64000

LOGIC DEVELOPMENT SYSTEM

SERVICE OVERVIEW

 HEWLETT
PACKARD

CERTIFICATION

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility, and to the calibration facilities of other International Standards Organization members.

WARRANTY

This Hewlett-Packard system product is warranted against defects in materials and workmanship for a period of 90 days from date of installation. During the warranty period, HP will, at its options, either repair or replace products which prove to be defective.

Warranty service of this product will be performed at Buyer's facility at no charge within HP service travel areas. Outside HP service travel areas, warranty service will be performed at Buyer's facility only upon HP's prior agreement and Buyer shall pay HP's round trip travel expenses. In all other cases, products must be returned to a service facility designated by HP.

For products returned to HP for warranty service. Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

HP warrants that its software and firmware designated by HP for use with an instrument will execute its programming instructions when properly installed on that instrument. HP does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HP SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

EXCLUSIVE REMEDIES

THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. HP SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

ASSISTANCE

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided at the back of this manual.

C W & A 9/79

SERVICE MANUAL

HP 64000 LOGIC DEVELOPMENT SYSTEM

SERVICE OVERVIEW

SERIAL NUMBERS

There are no serial numbers that apply strictly
to a system. The individual components are each
serialized.

SAFETY SUMMARY

The following general safety precautions must be observed during all phases of operation, service, and repair of this Instrument. Failure to comply with these precautions or with specific warnings elsewhere In this manual violates safety standards of design, manufacture, and intended use of the Instrument. Hewlett-Packard Company assumes no liability for the customer's failure to comply with these requirements.

GROUND THE INSTRUMENT.

To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The instrument is equipped with a three-conductor ac power cable. The power cable must either be plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adapter with the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet. The power jack and mating plug of the power cable meet International Electrotechnical Commission (IEC) safety standards.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE.

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

KEEP AWAY FROM LIVE CIRCUITS.

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

DO NOT SERVICE OR ADJUST ALONE.

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

USE CAUTION WHEN EXPOSING OR HANDLING THE CRT.

Breakage of the Cathode-ray Tube (CRT) causes a high-velocity scattering of glass fragments (implosion). To prevent CRT implosion, avoid rough handling or jarring of the instrument. Handling of the CRT shall be done only by qualified maintenance personnel using approved safety mask and gloves.

DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT.

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification of the instrument. Return the instrument to a Hewlett-Packard Sales and Service Office for service and repair to ensure that safety features are maintained.

DANGEROUS PROCEDURE WARNINGS.

Warnings, such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

> **WARNING**

**Dangerous voltages, capable of causing death, are present in this instrument.
Use extreme caution when handling, testing, and adjusting.**

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SECTION I

GENERAL INFORMATION

1-1. Introduction

1-2. This Service Overview manual contains information pertaining to
the HP64000 Logic Development System at the system level. Reference
information about the eight sections of this manual, including a table
of contents, list of illustrations, and a list of tables, is contained
in this section. A brief product introduction is also provided.
Associated manuals are listed in tables 1-1 and 1-2. Section II
explains site selection and installation, and covers disc
initialization. Section III is operating information. Performance
Verification and Troubleshooting procedures are in Section IV,
although troubleshooting should begin in Section II to insure that
the installation and system configuration are correct. Section V is
set aside for adjustment information. Replaceable parts are listed in
Section VI. Section VII contains manual backdating information. The
theory of operation constitutes Section VIII.

1-3. Product Introduction

1-4. The functions of the Model HP64000 Logic Development System are
classified under the headings of software development, hardware
development, and project integration. Our system combines both the
software and hardware aids necessary in the development of
microprocessor based products. Additional devices include a choice of
printers, a cassette tape drive unit, and a choice of PROM
programmers.

1-5. The software development aids include the editor and file
handling capabilities of the LDS, as well as the Pascal compiler and
the assemblers. As a hard-disc based system, the HP64000 also
provides the benefits of a shared memory resource. This, plus the
fact that up to six development stations may be connected to the disc
(or discs) in one network, means that any engineer in the network may
access the disc files. Not only does this allow other engineers to
copy, or evaluate one's programs, or news files, but it also allows a
powerful library of programs to be available to all, eliminating
redundant software development. The assemblers and the Pascal
compilers are the primary LDS tools for the Software Engineer, and
once the object code has been generated, use of internal emulation can
be made for debugging of programs. User definable command files allow
maximum flexibility in use of the linker/loader.

1-6. Hardware development focuses on the emulators. Replacing the microprocessor in the prototype circuit, the HP64000 Emulation Probe (via its DIP plug) interfaces the LDS to the user circuit. The powerful memory-mapping feature of the HP64000 allows the user to define in 1K memory blocks, what kind of memory is available at given addresses. While the prototype circuit is still only partially developed, emulation memory within the LDS may be used for storage of part of the program, and the rest of the program might be mapped to the part of the user memory that does exist. The internal logic state analyzer of the HP64000 may be used to monitor program flow, and could aid hardware designers by showing whether or not a given memory is responding with the appropriate data.

1-7. Once the hardware has been developed, the LDS can be used to aid project integration. Real-time emulation, using all of the user's circuitry except for the processor itself (the HP64000 is plugged into that socket), can allow software to be run in user hardware, from the LDS. Again, the internal logic analyzer can monitor program flow, and breakpoints can be specified to determine where a program goes awry. Single-stepping through the program can also be used to monitor results at each execution. Having a separate host CPU bus from the Emulation bus, allows for other station activity to take place while the emulator is running.

1-8. For more in-depth information about HP64000 applications refer to the Operator's manuals, or to the nearest HP Field Office.

1-9. The HP64000 is universal in nature because software needed to do assembly, debugging, and compiling of programs, and the hardware necessary for emulation, are provided as options which may be interchanged in order to support any of the popular microprocessors. See table 1-1 for a list of supported microprocessors.

1-10. The system bus is based on the HP-IB parallel communications interface, but due to constraints of the operating system software only approved devices may use the bus. System performance is such that users will not notice a slow-down in response, even if all of the possible six development stations in a network are utilized. Additional devices in the HP64000 System include a printer, a cassette tape unit, a PROM programmer, and an RS-232-C Serial Communications Port (to your computer or peripheral). The internal logic analyzer, and the emulators were already mentioned. A special feature of the HP64000 is the software to do Simulated I/O, where the user program in the emulation subsystem can make use of the HP64000 devices, such as the printer.

Table 1-1. Supported Microprocessors

HP Model 64200A	8080 Family Emulation System
Option 202	8080 Emulator System
Option 203	8085 Emulator System
Model 64201A Opt 202,203	Emulator Control
Model 64202A Opt 202	8080 Emulator Pod Assembly
Model 64203A Opt 203	8085 Emulator Pod Assembly
HP Model 64210A	6800 Family Emulator System
Opt 212	6800 Emulator System
Model 64211A	6800 Emulator Control
Model 64212A	6800 Emulator Pod Assembly
HP Model 64250A	Z80 Family Emulator System
Option 252	Z80 Emulator System
Model 64251A	Emulator Control
Model 64252A	Z80 Emulator Pod Assembly

1-11. Servicing the HP64000

1-12. Customer Engineer

1-13. The Customer Engineer is responsible for installation and on-site service of the HP64000 Logic Development System. Using the manuals listed in tables 1-4 and 1-5, and equipped with a Field Service Kit, HP P/N 64930A, the Customer Engineer should be able to repair the HP64000 System on-site. Questions may be referenced to the appropriate Service Engineer at the factory.

1-14. Field Engineer and Systems Engineer

1-15. The Field Engineer handles all of the sales and ordering information, and is responsible for pre-delivery site selection and preparation. The Systems Engineer is responsible for the software and applications aspects of the HP64000 Logic Development System. In areas without a Systems Engineer, the Field Engineer will pick up responsiblity for the software and applications considerations.

1-16. Software Services

1-17. Software services for users of Hewlett-Packard's Model 64000 Logic Development System include information and update services. A Software Notification Service is provided with each 64000 system. The Model 64900A Software Subscription Service gives the user the opportunity to update software and documentation automatically throughout the course of a year. The Model 64901A Limited Update Service allows the user to select updates for specific subsystems at any time.

1-18. The Software Subscription Service is provided free of charge during the normal warranty period.

1-19. Software Notification Service (SNS)

1-20. Software Notification Service (SNS) is provided at no charge with each Model 64000 Logic Development System. SNS is an information service sent to all 64000 users periodically which keeps them up to date on new products, software enhancements, and general information of interest. Since SNS is intended for the person using the 64000 system, informing the local HP Systems Engineer of the correct user name and address will assure that the SNS is promptly and properly delivered.

1-21. Software Update Services

1-22. Hewlett-Packard's commitment to excellence in the Logic Development System is not limited to the instruments alone. To maintain a high standard of quality, all software and documentation are also maintained at state-of-the-art levels. The customer can use the Model 64900A Software Subscription Service or the modular Model 64901A Limited Update Service to:
* Increase the system's efficiency and reduce costs with the most current innovations in software for easier use and quicker service,
* Maintain compatibility with all new features and functions as they become available across the years, and
* Take advantage immediately of the most recent R&D efforts at improving and enhancing the system.

1-23. Model 64900A Software Subscription Service

1-24. The Model 64900A Software Subscription Service is a one-year subscription to software and documentation updates for the Model 64000 Logic Development System. Tape cassettes of the latest enhancements and improvements for system software and applications software, together with the accompanying operators' and service manuals, will be sent two or more times each year the service is purchased. State-of-the-art software status is maintained automatically for all modules of the user's system. Updates for any products added to the system during the subscription period are included without additional cost.

1-25. The Software Subscription Service may be ordered at any time during the normal warranty period. Since all updates occuring during the initial warranty period are received free of charge, the Model 64900A subscription begins at the end of the warranty period, or at the end of the preceding subscription year. If an order is placed after the warranty period or after a subscription period expires, an order for Model 64900A is accepted only after adding updates (using the options of Model 64901A Limited Update Service) for any software modules different from the current software.

1-26. Model 64901A Limited Update Service

1-27. The Model 64901A Limited Update Service is a one-time update for specific modules. Current software and documentation are available using options which parallel the options offered for the 64001S Logic Development System. An alternative to the Model 64900A Software Subscription Service, the Model 64901A Limited Update Service permits a selective updating of system software. By using this one-time, selective updating service, the user can:
* Bring up critical portions of the system to current status,
* Update the 64000 System to come on-line with the Model 64900A Software Subscription Service after a lapse in subscription coverage, or
* Add new software products compatibly as the customer's system is expanded.

1-28. Software Compatibility Code

1-29. Most modifications and enhancements to 64000 System software modules will retain compatibility with existing software. Occasionally, software changes will have a sufficiently great impact to require changes throughout the system. Such major amendments constitute compatibility versions; e.g. A, B, C, et cetera. Each software module carries a compatibility code. When expanding a 64000 System with an added unit of more recent compatibility code, any software modules of the existing system which are not compatible with the more recent version must be updated simultaneously. Options for Model 64901A Limited Update Service are used to bring an existing system to the current compatibility version. Information on compatibility codes for software modules is available from the HP Systems Engineer.

1-30. Related Manuals

1-31. Tables 1-2 and 1-3 are provided to facilitate locating necessary manuals for each system component. Table 1-2, 64980A Manuals Configuration Guide, lists the titles of the manuals obtained by ordering a given 64980A option. Table 1-3, List of HP64100 Service Manuals, indicates the numbering system for the service manuals of the development station and each of its options. Ordering 64980A Option 001 will generate shipment of all items listed in table 1-3. This includes a binder, label, and all of the service manuals for the development station and its options.

Table 1-2. 64980A Manuals Configuration Guide

64980A Option	Description	Contents
001	Service Manuals	64980-90900 Standard Binder 64980-90975 Label-(System Service Manuals) Includes manuals listed in Table 1-3 (manual list for Development Station & Options)
002	Site Selection & Installation	64980-90900 Standard Binder 64980-90971 Label 64980-90982 Divider 64980-90902 Manual
003	System Overview—Editor Manual	64980-90900 Standard Binder 64980-90972 Label 64980-90983 Divider 64980-90903 System Overview Manual 64980-90984 Divider-Editor 64980-90904 Manual-Editor
004	Disc/Line Printer/Misc Binder Only	64980-90900 Standard Binder 64980-90973 Label 64980-90986 Divider-Disc 64980-90985 Divider-Line Printer 64980-90989 Divider-Misc
006	7906 Disc Manuals Only Order Option 004 for Binder	07906-90903 7906 Service Manual 07906-90901 7906 Disc Users Manual 07906-90902 7906 Disc Install Manual 12745-90901 12745 HP-IB Adapter Manual 13037-90006 13037 Disc Controller Manual 29425-90001 29425 Cabinet Manual 40019-90901 Manual
008	2608 Line Printer Manual Only Order Option 004 for Binder	02608-90904 Service Manual 02608-90901 2608 Operators Manual
010	7910 Disc Manuals Only	07910-90902 Disc Drive Installation Manual 07910-90903 Disc Drive Service Manual
020	7920 Disc Manuals Only	07920-90901 7920 Installation Manual 07920-90902 7920 Disc Service Manual 07920-90030 7920 Operators Manual 12745-90901 12745 HP-IB Adapter Manual 13037-90006 13037 Disc Controller Manual

Table 1-2. 64980A Manuals Configuration Guide (Cont'd)

64980A Option	Description	Contents
025	7925 Disc Manuals Only Order Option 004 for Binder	07925-90901 7925 Disc Users Manual 07925-90902 Manual 07925-90903 Disc Service Manual 12745-90901 12745 HP-IB Adapter Manual 13037-90006 13037 Disc Controller Manual
031	2631B Line Printer Manuals Order Option 004 for Binder	02631-90901 2631 Operators Manual 02635-90905 Manual 02631-90910 Service Manual
202	8080/85 Assembler & Linker Emulator/Analyzer Manuals	64980-90900 Standard Binder 64200-90971 Label 64980-90987 Divider-Assember/Linker 64200-90901 Manual-Assembler & Linker 64980-90988 Divider-Emulator/Analyzer 64980-90991 Manual-Emulator/Analyzer 64200-90982 Divider-Emulator/Analyzer Supplement 64200-90902 Manual-Emulator/Analyzer Supplement
210	6800 Assembler & Linker Emulator/Analyzer Manuals	64980-90900 Standard Binder 64210-90971 Label 64980-90987 Divider-Assembler & Linker 64980-90990 Manual-Assembler & Linker 64200-90981 Divider-Assembler Supplement 64841-90902 Manual 6800 Assembler Supplement 64980-90988 Divider-Emulator/Analyzer 64980-90991 Manual-Emulator/Analyzer 64200-90982 Divider-Emulator/Analyzer Supplement 64210-90902 Manual-6800 Emulator/Analyzer Supplement
252	Z80 Assembler & Linker Emulator/Analyzer Manuals	64980-90900 Standard Binder 64250-90971 Label 64980-90987 Divider-Assembler & Linker 64980-90990 Manual-Assembler & Linker 64200-90981 Divider-Assembler Supplement 64842-90902 Manual-Z80 Assembler Supplement 64980-90988 Divider-Emulator/Analyzer 64980-90991 Manual-Emulator/Analyzer 64200-90982 Divider-Emulator/Analyzer Supplement 64250-90902 Manual-Z80 Emulator/Analyzer Supplement
999	Cassette Binder	64980-90906 Storage Binder/Mini Cart

Table 1-3. Service Manuals for HP 64100 & Options

Standard Binder	64980-90900
Label-Service	64980-90975
Manual-Service Overview	64001-9090X
Manual Set-Service Mainframe	64100-9090X
Manual-Service Tape Control	64940-9090X
Manual-Service Internal Analysis	64300-9090X
Manual-Service Emulator Memory Control	64150-9090X
Manual-Service Emulator Memory 32KB	64152-9090X
Manual-Service Emulator Memory 16KB	64153-9090X
Manual-Service Emulator Memory 8KB	64154-9090X
Manual-Service 8080/85 Emulator Control	64200-9090X
Manual-Service 8080 Pod	64202-9090X
Manual-Service 8085 Pod	64203-9090X
Manual-Service 6800 Emulator Control	64210-9090X
Manual-Service 6800 Pod	64212-9090X
Manual-Service Z80 Emulator Control	64250-9090X
Manual-Service Z80 Pod	64252-9090X
Manual-Service Positive PROM Programmer	64500-9090X
Manual-Service 64502 PROM MODULE	64502-9090X
Manual-Service 64503 PROM MODULE	64503-9090X
Manual-Service 64504 PROM MODULE	64504-9090X
Manual-Service 64505 PROM MODULE	64505-9090X
Manual-Service 64507 PROM MODULE	64507-9090X
Manual-Service 64508 PROM MODULE	64508-9090X
Manual-Service 64509 PROM MODULE	64509-9090X
Manual-Service 64510 PROM MODULE	64510-9090X
Manual-Service 64513 PROM MODULE	64513-9090X

SECTION II

INSTALLATION

2-1. Introduction

2-2. This section provides the information for site selection, installation, and checkout of the Model 64000 Logic Development System. Refer to Service Overview Section I, tables 1-2 and 1-3, for the list of manuals associated with individual system components.

2-3. A summary of address and control settings for the system is provided in table 2-1. The setting location is given, as well as identification of selections.

Table 2-1. List of Selectable Settings, System Level

Device	Setting	Device	Setting
I. Development Stations. A. HP-IB Address (Rear Panel):	(2-7)	III. System Printer. A) 2631B or 2608A 1) HP-IB Address	(1)
B. Master Controller (I/O Bd.) (Master/Slave).		2) Power On (Rear Panel)	(On/Off)
C. Boot-Up Selector (Rear Panel): -Performance Verification -Local Mass Storage -ROM -System Bus, Disc	(1 1),binary (1 0),binary (0 1),binary (0 0),binary	3) Control Settings a) On Line/Off Line b) Self-Test c) Reset d) Lines Per Inch e) Display Functions f) Print-Default Settings	(6 or 8) (On/Off) (LPI, Char. Size)
D. Power On (Rear Panel)	(On/Off)		
II. System Memory (Disc). A. 7910: 1) HP-IB Address (Rear Pnl) 2) Power On (Rear Panel)	(0) (On/Off)		
B. MAC Disc - 7906,7920,7925: 1) 12745A Adaptor Settings: (In Controller Cabinet) a) HP-IB Address b) CPU #	(0) (0)		
2) 13037C Controller Settings: Power On (In Disc Cabinet)	(On/Off)		
3) Disc Drive Unit: a) Unit Select # (Inside Front Panel) b) Power On (Rear Panel)	(0) (On/Off)		

2-4. Abbreviated System Connection and Verification

Assuming that the criterion for site selection, operation environment, and power requirements are met, the following abbreviated outline can be followed for a quick system connection and verification.

