15	GRAY
9	+5	GRAY

TABLE 4-2: 9-PIN POWER CONNECTOR SIGNALS

4.5.9 Power Supply General Specification

The power supply operates from a single phase with earth ground. Each ground is tied to the PM-1150/4A chassis.

- AC Power Input Wave Shape

  AC line from 48 to 63Hz

  Harmonic or phase distortion of 10%

  AC line over voltage excursions up to 100% above nominal for a duration of 1ms, with a maximum duty cycle of 1%

  AC line under voltage excursions up to 100% below nominal for a duration of 1ms, with a maximum duty cycle of 1%

- Output Voltage and Signals

-15V	+5V	+15V
ACLO	DCLO	LTC

  NOTE: 15V is floating and can be used as either -15V or +15V as desired. The -5V supply is optional and normally not installed.

- Output Current

  -15V = 10.0A +15V = 3.5A
  +5V = 35.0A

- DC Regulation

  With load current varied from no load to full load and AC line frequency variation of $\pm$ 2Hz,

the maximum DC regulations are ± 1% for the +15V, -15V and +5V and 10% for the unregulated +15V.

- **Transient Response** — Maximum transient voltage variation for the +5V, +15V and -15V sources are ± 5% with the following load changes.

  +5V Supply - change in load current of 4A at 1A per microseconds rate.

  15V Supply - change in load current up to the rated load at 1A per microseconds rate.

- **Ripple and Noise** — The maximum ripple under all specified AC line and load conditions is 10MV RMS for +5V, -15V, +15V supplies.

- **Current Limiting** — Current limiting for 110% to 150% of maximum rated load is provided for each regulated output. In the event of overcurrent condition, the output voltage is reduced to limit the current to less than 40% of its specified maximum level.

- **Overvoltage Protection** — The power supply is over-voltage protected and its high limit response and voltages are shown in Table 4-3.

OUTPUT VOLTS	TRIP RANGE VOLTS	RESPONSE TIME	PEAK VOLTAGE ALLOWED
-15	16.5 - 18.5	10ms	20V
+5	6.0 - 7.0	10ms	8V

TABLE 4-3: POWER SUPPLY HIGH LIMIT RESONSE AND VOLTAGES

- **DC Under-voltage** — Three detectors are provided to monitor the three DC supplies. Whenever either one of the supply's voltages drops below the specified level, DCLO line will be asserted (0V) as shown:

  +5V when voltage drops to 4.75 ± 0.25%

  15V when voltage drops to 13.5V ± 1%

- **DCLO and ACLO Levels** — DC low (DCLO) and AC low (ACLO) perform to the specifications in Table 4-4.

LEVEL	OUTPUT VOLTAGE	LOAD CURRENT
TRUE (Asserted)	0-0.4VDC	60ma
FALSE	3.5-5.0VDC	-40ma

TABLE 4-4: DCLO AND ACLO PERFORMANCE SPECIFICATIONS

- Operating Temperature — 0°C to 60°C
- Non-operating Temperature — -40°C to 85°C
- Operating Thermal Shock — 10°C/hour between operating temperature limits.
- Operating Humidity — Up to 95% at 60°C without condensation
- Operating Altitude — From -1,000 feet to 10,000 feet
- Shipping Altitude — 30,000 maximum without damage
- Operating Vibration — Maximum of 1.0g's over a range of 15-500Hz in each of the three mutually perpendicular planes
- Operating Shock — Maximum of one shock pulse of 5g's in each of the three mutually perpendicular planes for a pulse duration of 11ms
- Shipping Shock — In accordance with MIL Specification MIL-STD-8108 method 516 procedure V without damage

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