A. Unpack system components.

B. Set development station System Control Source switches to PERFORMANCE VERIFICATION. Execute performance verification on development station.

C. Verify that U3 and U4 are set for MASTER CONTROLLER.

D. Set HP-IB address switches (disc=0, printer=1, development stations=2-7).

E. Connect disc to development station (ensure that the user has all disc files backed up on cassette tapes).

F. Set development station System Control Source switches to Local Mass Storage. Insert and initiate system tape (HP Model 64800).

G. Run disc performance verification. Format disc. Load system software. Set development station System Control Source switches to System Bus.

H. Connect system printer.

I. Connect additional development stations, one at a time.

2-5. Site Selection and Preparation

2-6. Site Selection Responsibilities

2-7. Customer

2-8. It is the responsibility of the customer to provide sufficient and adequately prepared space, electrical power, and air conditioning to ensure that the area will be suitable for Hewlett-Packard equipment installation. Hewlett-Packard retains the right to refuse to maintain Hewlett-Packard supplied equipment if the area is deemed inadequate.

NOTE

This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the installation manual, may cause interference to radio communications. As temporarily permitted by regulation it has not been tested for compliance with the limits for class A computing devices pursuant to subpart J or part 15 of FCC rules, which are designed to provide reasonable protection against such interference. Operation of this equipment in a residential area is likely to cause interference in which case user, at his own expense, will be required to correct the interference.

2-9. The customer is responsible for unpacking, inventory, and placement of the system on the selected site.

2-10. Customer Engineer

2-11. The Customer Engineer (CE) is responsible for the total site selection of the system.

2-12. After the delivery date has been verified, if HP is to install the system, the CE will contact the customer to schedule the installation date.

2-13. On the installation date, the CE will visually inspect all system components, install the system, and run diagnostic programs to verify system operation.

2-14. Site Preparation

2-15. Site preparation information for the HP64000 system includes environmental, power, cooling, and mounting requirements. Each of these requirements is discussed in detail in the following paragraphs.

2-16. Cabinet Space Requirements

2-17. Dimensions of the development station, line printers, and discs are given in figure 2-1. A location for the disc cabinet should be selected that will afford adequate space for the doors to be fully opened.

Cooling requirements of the development station include side clearances of 203 mm (8 in.) minimum.

NOTE

Dimensions are in millimeters and (inches).
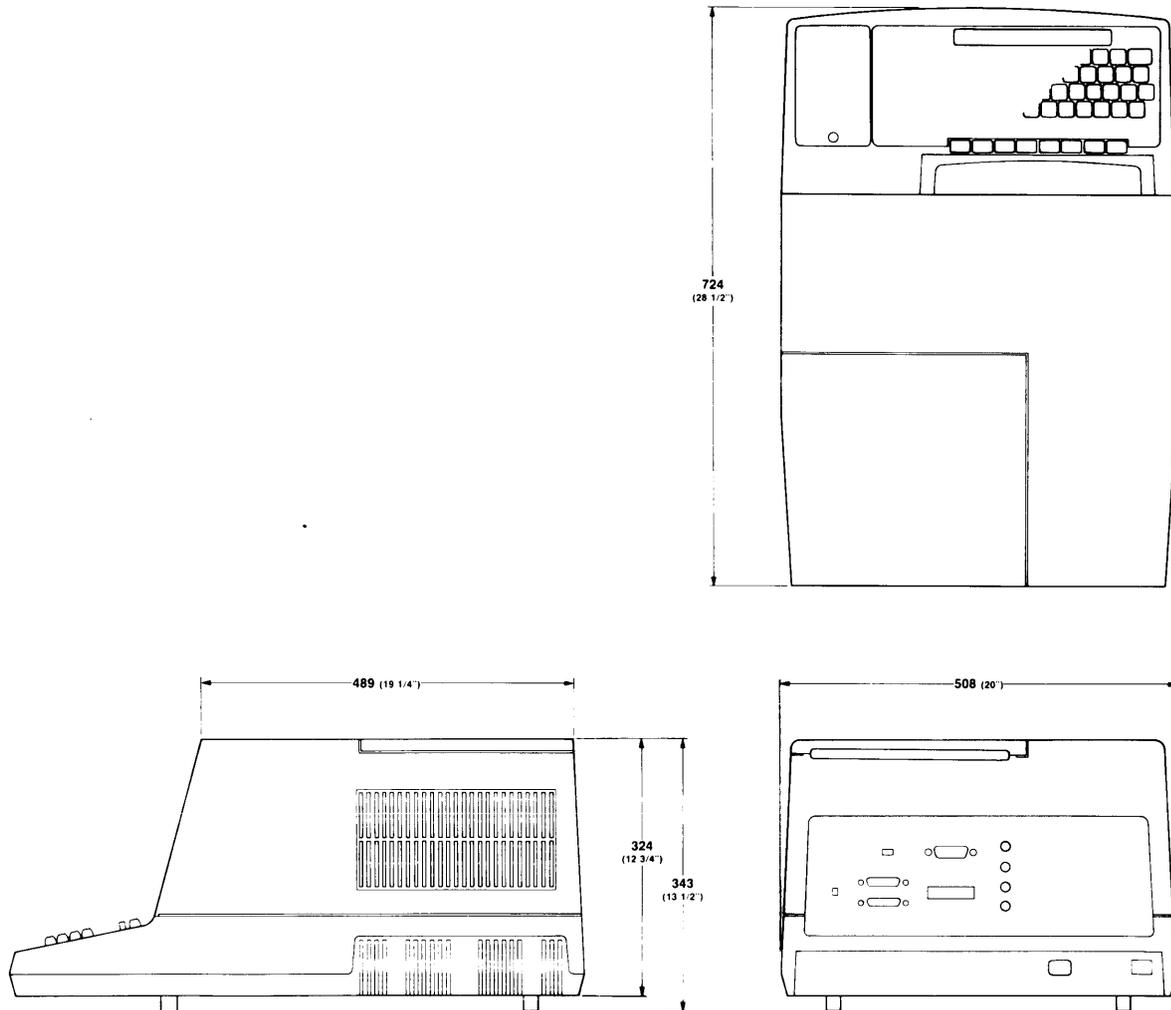
Figure 2-1. Space Requirements

1. HP Model 2631B Opt 046 Line Printer

2. HP Model 2608 Opt 046 Line Printer
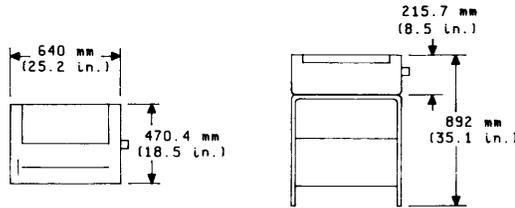
Clearance Requirements

a. Front and Rear - Adequate for operator access.

b. Side - 76 mm (3 in.)
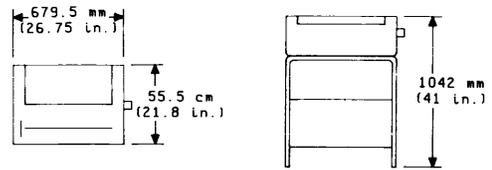
Clearance Requirements

a. Front and Rear - Adequate for operator access.

b. Left Side - 203 mm (8 in.) minimum.

3. HP Model 7906 Opt 102 Disc Drive
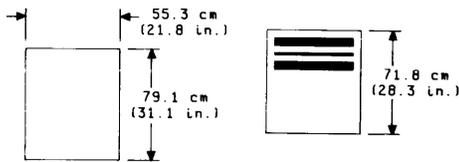
4. HP Model 7920/7925 Opt 102 Disc Drive

Clearance Requirements

a. Rear - 500 mm (20 in.) minimum from any object or barrier.
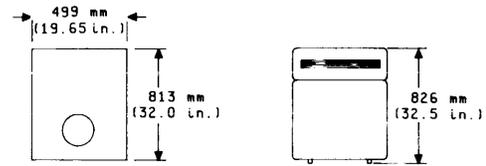
Clearance Requirements

a. Rear - 500 mm (20 in.) minimum from any object or barrier.

5. HP Model 7910H Disc Drive
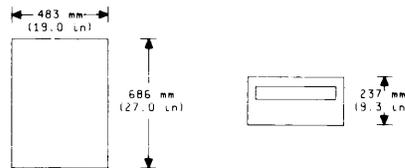
Clearance Requirements

a. Rear - 500 mm (20 in.) minimum from any object or barrier.

Figure 2-1. Space Requirements (Cont'd)

2-18. Environmental Requirements

2-19. The disc drive has been designed to operate with an air inlet temperature in the range of 10 deg C to 40 deg C (50 deg F to 104 deg F) with the rate of temperature change not to exceed 20 Celsius degrees (36 Fahrenheit degrees) per hour. It is expected that the disc cartridge to be used will be stored in the same room in which the disc drive is operating. To ensure interchangeability, it is further required that the air inlet temperature of the disc drive be within 2 Celsius degrees (4 Fahrenheit degrees) of room ambient.

2-20. Power Requirements

2-21. The system components may be operated continuously from a single-phase, primary power source of 100, 120, 220, or 240 Vac +5 or -10 percent at a line frequency of 47.5 to 66 Hz. Prior to installing the system, determine the primary power source to be used. Also, various safety codes require that the system components be grounded to protect operating and service personnel. A grounded three-conductor female power outlet must be made available to satisfy this requirement. If the primary power source to be used is other than 120Vac the power section of each system component must be reconfigured. See table 2-2 for a summary of power requirements.

Table 2-2. Power and Environmental Requirements

Product	Maximum 120 V	Current 240 V	Maximum Heat Load	Weight	Power Cable	Bus Cable
Model 64100A Mainframe	4.58 A	2.29 A	1661 BTU/hr 455 W	34.02 kg (75 lb)	2.2 m (7 ft)	2 m (6 ft)
———— units	————	————	————————			
Model 7906M Disc Drive (Opt 102)	8.15 A	4.08 A	2756 BTU/hr 755 W	154 kg (340 lb)	2.2 m (7 ft)	2 m (6 ft)
———— units	————	————	————————			
Model 7906S (Opt 102) Disc	5.45 A	2.73 A	1740 BTU/hr 510 W	138 kg (303 lb)	2.2 m (7 ft)	2 m (6 ft)
———— units	————	————	————————			
Model 7910H	2.27 A	1.22 A	920 BTU/hr 270 W	32 kg (70.6 lb)	2.2 m (7 ft)	2 m (6 ft)
———— units	————	————	————————			

Table 2-2. Power and Environmental Requirements (Cont'd)

Product	Maximum 120 V	Current 240 V	Maximum Heat Load	Weight	Power Cable	Bus Cable
Model 7920M (Opt 102) Disc Drive	8.45 A	4.23 A	2788 BTU/hr 817 W	159 kg (350 lb)	2.2 m (7 ft)	2 m (6 ft)
_____ units	_____	_____	_____			
Model 7920S (Opt 102) Disc	5.8 A	2.9 A	1809 BTU/hr 530 W	143 kg (315 lb)	2.2 m (7 ft)	2 m (6 ft)
_____ units	_____	_____	_____			
Model 7925M (Opt 102) Disc Drive	8.6 A	4.3 A	2901 BTU/hr 850 W	158 kg (350 lb)	2.2 m (7 ft)	2 m (6 ft)
_____ units	_____	_____	_____			
Model 7925S (Opt 102) Disc	6.5 A	3.25 A	2014 BTU/hr 590 W	143 kg (315 lb)	2.2 m (7 ft)	2 m (6 ft)
_____ units	_____	_____	_____			
2631B (Opt 046) Line Printer	2.2 A	1.1 A	901 BTU/hr 245 W	23 kg (51 lb)	2.2 m (7 ft)	2 m (6 ft)
	_____	_____	_____			
Stand				24 kg (53 lb)		
2608 (Opt 046) Line Printer	12.5 A	6.25 A	5120 BTU/hr 1500 W	97 kg (217 lb)	2.2 m (7 ft)	2 m (6 ft)
	_____	_____	_____			
Total	_____ A	_____ A	_____ BTU/hr _____ W	__ lb __ kg		

2-22. Determining System Power Requirements

2-23. Table 2-2 lists the maximum current requirements of each system component.   From these values the power requirements for the system may be determined. The power cords with country-dependent plugs are shown in figure 2-2.

<div align="center">NOTE</div>

Extension power cords must not be used under any circumstances.

For a basic system, the requirements at 120V would be as follows:

1 Model 64100A Development Station	4.58 Amps
1 Model 7910H Disc	2.27 Amps
1 Model 2631A Line Printer	2.30 Amps
	9.15 Amps

For an expanded system, the requirements at 120V would be:

6 Model 64100A Development Stations	27.48 Amps
1 Model 7920M Disc	8.45 Amps
1 Model 2608A Line Printer	12.50 Amps
	48.43 Amps

MALE NEMA (MOLDED)   FEMALE CEE

BROWN OR BLACK (L)
GREEN/YELLOW (E)
LIGHT BLUE OR WHITE (N)
(L) BROWN OR BLACK
(E) GREEN/YELLOW
(N) LIGHT BLUE OR WHITE

8120-1378 (GRAY, 2.3m)
8120-2371 (BLACK, 2.3m)

MALE CEE   FEMALE CEE

BROWN OR BLACK (L)
GREEN/YELLOW (E)
LIGHT BLUE OR WHITE (N)
(L) BROWN OR BLACK
(E) GREEN/YELLOW
(N) LIGHT BLUE OR WHITE

8120-1860 (1.5m)

FEMALE CEE

BLUE (N)
GREEN/YELLOW (E)
BROWN (L)
(L) BROWN
(E) GREEN/YELLOW
(N) BLUE

8120-2104 (2.0m)

MALE SCHUKO   FEMALE CEE

LIGHT BLUE (N)
GREEN/YELLOW (E)
BROWN (L)
(L) BROWN
(E) GREEN/YELLOW
(N) LIGHT BLUE

NOTE: THE LIGHT BLUE (N) AND BROWN (L) WIRES TO THE MALE SCHUKO
CONNECTOR MAY BE CONNECTED OPPOSITE TO THAT SHOWN.   8120-2857 (Shielded, 2.0m)

FEMALE CEE

LIGHT BLUE OR BLACK (N)
GREEN/YELLOW (E)
LIGHT BROWN OR RED (L)
(L) LIGHT BROWN OR RED
(E) GREEN/YELLOW
(N) LIGHT BLUE OR BLACK

8120-1369 (2.0m)

FEMALE CEE

LIGHT BLUE (N)
GREEN/YELLOW (E)
LIGHT BROWN (L)
(L) LIGHT BROWN
(E) GREEN/YELLOW
(N) LIGHT BLUE

8120-1351 (2.3m)

GREEN/YELLOW (E)
BLUE (N)
BROWN (L)
(L) BROWN
(E) GREEN/YELLOW
(N) BLUE

8120-2956 (2.0m)

E EARTH OR SAFETY GROUND
N NEUTRAL OR IDENTIFIED CONDUCTOR
L LINE OR ACTIVE CONDUCTOR

REF 7311-1D

Figure 2-2. International Power Cord Sets

2-24. Cooling Requirements

2-25. The development station requires side clearance of 203 mm (8 inches) minimum, for cooling purposes. A single blower motor provides adequate ventilation for the disc drive, when operated within the environmental limitations specified in table 2-1. Cooling air is drawn into the disc drive through a prefilter duct assembly and is primarily exhausted through the right rear at the bottom of the drive. The air flow developed provides cooling air to the heat sink on the power and motor control printed-circuit assembly (PCA) A8 and filtered air to both the removable and fixed discs. The air filtration system purges the cooling air supply to the disc area of 99-percent of contaminants 0.3 micron or larger.

2-26. Grounding

2-27. The Model 64000 components are equipped with a three-conductor power cord which, when connected to an appropriate power receptacle, grounds the system. The green-wire safety ground is connected to the metal frames of each component in the system to provide a return path for fault currents due to equipment malfunction or external faults such as lightning strikes. Do not operate the system from an ac power outlet which has no ground connection. Be sure that there is a green-wire ground running from the power outlet to the distribution panel where the circuit breaker is installed.

NOTE

To ensure good communications over the system bus it is mandatory that all power sources be at the same ground potential.

2-28. Convenience Outlets

2-29. Power outlets for janitorial maintenance (vacuum cleaners, floor buffers, etc.) must be wired on a separate circuit breaker from the Model 64000. If these precautions are not taken, operation of janitorial equipment will induce noise transients on the system power lines, which can cause abnormal operation of the system.

2-30. Isolation Transformer

2-31. Switching heavy electrical machinery loads or operating certain types of equipment near the system can cause problems, even though the source is on a different circuit breaker. In some cases, it is mandatory to provide a separate circuit and circuit breaker for the system directly from the main building power. In extreme cases of severe electrical noise, it may be necessary to install an isolation transformer.

2-32. Power Line Noise

2-33. Power taken from a typical ac power line is inherently noisy and fluctuations can be caused by utility power company switching, circuit breakers tripping, air conditioning equipment, electrical welders, elevators, copying machines, or by the start-up of large electric motors.

2-34. Even though you cannot control or prevent disruptions from the first two items, remember when planning the site to not connect the Model 64000 components on the same circuit breaker with any of the other named equipment.

2-35. Telephone

2-36. A telephone should be located near the system so that a customer or CE can discuss a servicing problem while working on the unit.

2-37. System Bus

2-38. General Interconnect Information

2-39. The Model 64000 components must be connected in series. The master controller development station (see page 2-45) must be connected on one end. It must not be connected in the center of the system. The bus cable is an HP 8120-2718 Cable.

2-40. The maximum distance for the interconnection is 20 meters. The maximum number of loads that can be connected is 15. The load distribution is as follows:

```
     Master controller = 8 loads
     Line printer      = 1 load
     System disc       = 1 load
     Each Model 64100A
     Development
     Station           = 1 load
     (non-controller)  _____
                        10 loads (or 15 loads for a maximum system)
```

2-41. The system bus connector on the rear panel, provides the
necessary interface of the Model 64100 with other components in the
system.

NOTE

Although the cable(s) used to interconnect
components of the Model 64000 are HP-IB cables DO
NOT interpret the system bus as an HP-IB bus. Only
those items specified for the Model 64000 Logic
Development System may be connected to this bus.

System Bus Connector
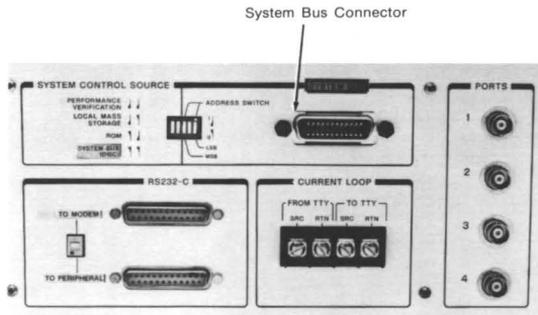
Figure 2-3. HP 64100A Rear Panel

NOTE

Star connections (3 cables connected at one point)
are not allowed in the Model 64000. Only two
connectors may be connected at any one point
(daisy-chain).

2-42. System Configuration

2-43. The system bus, based on the HP-IB, provides the medium for
communication   between   the   components of the system. Each device on
the bus must have a unique address. System memory (disc) must   reside
at   address   0, the system printer (if any) must occupy address 1, and
development stations may use addresses 2 - 7 (additional system memory
devices may use address 2 - 7, but the first disc must be   at   address
0).   A   hard-disc   based   system,   as the Basic System Configuration
figure shows,   there   must   be   at   least   one   disc   memory,   and   one
development   station, and there may be a printer.   In order to utilize
the shared data-base resource, the system may be built upon, as   shown
in   the Expanded Configuration figure.   If the one disc is used, up to
six development stations may be   on   the   system   bus   (address   1   is
reserved   for   the   printer,   and even if no printer is used,   nothing
else may occupy that address).   In order for the development   station,
line   printer   and   the disc to communicate with each other, each must
have a unique address. In this configuration there can be no more than
two interface cables connected at one place.
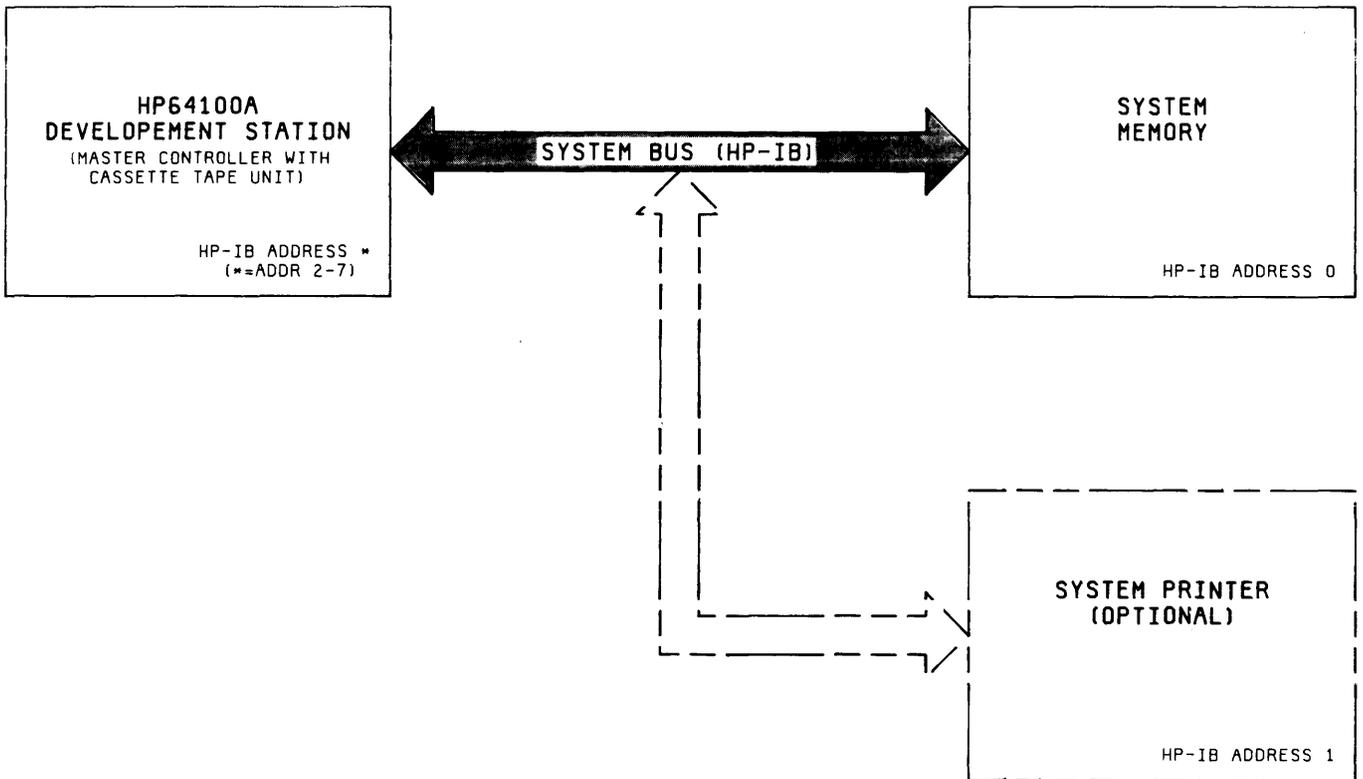
Figure 2-4. HP 64000 Basic Configuration
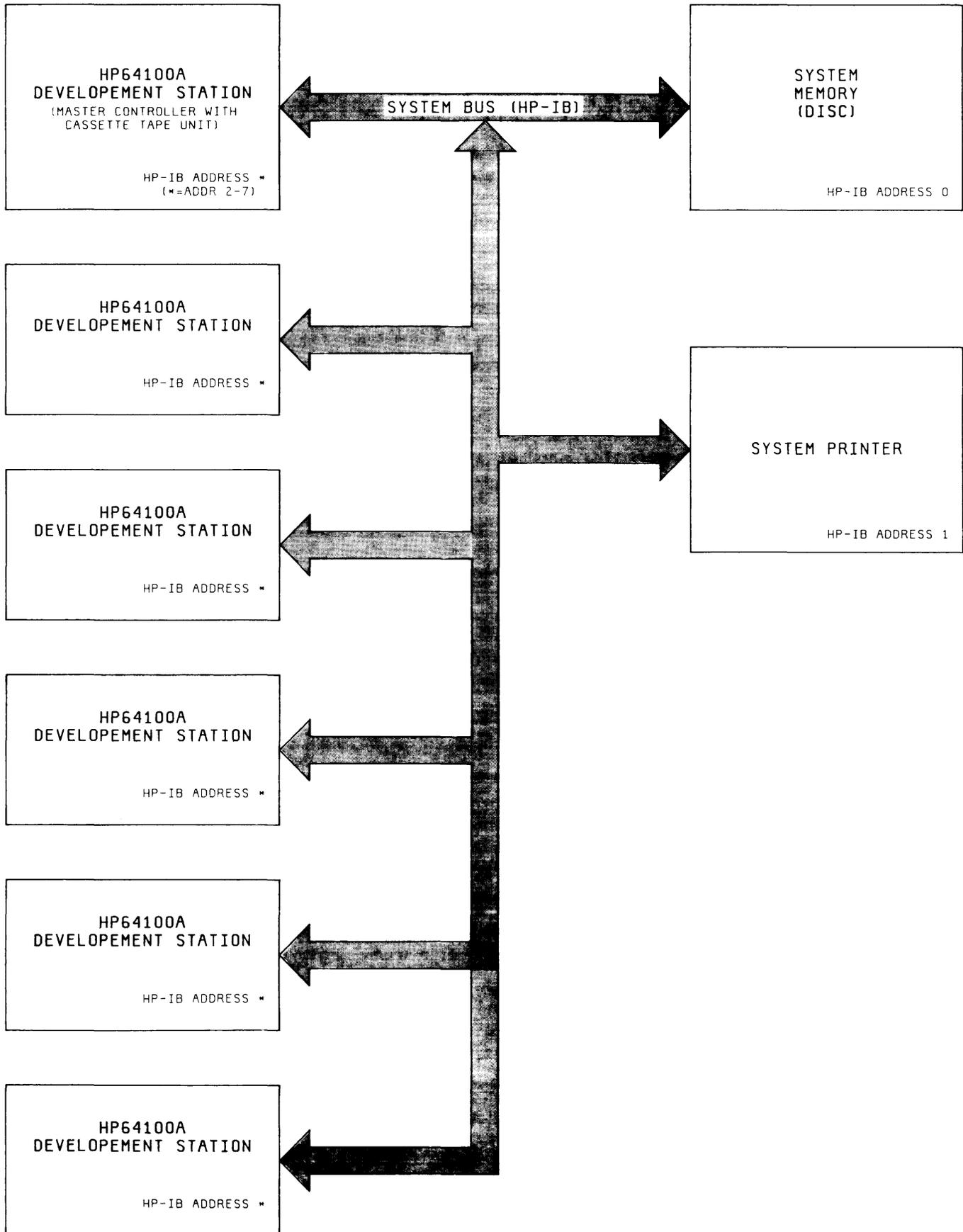
Figure 2-5. HP 64000 Expanded Configuration

2-44. Installation of HP64100A Development Station

2-45. Development Station Power Supply Loading

2-46. There is a limit to the number and types of option boards that may be installed in the card cage with the 250 watt Power Supply. The limit is determined by the amount of available current from the power supplies.

Power Supply Available Currents

Power Supply	+12V	+5V	(-5V) + (-3V)
Maximum Supply Current	6A	23.5A	10A
Basic Mainframe Loads	3.5A	5.7A	0.0A
Available Current	2.5A	17.8A	10A

Power Supply Loads

Basic HP64100A Mainframe	+12V	+5V	(-5V) + (-3V)
Development Station Pullups		.050	
Processor, ROM	.595	1.429	.0003
I/O	.164	.708	
Disp Control, RAM	.640	1.533	.0064
Keyboard		.239	
Display Driver	1.500	.100	
Rear Connector		.714	
Subtotal	2.899	4.723	.0067
(x 1.2 load factor)			
= Equivalent Load:	3.5	5.7	0.0

Option Cards	+12V	+5V	(-5V) + (-3V)
Analysis		3.0	.6
8080 Emulation Sys	.1	6.0	
8085 Emulation Sys		6.4	
6800 Emulation Sys		6.5	
Z80 Emulation Sys		5.3	
Prom Zapper	.1	1.3	
Cartridge Control	.3	.3	
Memory Control *		1.0	
Memory **			
4K (8 kbytes)		2.9 (1.2)	
8K (16 kbytes)		3.1 (1.5)	
16K (32 kbytes)		3.6 (1.9)	

* The memory control card can handle up to four (4) memory boards.
**Number in ( ) applies when no rows are addressed. One row on one memory board is addressed at all times.

2-47. Sample Calculation

2-48. If the card cage were configured as follows:

Analysis Board	3.0
6800 Emulation System	6.5
PROM Programmer System	1.3
Minicartridge Control	.3
(tape drive system)	
Memory	
Control	1
16K addressed	3.6
16K	1.9

The total current drawn would be: 17.6A (5V Supply Only)

2-49. When the listed options are placed in the Model 64100A it totals 17.6 amps. This leaves .2A available for use by an option board. Do not add any option board that exceeds 200mA.

2-50. Each time the option cards are reconfigured, the loading of the cards must be figured to ensure the limits of the power supply are not exceeded.

2-51. Bus Configuration

2-52. The cards interface to the system through the mother board on the bottom of the card cage. A cable from the rear panel board (on the rear panel) makes connection to the top center connector on the I/O board.

2-53. Card cable passage to the outside of the Development Station is through the rear of the top cover and rear panel. Three slots with clamps are provided. Cable length for option cards is determined at the factory and is shipped at maximum length.

2-54. For convenience, a label is just above the card cage on the left
hand side. As cards are inserted into the card cage, mark the card
name on the label. The label can be erased and the card name changed
as the card cage is reconfigured.
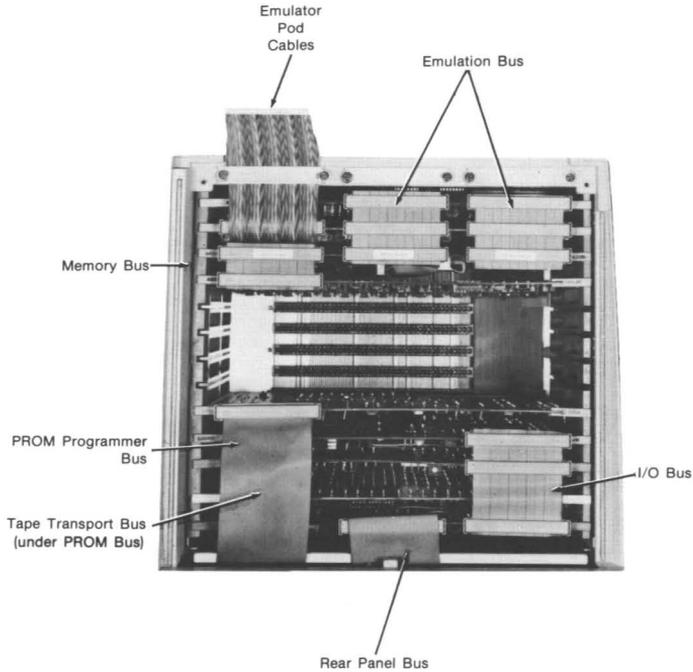
Figure 2-6. Bus Configuration

2-55. The I/O Bus requires connection between the I/O (slot A) card
and CPU Card (slot C). The connection is made with a ribbon cable on
the top right hand connector of each card. If the Tape Control card is
in the system the top right hand connector must be connected to the
I/O Bus. This may require one of the cables shown in the HP Model
52150A cable kit figure.
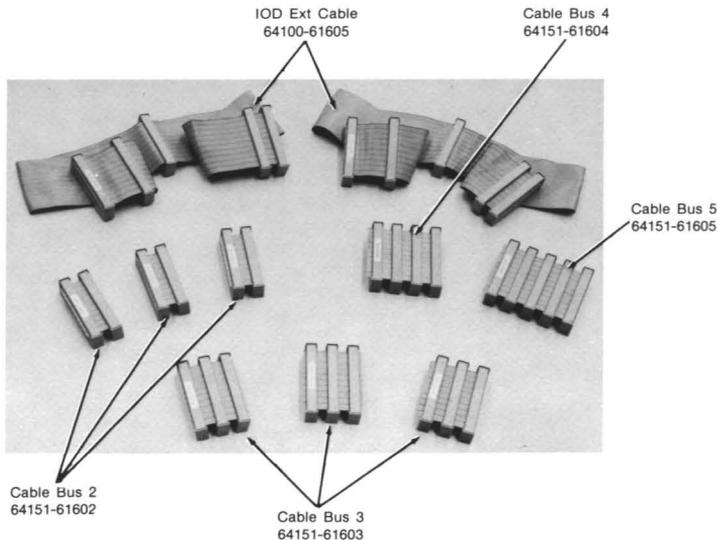
Figure 2-7. Model 52150 Cable Kit

2-56. The Memory Bus requires the Memory Control board be connected to
the applicable memory boards. This connection is made on the top left
hand connector. Appropriate 2 or 3 connector cables should be used to
interconnect all memory boards.

NOTE

There must be one Memory Controller board for
every four memory boards or less regardless of
the amount of memory.

2-57. Card Installation

2-58. To install one of the option cards, hold the edge of the card as shown in the card installation figure. The components should face the front of the development station. Slide the board down into the card cage. Align the connector on the bottom of the board with the socket on the mother board. Apply enough pressure to seat the board in the socket.
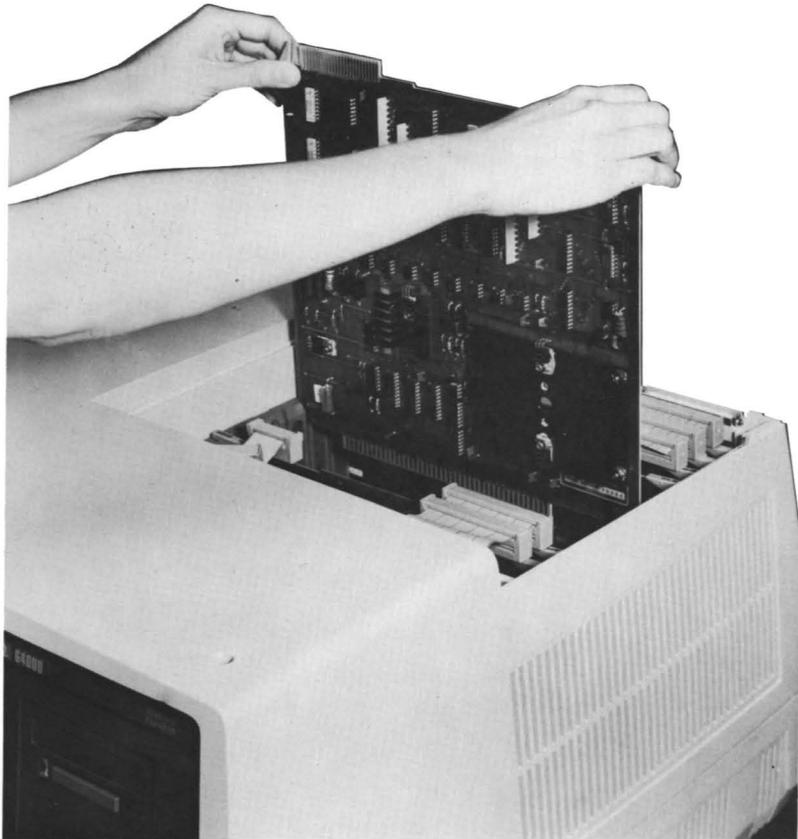
Figure 2-8. Card Installation

Emulation/Memory Configuration

1) Emulation/Analysis/Memory and 2) Emulation/Memory. The PROM Programmer Control card can be placed in any slot 0 through 9 depending on the configuration.

1. Emulation/Analysis/Memory

A _____ I/O Board
B _____ Display Control Board
C _____ CPU Board
0 _____ Tape Controller Board (If used in the system)
1 _____
2 _____ PROM Programmer Control Board may be
3 _____ in any slot 1 through 4.
4 _____
5 _____ Memory Board
6 _____ Memory Board
7 _____ Memory Control Board
8 _____ Internal Analysis Board
9 _____ Emulator Board

2. Emulation/Memory

A _____ I/O Board
B _____ Display Control Board
C _____ CPU Board _____ Tape Controller Board
0 _____ Tape Controller Board (If used in the system)
1 _____
2 _____ PROM Programmer Control Board may be
3 _____ in any slot 1 through 5.
4 _____
5 _____
6 _____ Memory Board
7 _____ Memory Board
8 _____ Memory Control Board
9 _____ Emulator Board

Figure 2-9. Recommended Card Cage Configuration

2-59. Boot-up

2-60. There are four methods of booting-up the Model 64100A
Development Station. The position of the System Control Source switch
(located on the rear panel) determines the method of system boot-up.
This switch funtion is the two-left most bits of the switch under the
label SYSTEM CONTROL SOURCE. Following is an explanation of the
boot-up switch positions.
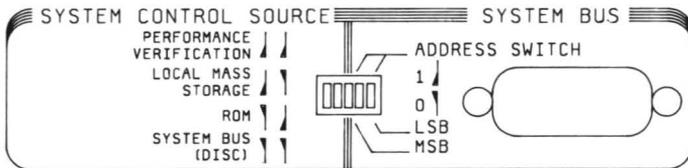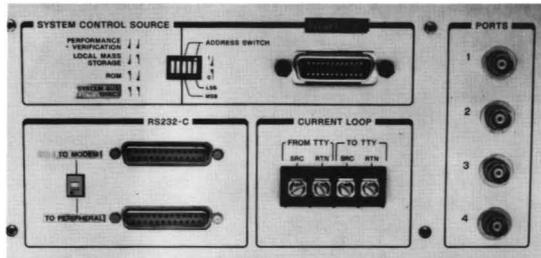
Figure 2-10. System Control Source

Boot-up Settings

Value	Function	Resulting Action
1 1	PERFORMANCE VERIFICATION	In this mode, an internal self check is run on the Model 64100A Development Station mainframe.
1 0	LOCAL MASS STORAGE	In this mode, the Model 64100A is set to boot-up from the cassette tape. This mode is used to load system software onto the disc.
0 1	ROM	Not used in the Model 64100A Development Station.
0 0	SYSTEM BUS (DISC)	After the operating system has been loaded to the disc, the Model 64100A must be set to this mode for normal operation.

2-61. Development Station Power Configuration

2-62. Make sure that each component in the system is configured for the correct voltage.

A.   Set line selector to proper source voltage.

B.   Verify fuse rating for source. 110V fuse should be 6 A.   220 V fuse should be 3 A.
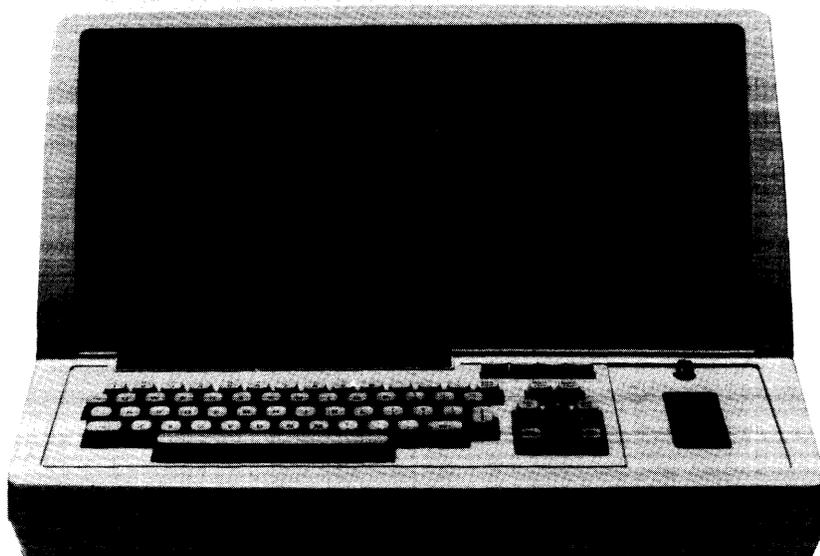
Figure 2-11. HP 64100A Logic Development Station

2-63. Development Station Performance Verification

2-64. Set the SYSTEM CONTROL SOURCE switch on the rear panel to PERFORMANCE VERIFICATION (1 1). Turn the development station power ON. There will be a loud squeak (sometimes mistaken for a beep) the instant the power is switched on. This will quickly be followed by a real beep and if the display is warmed up, a random series of characters in the upper left corner of the display. The random characters will remain approximately 1/2 second, after which a second beep will be heard and the Display Pattern figure will be visible.

2-65. The first beep signals the successful completion of the Short ROM Test which ensures that enough of the ROM code is working to enable the use of the Long ROM Test's diagnostic capability. This is accomplished by doing a partial checksum of the ROM code. If the checksum is good, the performance verification proceeds to the Short RAM Test, otherwise the Short ROM Test loops.

2-66. The second beep signals the successful completion of the Short RAM Test which reads ROM data and writes this information to RAM addresses. This includes some general memory locations and all display and basepage locations. The test then waits one second to verify the RAM's refresh and XOR's the ROM and RAM data. At the same time the ROM data is read again, complemented, and stored in RAM. After another one second wait, the RAM data is XOR'd with complemented ROM data. If the ROM and RAM data is identical, the XORs will result in all zeros and the test will pass. Any difference between ROM and RAM data gives a non-zero result which causes the test to repeat. Random data should be visible in the upper left corner of the display during this test.

2-67. The following text explains the step of performance verification associated with its accompanying figure. The Display Test is run independently of the other tests. The remaining tests may be cycled through, or run one at a time.

NOTE

The test in progress is highlighted by inverse video on the display, and with an asterisk on the figure.
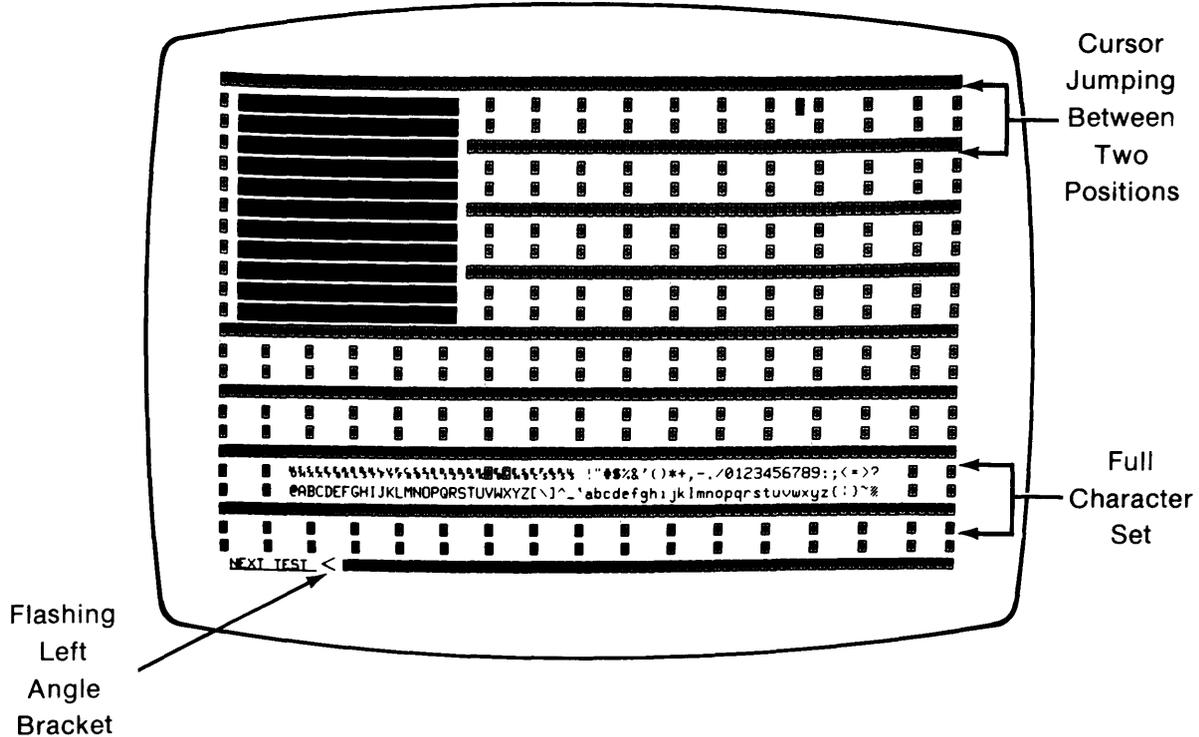
Figure 2-12. Display Test

A.   Purpose: Generates a standard pattern that contains all possible
characters. The test is repetitive and does not indicate the
number of passes or the number of failures. The presence of all
characters (no blanks in character lines) indicate proper
operation of the display circuits. The presence of the cursor
jumping back and forth indicates the ability of the CPU to write
to the display RAM. The blinking character indicates correct
operation of the blinking function. If any one of these functions
is in error, refer to the HP64100A Mainframe Service Manual (see
table 1-3).

B. After the display test is verified, press (next test) .
    The soft keys are relabeled as follows:

(next test) (start) (cycle) (display test) (end tests) (   ) (   ) (   )

(next test)   —   Press to select next test. Each time the test
                            key is pressed it will move the test function to
                            the next test.

(start)   —   Starts the test. The test that is being performed
                            will be displayed in inverse video.

(cycle)   —   If all of the tests are to be run, press (cycle) .
                            This causes the test to be run in sequence.   For
                            all tests to pass, the indication for "Test
                            Failed" should be 0 (zero) or N/A (Not
                            Applicable). The cycle mode can also be used to
                            check the development station for intermittent
                            failures since any failure will be permanently
                            recorded.

                              NOTE
_____
The keyboard test is not included in the cycle
test.
_____

(display test)   —   Pressing this soft key returns the test sequence
                            to the display test.

(end tests)   —   Pressing this soft key reboots the development
                            station according to the setting of the rear
                            panel SYSTEM CONTROL SOURCE switches.
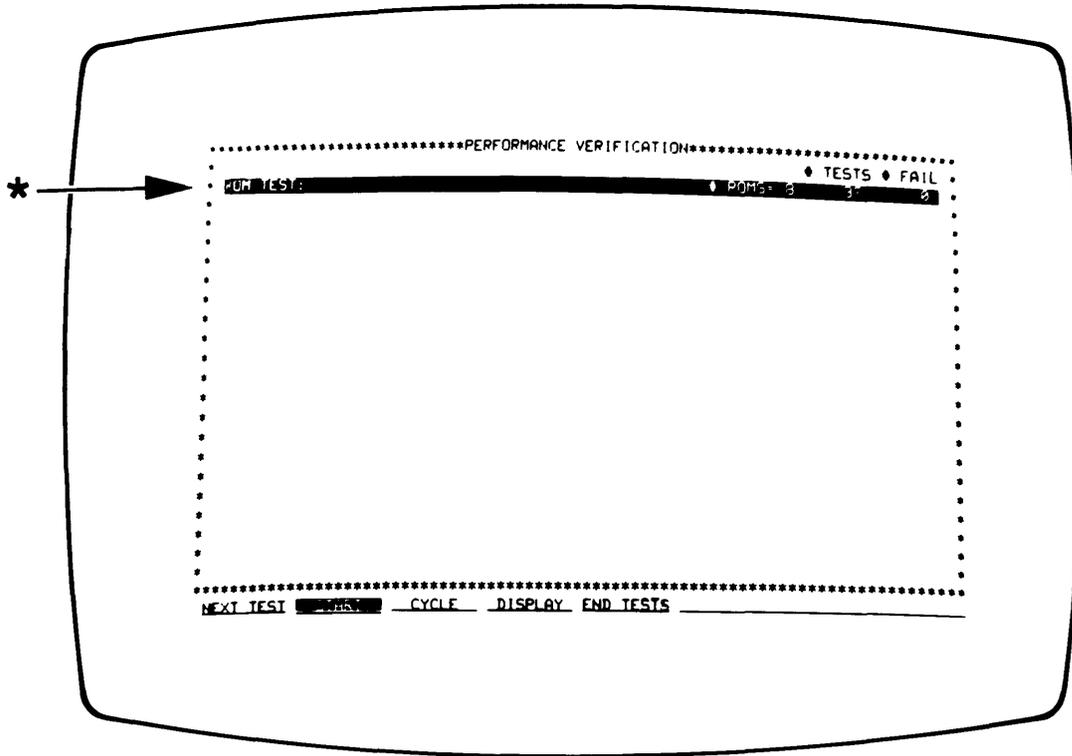
Figure 2-13. ROM Test

C. Purpose: Verifies ROM operation. This test compares the checksum
    of each ROM to its expected value. If all checksums are correct,
    the test will pass. In order to keep uninstalled ROMs from being
    displayed, the test routine ignores the test result if the
    checksum of the upper and lower byte of a ROM pair are zero.
    Since a hardware problem could cause this same result, the number
    of ROMs detected with a non-zero checksum is displayed.

Figure 2-14. RAM Test

NOTE
_____

This test takes approximately eight seconds.
_____

D. Purpose: Verifies RAM operation. The test is divided into two steps. The first step reads the contents of the primary ROM and then stores the data in RAM (that portion not checked during the Short RAM test). The RAM is read and compared to ROM just as in the Short RAM Test. The second step rechecks RAM previously checked in the Short RAM Test. This time, however, part of the ROM contains display information which must be read before the test and restored after the test. The test itself consists of writing walking 1's and 0's patterns to each RAM address and reading it back again. The walking 1's and 0's are visible on the CRT as a blinking pattern with characters moving to the bottom of the CRT. If the test fails, refer to the Mainframe Service Manual.

E. The I/O Tests are detailed in the following pages, and constitute
    the remainder of the Development Station (mainframe) Performance
    Verification procedures. To test emulation, emulation memory, or
    analysis boards, the disc must be operational such that
    "option_test" may be run. The procedure is mentioned in this
    manual under "Installation of Additional System Devices", but is
    covered in detail in the Performance Verification section of the
    given option board.

* Always 1
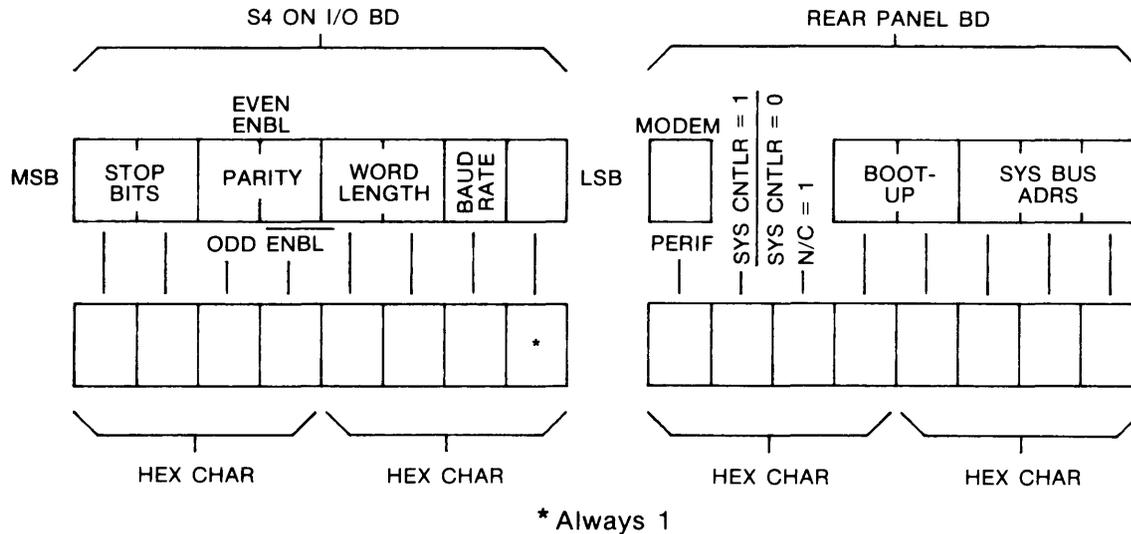
Figure 2-15. I/O Read Test Switch Interpretation

I/O functions are checked by the following I/O tests:

I/O WRITE   -   operates the beeper and other write functions.

I/O READ   -   reads the status of S4 on the I/O Board and the
                     rear panel board switches.

I/O Interrupt   -   checks processing of the line frequency
                     interrupt.

I/O Keyboard   -   operator input to verify functional operations
                     of all keys.

I/O System Bus -   verifies system bus circuitry.

I/O RS-232   -   verifies serial communications circuitry.

Tape Test   -   verifies operation of tape drive unit.

```
*****************************PERFORMANCE VERIFICATION*********************************
*                                                            # TESTS # FAIL *
* POM TEST:                                      # ROMS= 8        3        0   *
*                                                                              *
* RAM TEST:                                                       3        0   *
*                                                                              *
* I/0 WRITE TEST:                                                 1       N/A  *
*                                                                              *
*    READ TEST:        I 0 BD S4 = FF,  R. PANEL = 78           205     N A   *
*                                                                              *
*    TIME INTERRUPT TEST:                                         2        0   *
*                                                                              *
*    KYBD TEST:                                                   0        0   *
*                                                                              *
*    SYS BUS TEST:                                                2        0   *
*                                                                              *
*    RS232 TEST:                                                  2        0   *
*                                                                              *
* TAPE SYSTEM TEST                                                2        0   *
*  WIND  REW0  WRT0  REW1  WRT1  REW0  RED0  RED0  REW1  FIND  RED1           *
*                                                                              *
*                                                                              *
*                                                                              *
*********************************************************************************
 NEXT TEST               CYCLE    DISPLAY  END TESTS
```
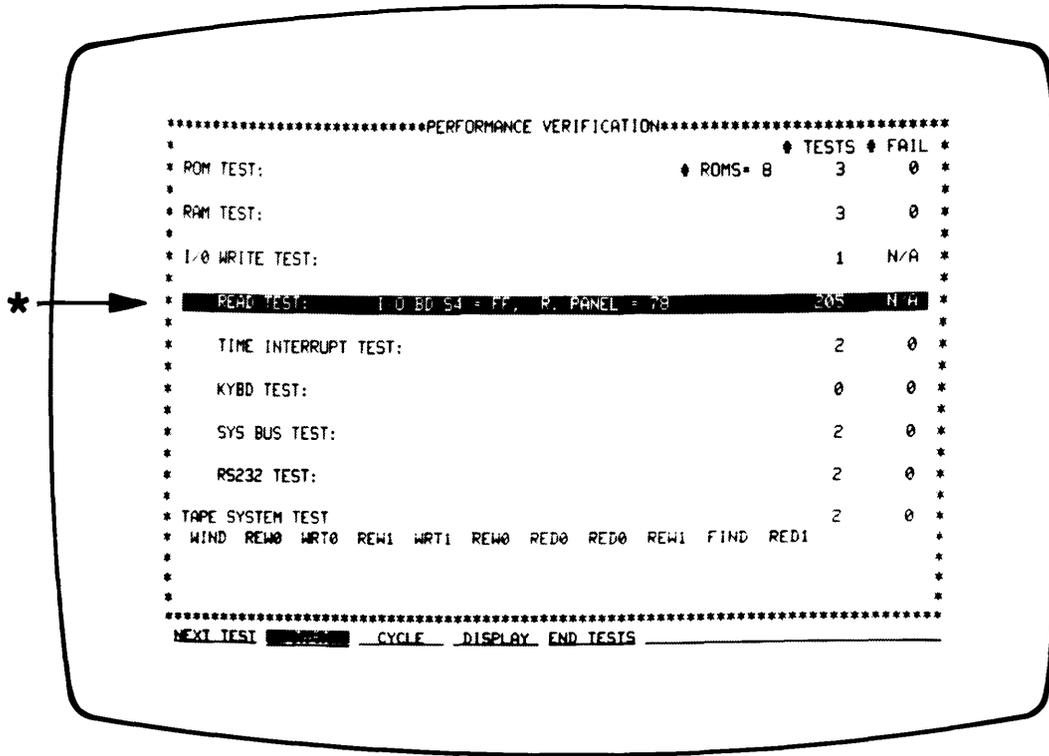
Figure 2-16. I/O Read Test

F. Purpose: The I/O Write test will sound the beeper once for each
    occurrence of the test. The I/O Read test produces two hex
    displays of the switch settings, one for S4 on the I/O Controller
    board, and another display for all of the settings on the I/O Rear
    Panel board. These may be interpreted by the indications on the
    above figure. The remaining tests indicate failure, if any.
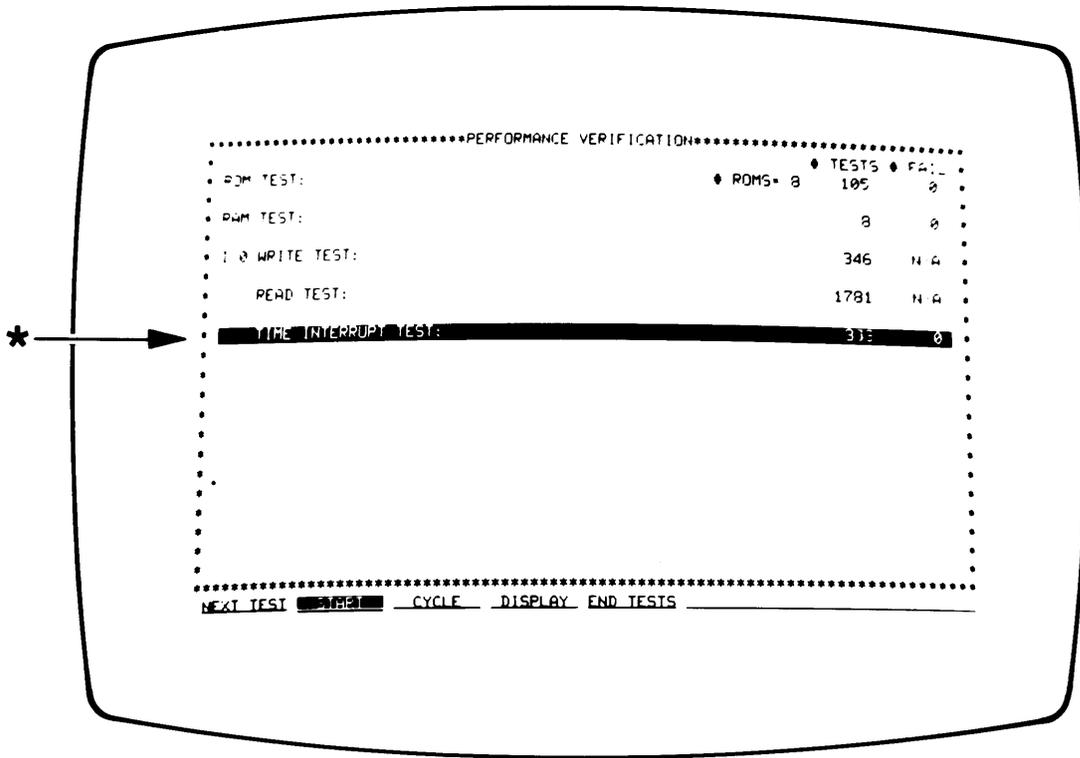
Figure 2-17. I/O Time Interrupt Test

G. Purpose: The power line sync signal is used to interrupt the CPU
    so that it can keep track of time. This test verifies that an
    internal signal causes this interrupt at a rate of 48 to 62 Hz and
    that the CPU can correctly read and respond to this interrupt.
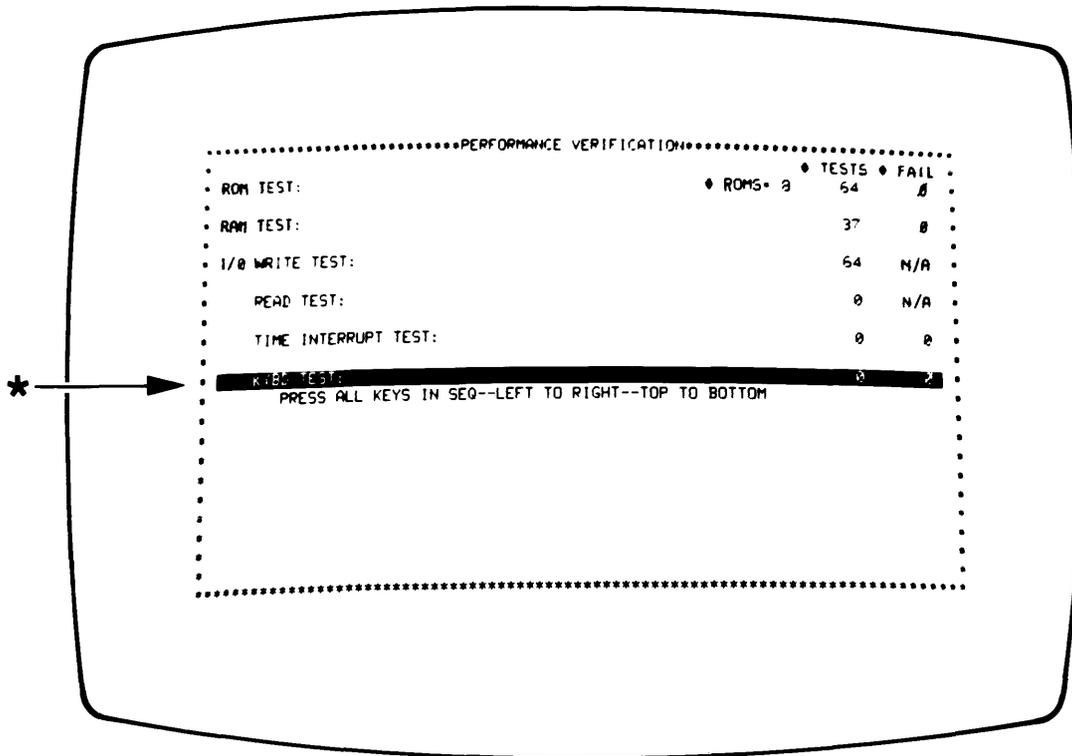
Figure 2-18. I/O Keyboard Test

H.   Purpose: Verifies the functional operation of all front panel
     keys. Press `next test until kybrd test is in inverse video.
     Press the key in the sequence shown in figure 2-19, on the
     following page. If a key is pressed out of sequence or if two
     keys are pressed at the same time, a "kybrd failed" message will
     be displayed on the CRT. If the keys are pressed in sequence and
     all passed, a " " message will be displayed on the CRT. If a true
     keyboard failure is encountered, refer to the Mainframe Service
     Manual.

Start Here

End
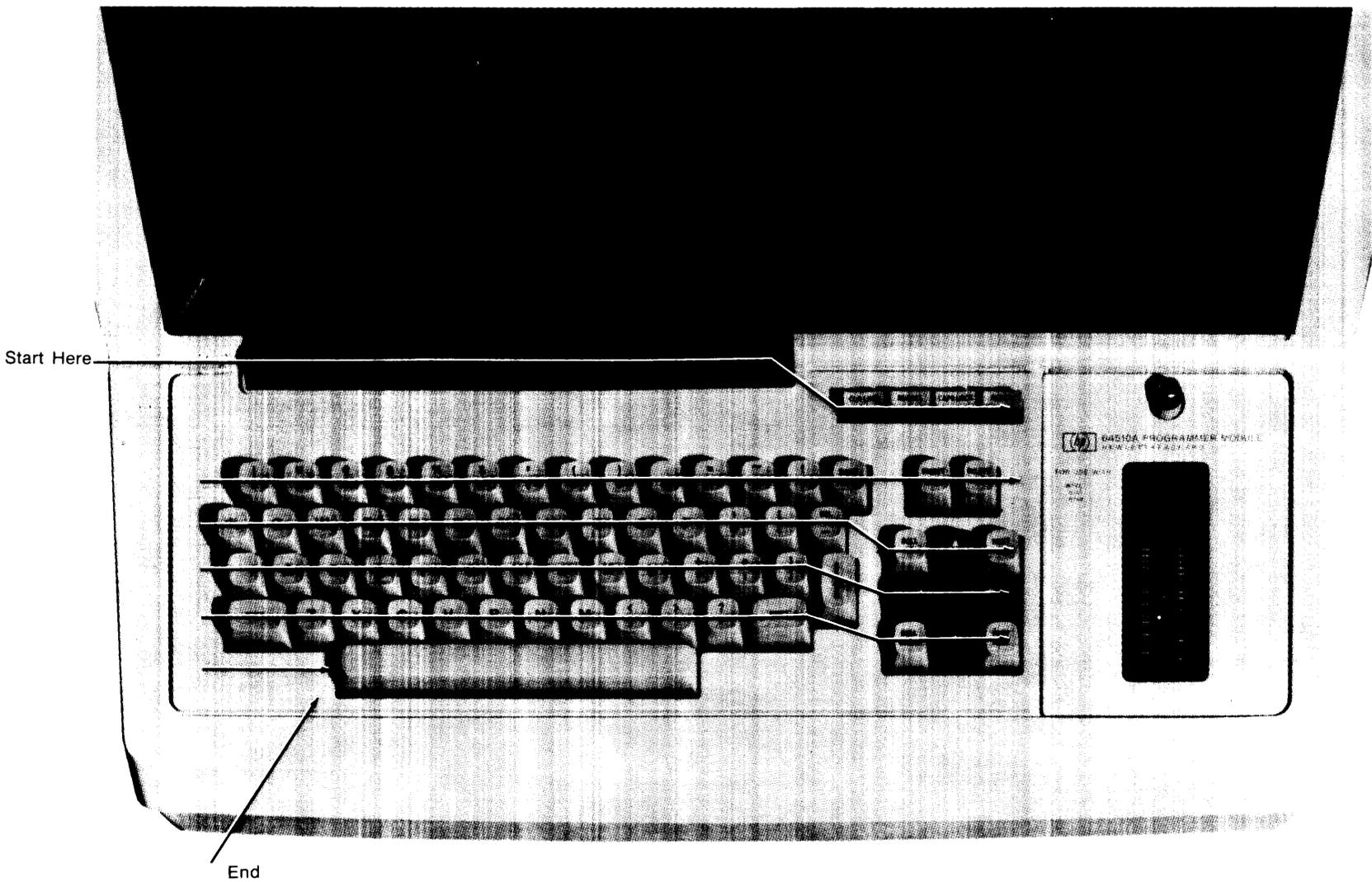
Figure 2-19. Keyboard Test Sequence
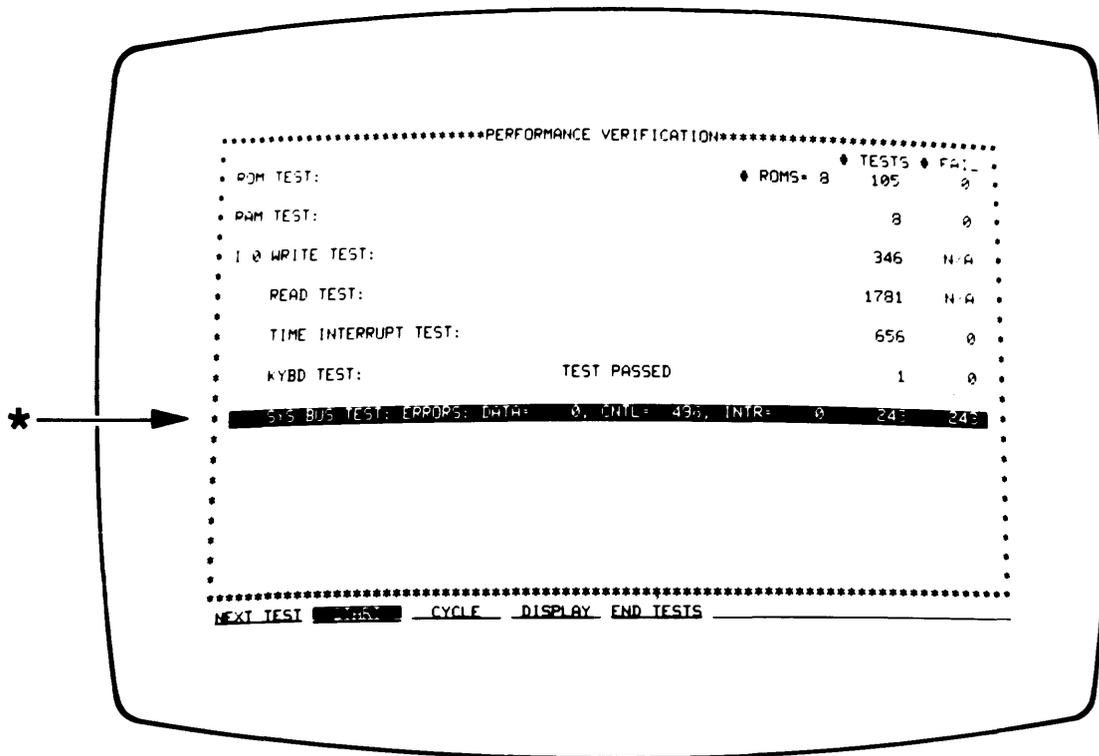
Figure 2-20. I/O System Bus Test

NOTE
_____

Check position of S5.   Bit 1 should be in the 0
position.
_____

I.   Purpose: Verify operation of the development station system bus
     circuitry.   If a failure occurs, refer to the Mainframe Service
     Manual.
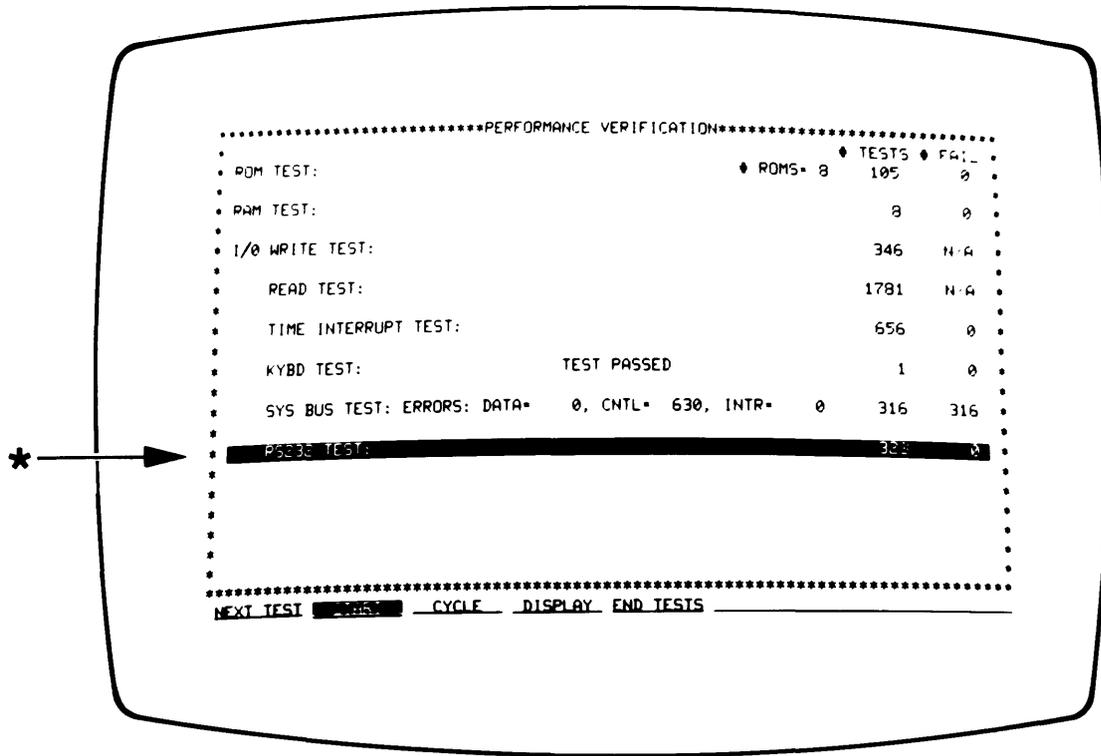
Figure 2-21. I/O RS-232 Test

NOTE
_____

Bit 1 of S5 must be 0 or the RS-232 test will fail.
These failures are identified as CNTL failures.
_____

J. Purpose: Verifies operation of USART and associated I/O circuitry.
    If failure occurs, refer to the Mainframe Service Manual.
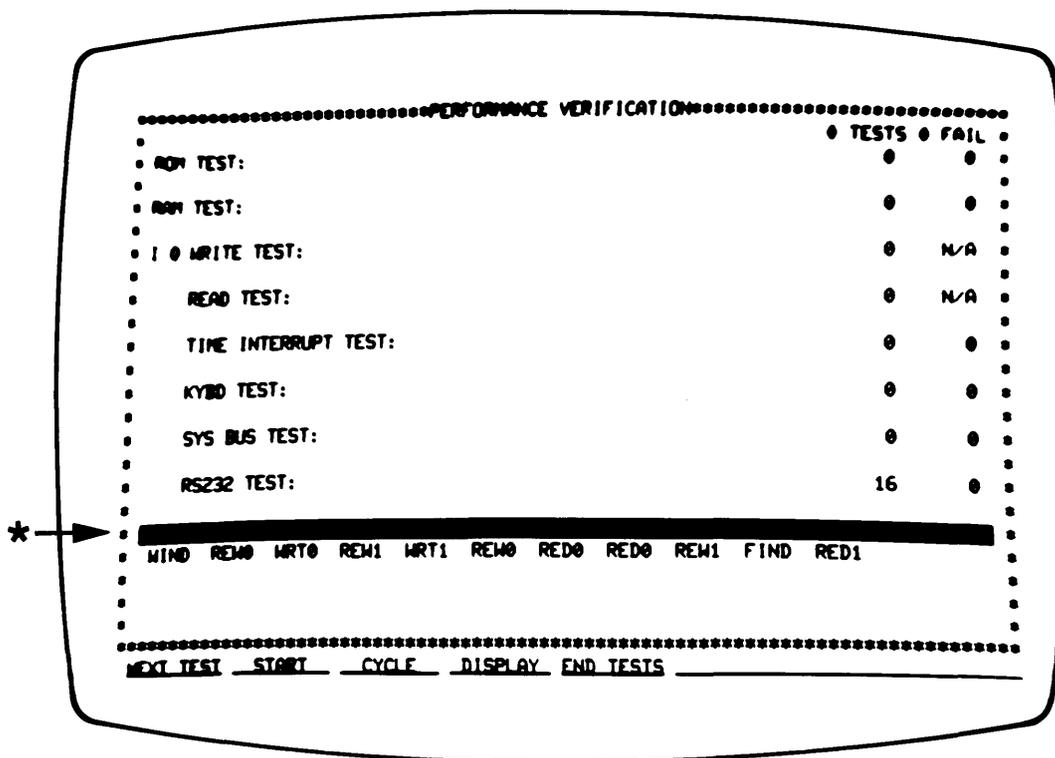
Figure 2-22. Tape System Test

NOTE
_____

Install new blank mini-cartridge at start of test.
_____

K. Purpose: Verifies operation of all tape functions. Install a
    blank mini-cartridge [not write protected] in the tape drive unit.
    The test will automatically step through the sequence. If a tape
    error occurs, see the Tape Controller Tab in the Mainframe Service
    Manual.

2-68. After the development station has passed the performance
verification, remove the card cage cover in order to view the rear
panel circuit board (see the card cage access figure). Set the
jumpers on the I/O Rear Panel circuit board for Master Controller
(inside card cage; see Rear Panel Circuit Board figure).
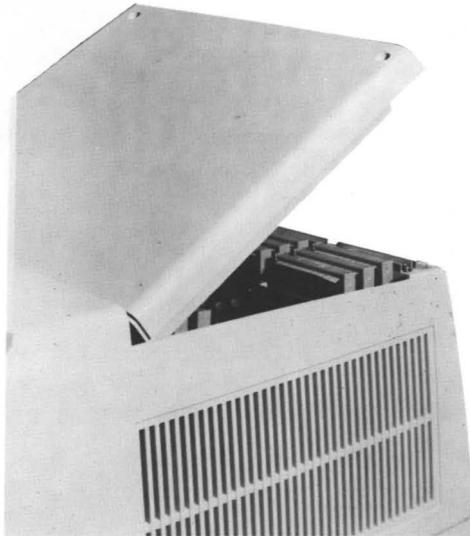
Figure 2-23. Card Cage Access

Master Controller
Positions
U3   U4

U11   U12
Non-Controller
Positions
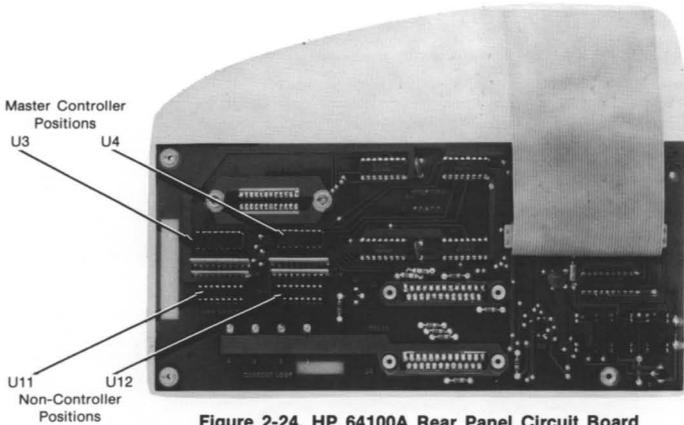
Figure 2-24. HP 64100A Rear Panel Circuit Board
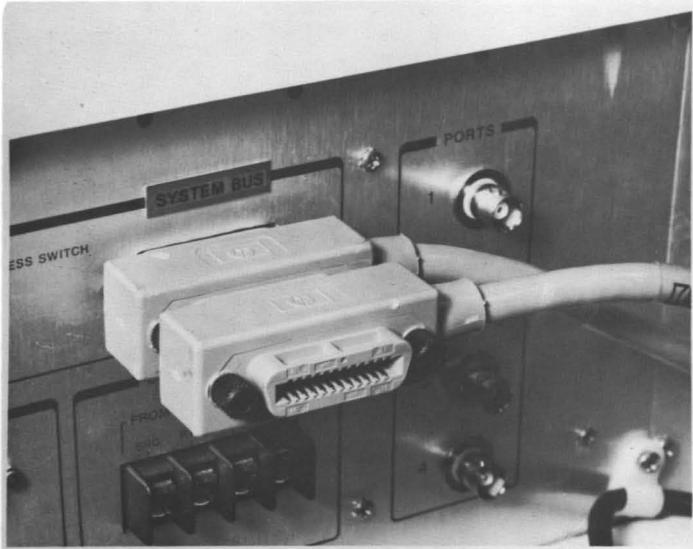
Figure 2-25. HP 64100A System Bus Connector

2-69. On the outside of the station, at the rear, set the System
Control Source to Local Mass Storage (to load a tape). Set the system
bus switch to "2". Connect the system bus cable between the disc and
this master controller development station. Turn the development
station power off.

2-70. Installation of System Memory

2-71. The installation of system memory is broken down into the two general catagories of discs used: (1) the 7910H is covered under the first topic heading, Winchester Disc Drives, and (2) the 7906, 7920 and 7925 are covered under the second topic heading, Multi-Access Controller Disc Drive Family (MAC discs).

2-72. Winchester Disc Drives - Model 7910H

2-73. The HP7910H (figure 2-X) is an HP-IB compatible, Winchester Technology disc drive. The formatted storage capability is 12M bytes. Should a Winchester drive mechanism prove defective and require transport, refer to the shipping instructions at the end of this section (II).
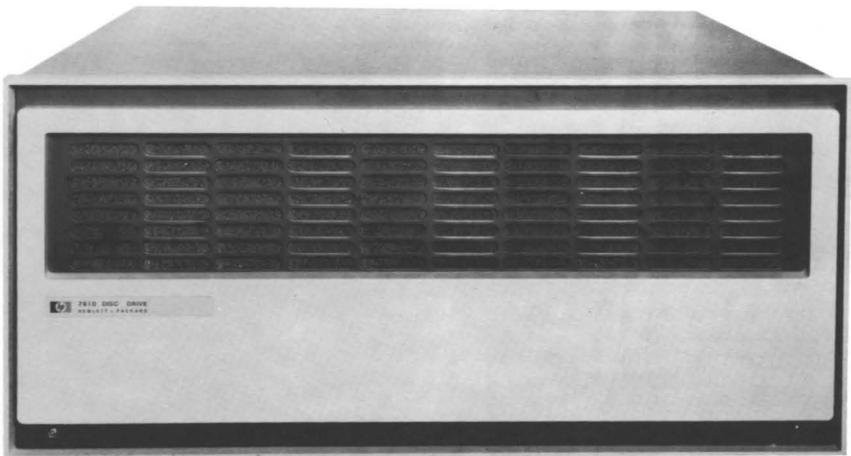
Figure 2-26. Model 7910H Disc Drive

2-74. Power Configuration

2-75. The following paragraphs cover the power configuration of the 7910H Disc Drive.

A. Set voltage select switch (on rear panel, figure 2-X) for proper voltage.

B. Verify that fuse rating is correct for selected voltage (indicated on rear panel).
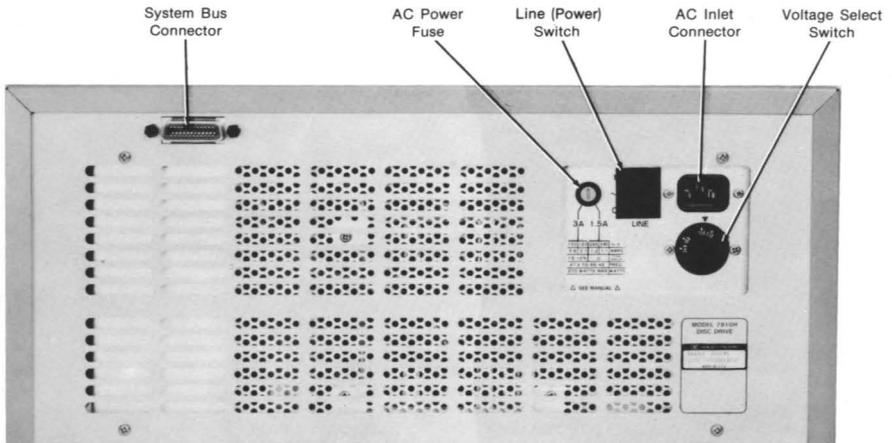
Figure 2-27. Model 7910H Rear Panel

2-76. Address Setting

2-77. Remove 7910 front panel by pulling out first at the bottom.
Then remove the PCA access cover by taking out the four screws (see
figure 2-28). Rotate the HP-IB Unit Address thumbwheel to 0 and
replace the PCA access cover.
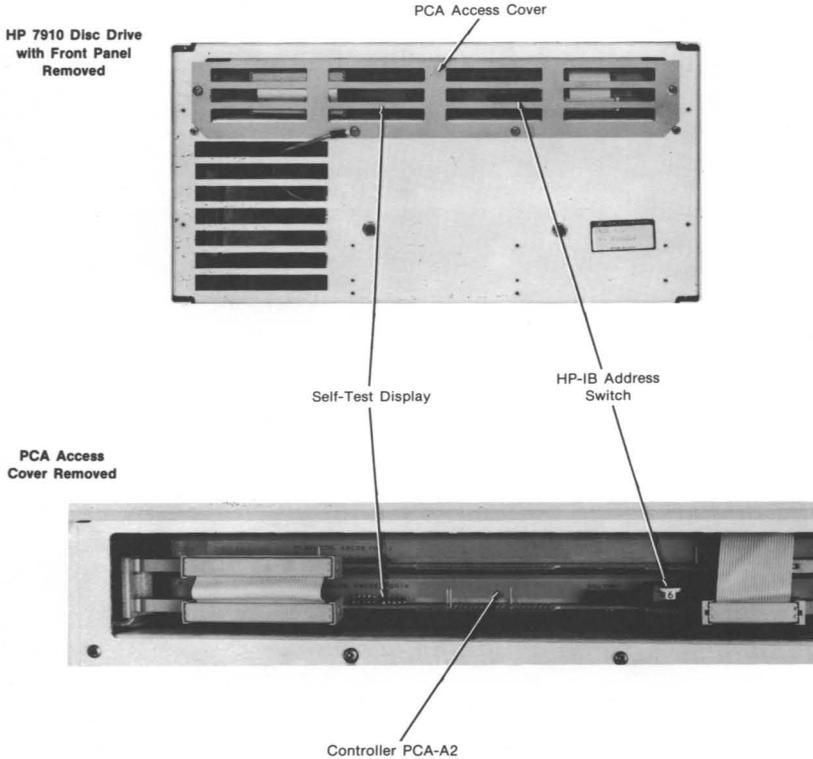
Figure 2-28. HP-IB Address Switch and Self-Test LED's

2-78. Self Test

2-79. Leaving the front panel off momentarily, set the rear-panel
power (LINE) switch to on. Allow approximately 30 to 60 seconds for
the disc to come up to operating speed and complete self test.

2-80. During self test, the 10 LED's located on the 7910 Controller
Board (the lower of the two boards visible from the front, see figure
2-28) will be flashing. When self test is complete, all of the LED's
on the controller board should be off except for the self test LED(*)
which should remain on until a disc access is performed. If LED's
indicate otherwise, refer to table 3-6 in the 7910 Service Manual.

2-81. Disc Initialization

2-82. Connect the system bus cable from the 7910 rear panel to the
master controller development station. Ensure that the development
station's rear panel "System Control Source" switches are set to
boot-up from LOCAL MASS STORAGE. Turn the development station on.

A. The development station CRT will display the message:

   BOOT IN PROGRESS   WAITING FOR CARTRIDGE

Figure 2-29. System Tape Installation

Install the HP64800A system tape into the tape transport.
Press the cartridge in until it engages; it isn't necessary to
hold it in. The tape transport light will come on and the
transport will be heard moving. After several moments the
display will appear as shown in System Disc Utility figure.

```
                        SYSTEM DISC UTILITY

      WARNING:  All other stations should be powered off.
      If soft fix is run the printer (if any) should remain on.

      Options:

      format......Format the disc

      test........Test the disc

      fmt & tst...Format the disc and test.  Mark defective tracks

      soft fix....Fix file linkages

      hard fix....Read and write each disc sector  (Not available for 7910)


      STATUS: Awaiting selection _____ 0:01



       format   test   fmt & tst soft fix  hard fix _____ _____ __end__
```

Figure 2-30. System Disc Utility Display

Formatting causes the loss of all information stored in disc memory, so reformatting a disc in an existing Model 64000 System first requires backing up all user files on cassette tape. For a new system, the disc must be initialized so the soft key selection "fmt & tst" should be made.

   B. The development station CRT will display the message:

        TEST TIME IN MINUTES?

      The recommended test time is 30 minutes, in order to provide enough data samples for a valid statistical analysis. Press the "30 mins" soft key and "return".

C. As the testing and formatting phases of disc initialization may be performed independently of one another, the system allows the user to select them seperately. Initializing a new system requires both formatting and testing.

NOTE
_____

A flashing inverse video WARNING will be displayed. This warning states that FORMATTING causes the permanent loss of all information stored in disc memory. Existing user files should be backed up on cassette tape.
_____

The development station CRT will present the question:

Do You Want To Format?

The soft keys offer the choices:

Yes   No

i. If "Yes" is selected, the formatting begins. The first step is a loop back test where the development station writes data to a hardware buffer in disc controller, and reads it back, verifying the communication lines. In the event of an error the message displayed will be:

LOOP BACK TEST FAILED

If this message is received, refer to section IV for troubleshooting, although the formatting will continue. The number of defective tracks is reported on the CRT just above the status line. With the HP64000 formatting software, tracks marked "Defective" cannot be recovered. If the number of defective tracks increments steadily, press the "Abort" soft key. Cable installation should be checked, and the disc initialization restarted. Recurring defective tracks are cause for turning to troubleshooting procedures in section IV.

ii. If "No" is selected, the soft keys will offer the System Disc Utility menu again. Use "end" to exit.

```
MINUTES OF TESTING----    5
              LIMIT-    10

MEGABYTES VERIFIED--     26
        DISC ERRORS-     0

MEGABYTES OF I/O------    1
     TRANSMIT ERRORS-     0
      RECEIVE ERRORS-     0

TIMED SEEKS---------    166
         SEEK ERRORS-     0




    1 DEFECTIVE TRACKS


STATUS: TESTING _____  0:17
        7910 DISC DRIVE AT ADDRESS 0 UNIT 0      PREVIOUSLY FORMATTED



  end test   abort   new limit ____  ____  ____  ____  ____  ____
```
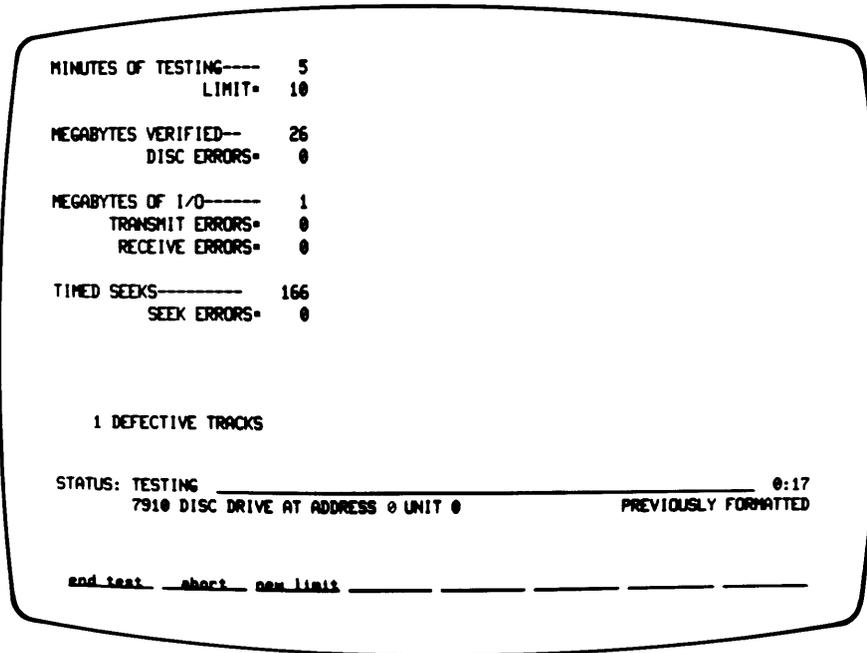
Figure 2-31. Disc Verification Display

2-83. At this point the testing begins, unless "No Test" had been selected.   As   the   disc   verification display figure indicates, the display will show the minutes of testing, megabytes verified, disc errors (if any), megabytes of I/O, transmit or receive errors, the number of timed seeks, and seek errors (if any). Upon completion of testing, the system writes a file directory and builds a free list of available pages for file storage.   The number of Disc errors, transmit/receive errors, and seek errors should all be 0. If errors were detected refer to the troubleshooting procedures in section IV.

2-84. Theory of the disc initialization procedures is also covered in section IV.   Included are flowcharts detailing the exact sequence of events for formatting, and testing. Guidelines for interpretting disc errors, I/O transmit and receive errors, and seek errors   are presented, to aid in establishing whether a problem exists in the development station I/O Rear Panel board, within the system bus cable and HP-IB interface, or within the disc itself. It is always a good idea to reseat circuit boards and cables prior to troubleshooting. After formatting, any tracks which tested as bad two or more times will be marked DEFECTIVE. Regardless of whether or not any tracks are found defective, the following messages will appear in sequence on the status lines:
                    Writing Directory
                    Building Free List

2-85. After the free list is built, the disc is completely initialized. The soft keys will offer the System Disc Utility menu (without the instructions). Press "end" to exit the Disc Utility module. The operating system files residing on the 64800A tape will then be loaded onto the disc, and the CRT will display the message "BOOT IN PROGRESS".

2-86. After all files on the 64800 tape cartridge are loaded, the CRT will display "System Software Load is Complete." At that time, insert any additional software tapes to be stored on the disc.

```
I/O BUS CONFIGURATION

ADRS   DEVICE
  0    7910 DISC MEMORY              LU=0
  4    64100
  5    64100
  7    THIS 64100, MASTER CONTROLLER




STATUS: Awaiting command        userid  _____ 0:26

  _

    edit    compile assemble   link    emulate prom_prog (CMDFILE) ===ETC===
```
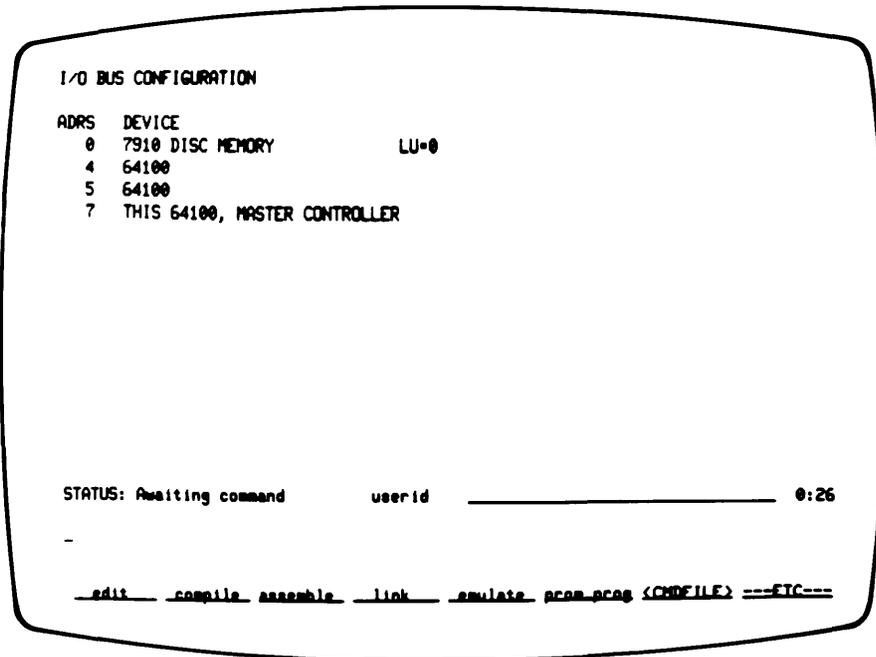
Figure 2-32. System Boot-Up Display

2-87. When all software is loaded, set the development station SYSTEM CONTROL SOURCE switches to SYSTEM BUS. The CRT display should be as shown in the System Boot-Up Display. At this point use of the editor may be made, option_test may be performed on emulation memory, emulation or analysis boards, or additional system devices may be installed and verified.

2-88. Multi-Access-Controller (MAC) Disc Drive Family

2-89. The central component that the MAC discs have in common is the
13037 disc controller.   The unit, housed in the bottom of the disc
cabinet, is responsible for transfer of data to and from the discs.
For the HP64000 System, the top card in the controller must be a
12745A HP-IB Adapter, which interfaces to the system bus.   The disc
drives available, Models 7906M, 7920, and 7925, have data capacities
of 20, 50, and 120 M bytes of storage, respectively.
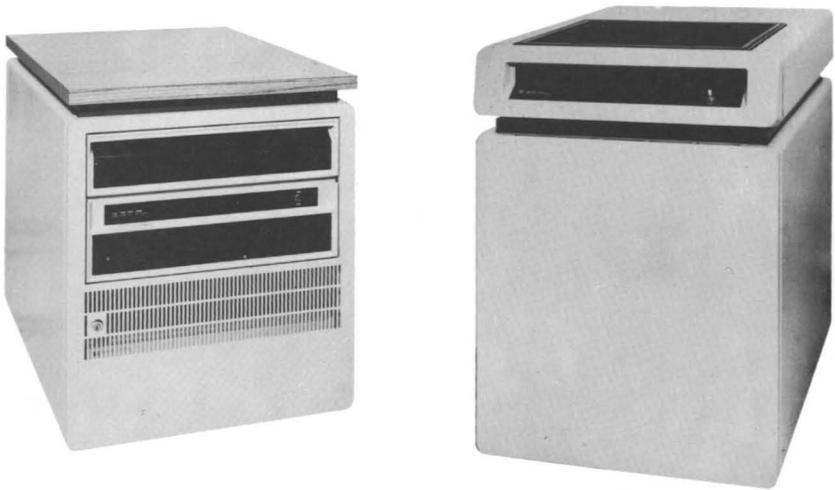
Figure 2-33. Models 7906M and 7925 MAC Discs

(The 7920 is similar in appearance to the Model 7925)

2-90. Power Configuration

2-91. The MAC disc, when ordered as a 64001S option will arrive
cabinetized. The 13037C Disc Controller will be mounted at the bottom
of the cabinet, with the 12745A HP-IB Adapter Card installed inside
the controller in the top slot. The disc drive mechanism will be
mounted at the top of the cabinet. The cabinet contains a power
receptacle unit, into which the power cords from the drive and
controller plug. From here, the power for the entire unit may be
switched. Note also, that the 13037 Controller has its own power
switch, which should generally be left on. The disc components may be
configured for 100, 110, 220, or 240 Volt operation. For the cabinet,
this means differences in fuses, power cords, and power receptacles.
For the controller and drive it also includes strapping of the power
transformers. Refer to the appropriate installation manuals listed in
table 1-2, for detailed instructions.

   A. Check that the power cord from the controller is connected to
      the cabinet power receptacle, as shown is the 13037 Disc
      Controller Rear Panel figure. The controller power switch
      should be turned on (1).

   B. Check that the power cord from the disc drive is plugged into
      the cabinet power receptacle. See the Model 7906 Rear Panel
      figure, or the Model 7920 Rear Panel figure for the locations
      of the AC inlet connector (the 7925 rear panel is the same as
      the 7920).

   C. The 29425 Cabinet Rear Panel figure shows the AC "LINE"
      connector, and power switch for the disc console. Leave the
      power cord disconnected while the following internal address
      settings and cable configurations are performed.

Figure 2-34. 13037 Disc Controller Rear Panel
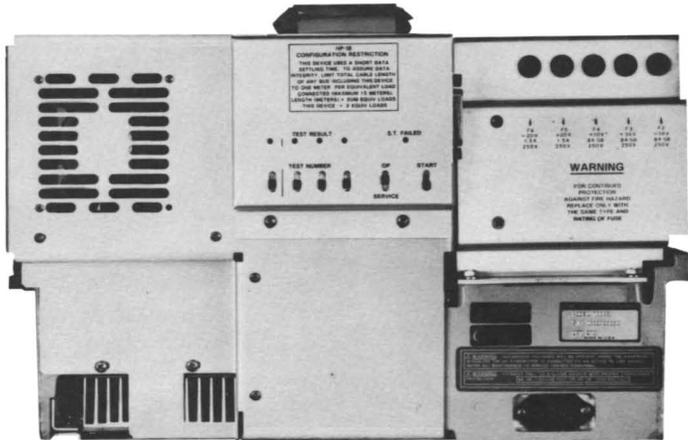
Figure 2-35. Model 7906M Rear Panel
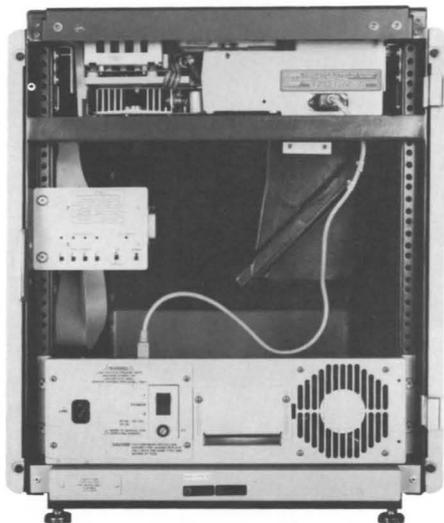
Figure 2-36. Model 7920 Rear Panel
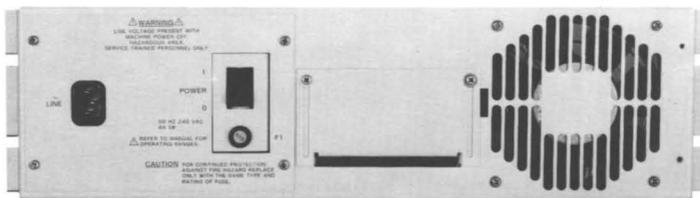
Figure 2-37. 29425 Cabinet Rear Panel

2-92. MAC Disc Block Diagram Description

2-93. In the Multi-Access-Controller (MAC) Disc Drive Family, one 13037C Disc Controller can operate up to 8 disc drives (which are differentiated by a switch setting of Unit Select # 0 through 7). The 13037C hardware is also capable of access by up to 8 different CPU's, but constraints of the operating system software for the HP64000 System allow only one CPU (at CPU # 0). The HP-IB based System Bus of the HP64000 futher requires that the 13037 controller be interfaced by a 12745A HP-IB Adapter Card. This unit plugs right into the top slot of the 13037 controller (the second slot is left empty in order to promote adequate air flow. Disc controllers are extremely temperative-sensitive). In the HP64000 System, at HP-IB Address 0 must be located a disc memory, onto which the operating system software will be loaded. At system power-up the operating system software automatically assigns Logic Unit Numbers (not a switch setting), starting with the lowest Unit Select Number at HP-IB Address 0. It is this L.U. # 0 upon which the system files are stored. Additional disc memories may be located at unused HP-IB Address 2 through 7.

2-94. The HP-IB Adapter Card interfaces the HP64000 Logic Development System to the 13037C Disc Controller. Two thumbwheel switches, HP-IB Address, and CPU #, are located on this board. The Device Controller card provides the data transfer between the disc controller, and the disc drive unit. It is this board to which the multiunit cable and data cables must attach. The Error Correct card contains the logic necessary to generate and decode the error correct code which is used to determine if the same data that was written to a disc is also that which is read back. The Microprocessor board provides the polling, and timing coordination of the other boards.
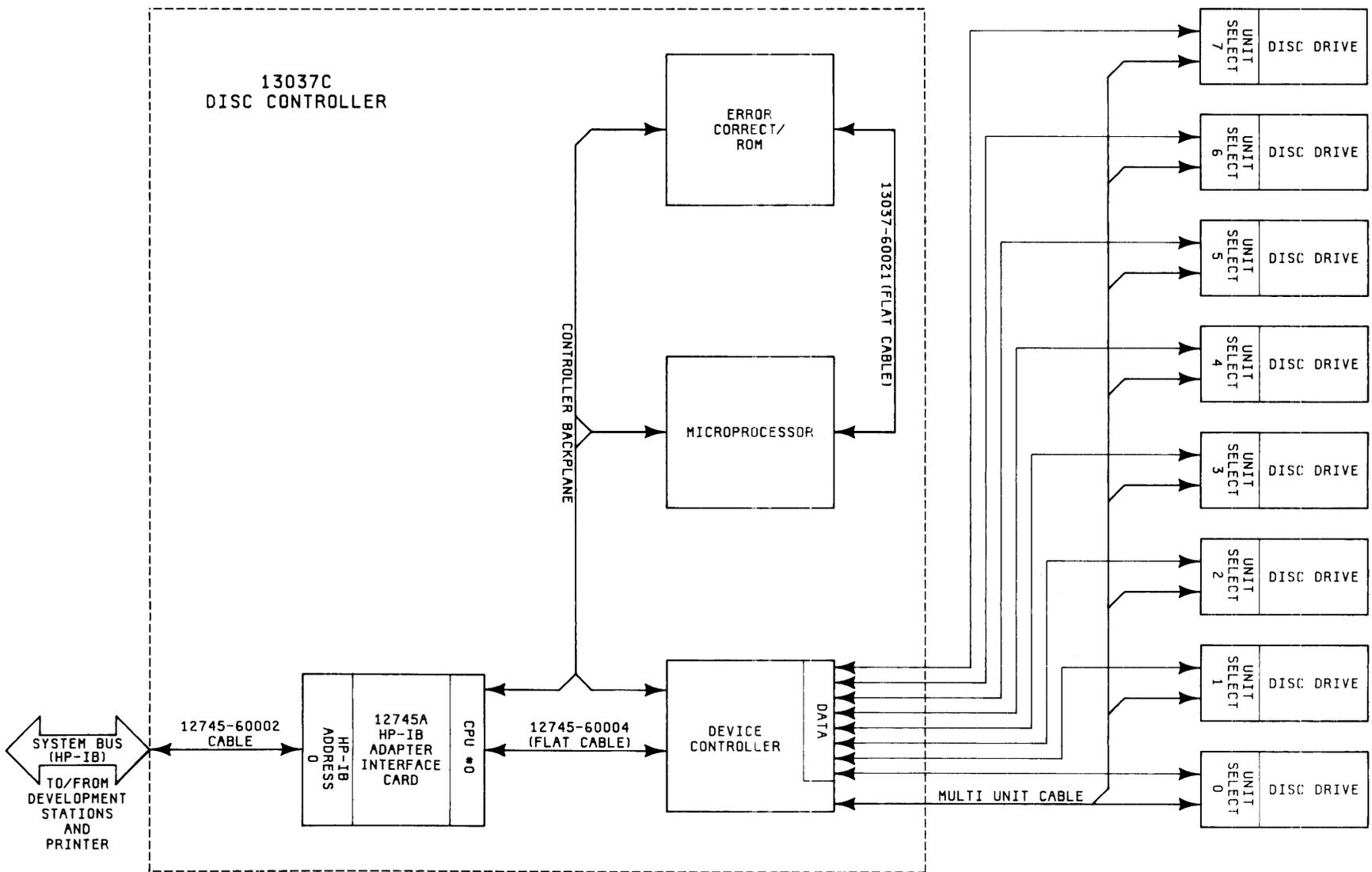
Figure 2-38. MAC Disc Block Diagram
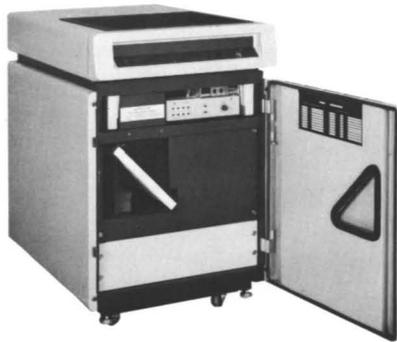
Figure 2-39. 13037 Disc Controller Front Panel, Cabinet Mounted

2-95. Address Setting and Cable Configuration

2-96. Open the disc cabinet front door, and locate the 13037 front panel as shown in the above figure. Remove the four screws and take the 13037 front panel off.

2-97. Check that the 12745A HP-IB Adapter Card is in the top slot of the controller card cage as shown in the 12745 and 13037 Cable Configuration figure. The following page shows the location of the CPU # and HP-IB Address switches on the 12745 HP-IB Adapter Card. Set the left thumbwheel switch to CPU # 0. Set the right thumbwheel switch to HP-IB address 0. The 12745-60002 cable should be connected at the right of the card, and go to the HP-IB connector at the rear of the cabinet. The 12745-60004 flat cable should connect to the Device Controller card, in the third slot, and be at the left side of these boards. The Device Controller card should also have the Disc Data Cable (Cables), and the Multiunit Cable connected. The other end of these cables should be connected to the disc drive. The next slot down should house the Error Correct card, with the Microprocessor card in the bottom slot. These two boards should be connected in the center with the 13037-60021 flat cable.
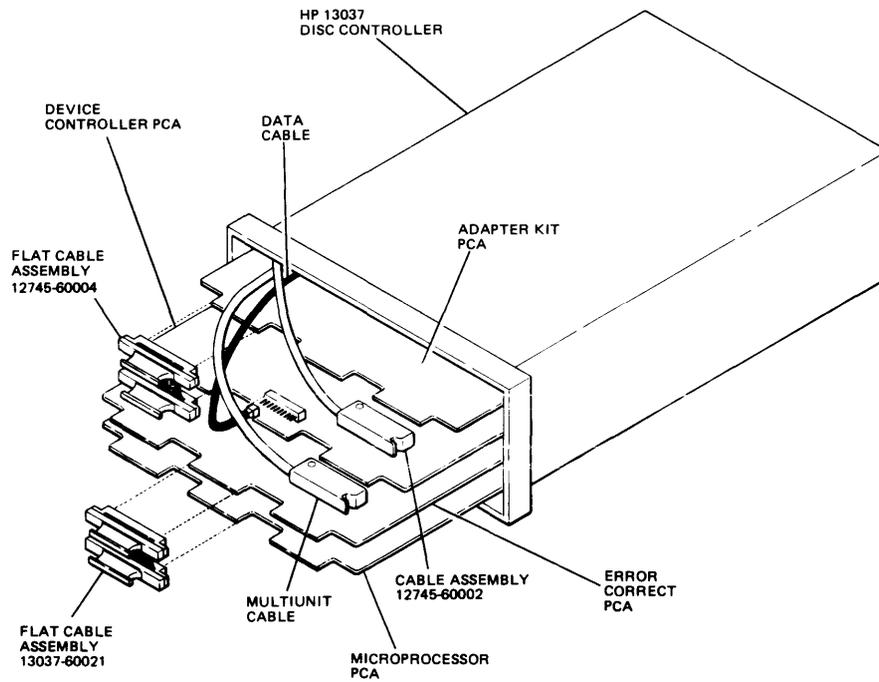
NOTE: THE CABLING CONFIGURATION SHOWN ABOVE IS FOR A SINGLE-CPU SYSTEM.

Figure 2-40. 12745 and 13037 Cable Configurations
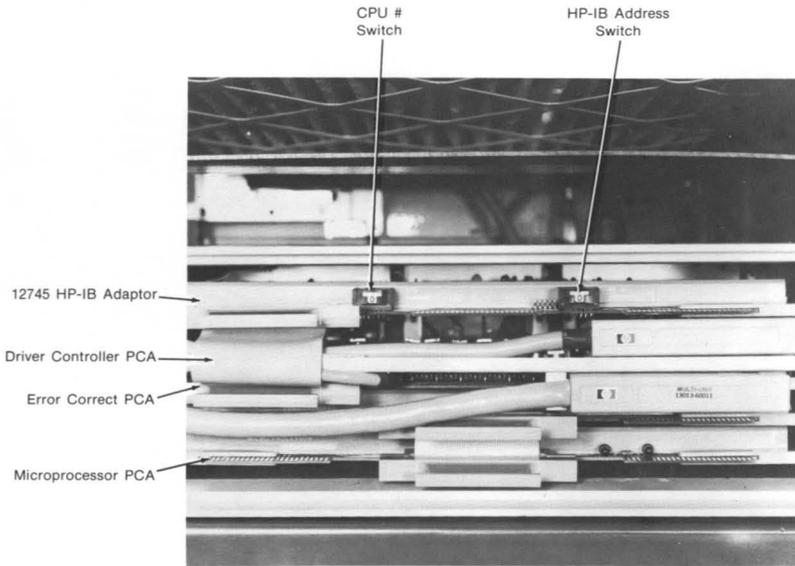
Figure 2-41. HP-IB Adapter Card CPU # and HP-IB Address Switches

2-98. For Models 7920 and 7925, with the disc cabinet front door still
open, locate the Unit Select rotary switch as shown in the 7925
Control Panel figure on the following page. Set the Unit Select # to
0. As shown in the 7906 Control Panel figure, a separate cover (also
at the front) must be lowered to expose the control panel. Set the
Unit Select # to 0 (the slide switches should be in the down
position).
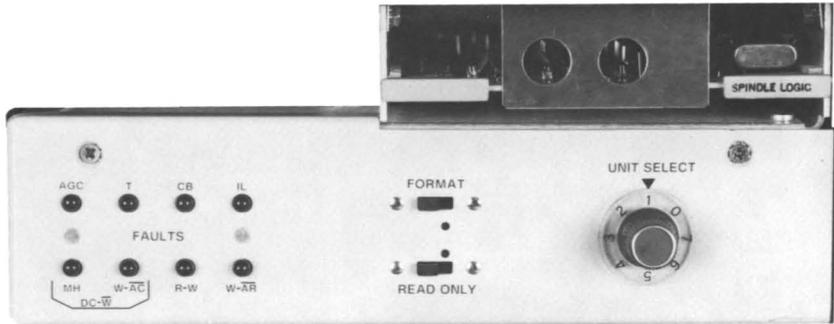
Figure 2-42. 7925 Control Panel
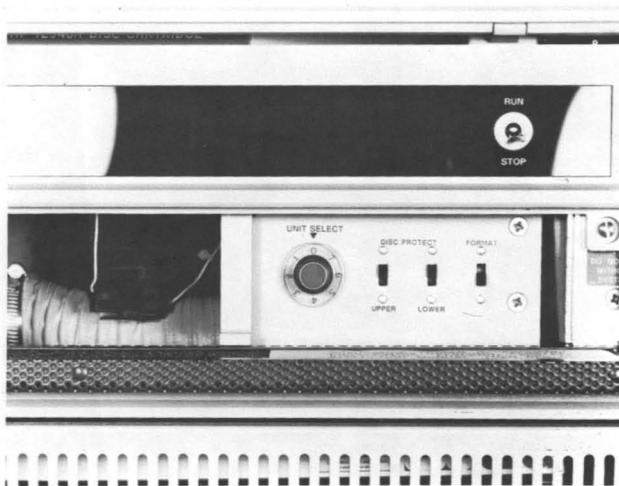
Figure 2-43. 7906 Control Panel

Figure 2-44. 7925 Operator Panel

2-99. As shown on the 7925 Operator Panel, the RUN/STOP switch is located to the right. Set this switch to "RUN". The disc pack drops in the top of the unit. The 7920 is similar. At this point, the power cord may be connected to the cabinet rear panel, and the cabinet power switch turned on (1). The "DRIVE READY" light should come on.
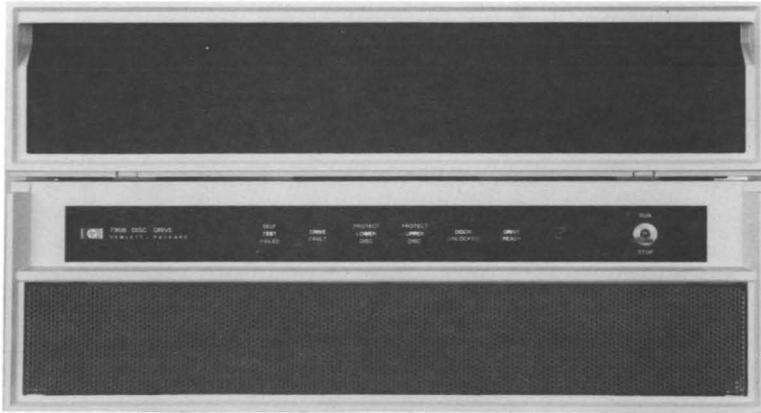
Figure 2-45. 7906 Operator Panel

2-100. For the Model 7906, the RUN/STOP switch is shown in the 7906 Operator Panel figure. Set this switch to "RUN". Pull open the drawer at the top of the drive, as shown in the 7906 Disc Platter Access figure. Insert a disc, and close the door. Connect the power cord to the cabinet rear panel, and turn the power switch on (1). The "DRIVE READY" light should come on.
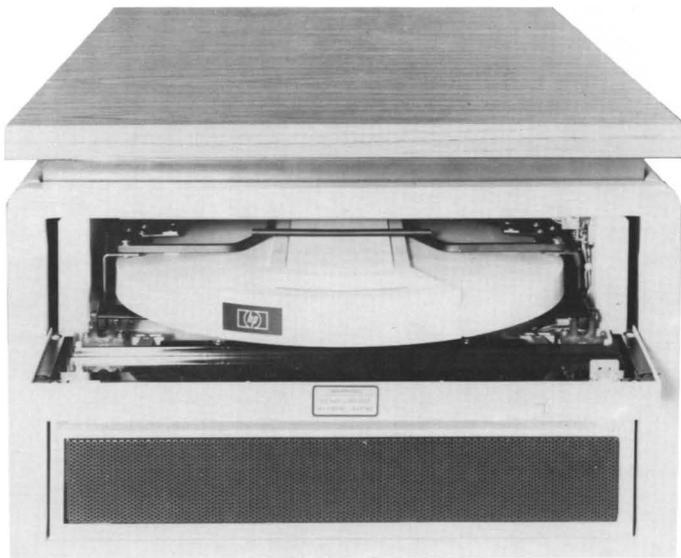
Figure 2-46. 7906 Disc Platter Access

2-101. Disc Initialization

2-102. The disc initialization procedures for the MAC Family Discs are
the same as for the Winchester Drive Disc, with the following
exception:

    Exception - For the 7906 Disc Drive with a removable upper disc,
    the following message will appear on the command line during the
    System Disc Utility Display:
      The 7906 Disc Memory has a removable (upper) disc and a
      nonremovable (lower) disc. They can be treated as a single
      logical unit (LU), or alternatively each disc can be treated
      and used as two separate LU's.
        WHICH PART DO YOU WANT OPERATIONS ON NOW?
      Select one of the soft key choices: "entire/lower/upper".

Refer to the Winchester Drive Disc Initialization procedures in
paragraph 2-81 for formatting and/or testing of the disc, and to load
system files.

2-103. Additional System Devices Hookup

2-104. Option Test Performance Verification

2-105. Option test provides performance verification and software-based troubleshooting assistance for the Emulation, Analysis, and Emulation Memory option boards. As option test consists of disc-based files, a basic system containing a Master Controller Development Station and a Logic Unit 0 Disc must be operational (installed and verified) before option test can be used.

2-106. System Printer

2-107. The HP64000 Logic Development System is designed to utilize a Model 2631 or a Model 2608 printer. These printers offer high resolution print quality, and are HP-IB compatible. Use of the cartridge ribbons by both printer models enhances user convenience.

Figure 2-47. Model 2608 Line Printer and Model 2631 Printer

2-108. If the 64000 System includes a 2631 (or 2608) printer, it may be connected to the system according to the following procedure:

A. Printer Self Test - With the system bus cable disconnected attach the power cord to the printer. The Self Test button shown on the printer control panel figure initiates a "GO/NO GO" routine which tests the printer to determine if it is in proper operating condition.

   i. Install paper in the printer.

   ii. Push the Self Test button.

   iii. Listen for audible tones to sound and observe that the head carriage moves from the left stop to the right stop and then back to the left stop. All characters are then printed.

   iv. If the Self Test fails, press the printer RESET button and try the test a second time. If it still fails refer to the printer service manual.
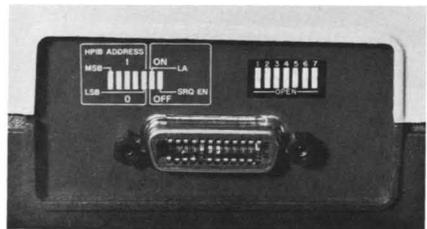
Figure 2-48. Printer Control Panel and System Bus Address Switch

B. Set the PRINT switch to
        NORM
        8LP1 or 6LP1

C. Set the address switch on the rear of the printer to 1.   SRQ
    and LA bits must always be set to 0.

D. Connect the printer to the disc with a system bus cable.

                              NOTE
    _____

    Do not connect the printer to the HP64100 Master
    Controller station. The Master Controller must
    always terminate the System Bus.
    _____

2-109. Additional Development Stations

2-110. Additional development stations can be added (in series) up to
a total of six.   With the first development station set as master
controller, all other stations must be set as slave controllers.

To add development stations, proceed as follows:

A. Set station to slave controller.

B. Run development station performance verification.

C. Set address switch to next appropriate address.

D. Connect system bus cable to next component.

                              NOTE
    _____

    The master controller station must be on one end of
    the entire bus system cable.
    _____

E. Turn slave controller power on.

F. Press SHIFT RESET on the master controller to   recognize   the
    newly   added   station.   The display should show the I/O
    configuration with the new station recognized. If a "DEVICE NOT
    RECOGNIZED" message is given for the particular address, redo
    the performance verification.   If the problem still exists,
    refer to the Development Station Mainframe manual.

G. Once all development stations are on line, the entire system is
    operational.
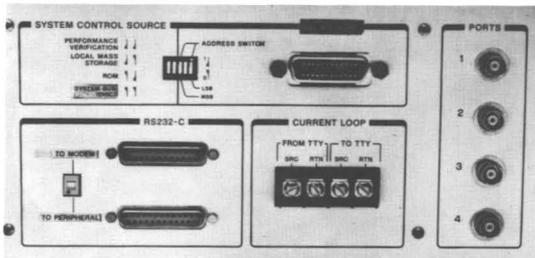
Figure 2-49. RS-232-C Connectors

2-111. RS-232-C Serial Communications Port

2-112. The HP64100A Logic Development Stations are all equipped with
serial   communications   ports   following   the   RS-232-C specifications.
The location of the connectors on the development station rear panel
is   indicated in the RS-232-C Connectors figure.   Detailed information
regarding the use of the ports is   covered   in   both   the   development
station Mainframe Service Manual, under the I/O tab, and in the System
Overview Operator's Manual, in Chapter 2.   The RS-232-C   Schematic   is
shown here to identify the signal names with their pin assignments.
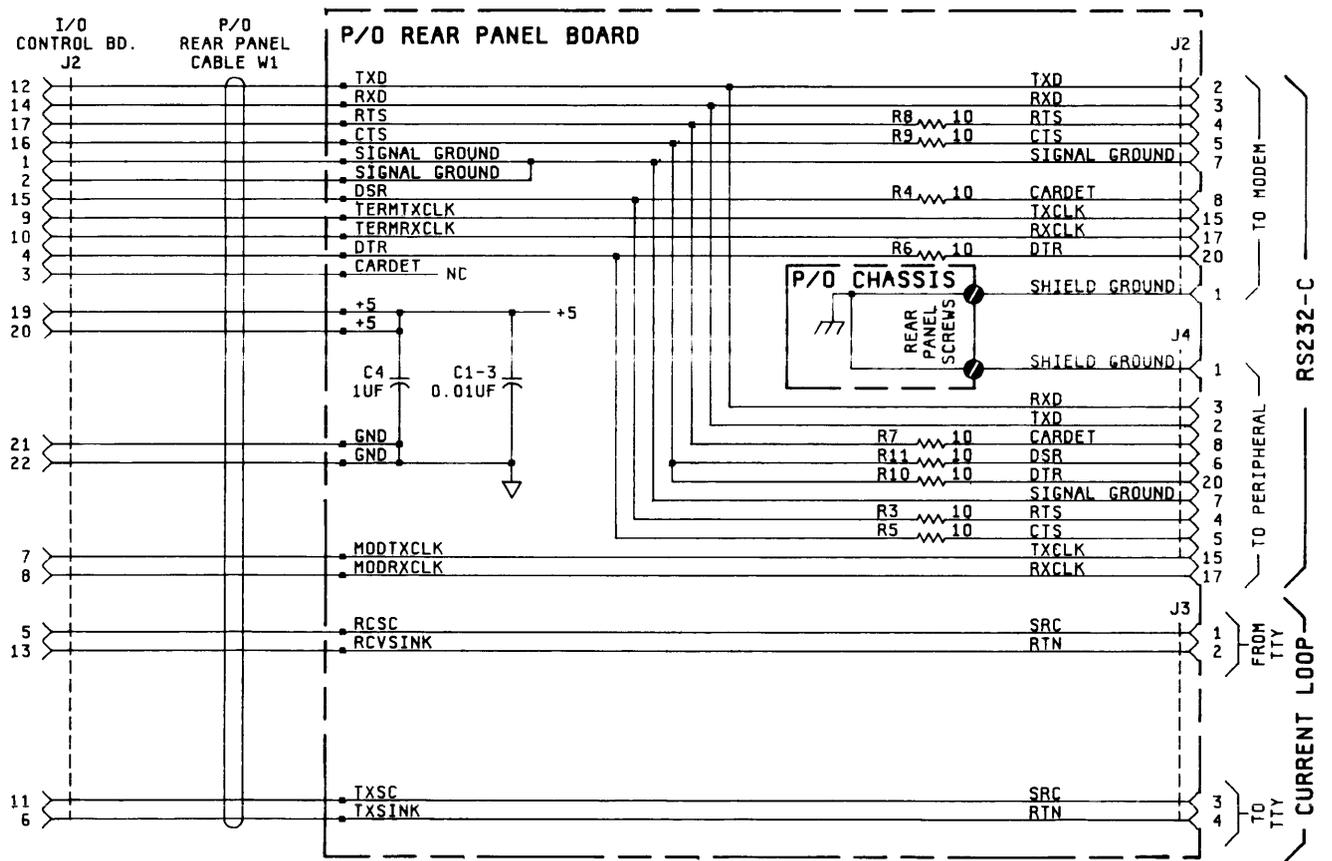
Figure 2-50. RS-232-C Schematic

2-113. Ordering and Shipping

2-114. Carrier Selection

2-115. The Model 64000 is sold F.O.B. Origin, so you can choose the
type of carrier for hauling and delivery. There are three different
methods for shipping Model 64000 components. They are 1) electronic
padded van, 2) air consolidation program (ACP), and 3) common carrier
(truck). Any of the methods are available within Continental U.S.A.
and Canada. All international shipments use ACP. For all shipments, HP
selects the carrier company for your specific choice of conveyance.

There are three methods of shipping from which to choose:

	Advantages	Disadvantages
1. Electronic Padded Van	Carrier will place the system on site at the exact spot designated by the customer. No crate required. Least susceptible to shipping damage. Short shipping time.	Cost slightly higher than Air Consolidation Program
2. Air Consolidation Program (used for all International shipments)	Fastest shipping method	System is delivered to customer dock but not the actual installation site. Customer must uncrate the system.
3. Common Carrier	Lowest cost to customer	Longer shipping time than other methods. Most susceptible to shipping damage. System is delivered to customer dock but not the actual installation site.

2-116. Notification

2-117. After you have placed an order for a Model 64000, the following events will take place:

    a. Within two weeks you will receive an acknowledgement of the order and this Site Selection and Installation manual (HP part no. 64980-90902). Also included will be the address and phone number of the local HP Customer Engineering (CE) office.

    b. At the same time, the local CE office will be notified of your order.

    c. You will be sent a notification when the Model 64000 will be shipped and a re-identification listing of the system configuration ordered.

    d. At the same time, the local CE office will be notified of the shipment date.

    e. The shipping company will contact you about actual time of delivery.

2-118. Arrival of Coordinated Shipments

2-119. All Model 64000 components will be delivered on a drop-ship basis. The normal time span for delivery of all system components is a maximum of two weeks.

2-120. If you do not receive a complete shipment of your purchase order within two weeks of the first delivery, you should notify the CE so that proper action can be taken for completing delivery.

Receiving the Model 64000

NOTE

Hewlett-Packard Personnel are not authorized to accept or sign for deliveries of Hewlett-Packard equipment for the customer. Accepting deliveries is the responsibility of the customer.

2-121. You have the responsibility to place the system on site, unpack, and dispose of any packing material.

2-122. Inspecting the Shipment

2-123. The main components (Model 64100A Development Stations, Model 7906M Disc, and Model 2631A Printer) of the Model 64000 Logic Development System arrive in different cartons from different Hewlett-Packard divisions.

NOTE

The Models 7906, 7920 and 7925 Disc require unique installation procedures that must be performed by an HP Service Representative.

2-124. Before unpacking the system, it is extremely important for you to verify the packing list for any discrepancies, and visually inspect the shipment for damage.

2-125. Verify the Packing List: Only one packing list is attached to each shipment, in an envelope on the outside of one of the cartons or boxes. If there are missing items when checked against the packing list, you must notify the carrier immediately for determination of those items.

2-126. Inspecting for Shipping Damage: Before unpacking the system, you should visually inspect all shipping crates and boxes for damage.

2-127. If any exterior damage or staining is found, you must have both the carrier's representative and the local HP Customer Engineer present when an item is to be unpacked.

2-128. If there is cosmetic damage to the Model 64000 component case as a result of mishandling during shipment (damaged crates, stains, etc.), the carrier is liable for repair and/or replacement of any parts. The HP CE should also immediately open all cabinets and make a visual inspection of all internal parts. If there is internal damage, the carrier is also liable for repair and/or replacement of those parts. The HP Customer Engineer should take immediate action to replace any damaged parts without waiting for the settlement of claims.

2-129. Internal Damage (No Damage to Shipping Containers): Internal Damage (within a cabinet) may be discovered after the shipment has been unpacked. On the premise that there was no damage to the shipping container, HP is liable for repair and/or replacement of any parts. You must notify the local HP CE so that the part can be replaced immediately under warranty.

```
CAUTION
```

The Model 64100A weighs 34.02 Kg (75 lbs), the Model 7906M weighs 54 Kg (340 lbs), and the Model 2631A (with stand) weighs 47 Kg (104 lbs). Two persons are required to lift the units from the shipping containers.

2-130. Unpacking the Model 64000 Components

2-131. When unpacking the units, retain all packing materials and hardware for future use. Remove the units from the shipping carton and the packing material.

2-132. After unpacking all the units, check all shipping documents and the identification tags on the back of the units to ensure that they conform to the purchase specification.

2-133. If for any reason, it becomes necessary to reship one of the units, repack it in the original packing material and shipping carton.

NOTE

The stand for the model 2631A requires assembly instructions found in the documentation package for the line printer.

SECTION III

OPERATION

3-1. Introduction

3-2. Section II   of this Service Overview Manual contains   the
installation   information   necessary to bring the HP64000 Logic
Development System up to proper operating conditions.

3-3. The user's operating instructions are contained in the Reference
Manuals.   The System Overview Manual, HP P/N 64980-90903, introduces
all of the necessary operating information, and directs the user to
other Reference Manuals for more detailed information.

SECTION IV

PERFORMANCE VERIFICATION AND TROUBLESHOOTING

4-1.   Introduction

4-2. This section contains information regarding troubleshooting of
the HP64000 at the system level. Section II of this manual contains
installation and configuration information.   Procedures for running
performance verification tests and disc initialization programs are
also included there.   Due to the configuration information, and
verification tests, troubleshooting should begin in section II. More
in-depth theory about the coverage of tests in section II, and
additional tests for troubleshooting, are provided here, in section
IV.   First a quick system performance verification exercise is
executed, which utilizes a development station to edit a new file,
stores it on disc, retrieves the file, and lists it to the printer.
Troubleshooting paragraphs then follow, in the order: development
station (mainframe), system bus, disc memory, option performance
verification, and printer.

4-3. Performance Verification Theory

4-4. The performance verification in this section is intended to
verify system communication between devices.

4-5. The I/O BUS CONFIGURATION display indicates the configuration
of the HP64000 System Bus.   The appearance of a device with its
corresponding address assures that the device can be "seen" by the
Master Controller station. Proper System Bus protocol is essentially
guaranteed if all devices respond with their address as set during
installation.

4-6. The creation, storage, and retrieval of a file onto the disc
drive is necessary to check that new data may be correctly transferred
to the disc. This functionally exercises most of the circuitry in the
disc drive and the disc controller. However only one data head (out
of three for the 7906) is used and only a minute portion of the disc
storage media is used. A complete check of data on all disc drive
media surfaces requires the operation of the testing procedure on the
64800 system tape. Refer to troubleshooting disc memory for details.

4-7. Listing information to the printer checks out nearly all printer
operations.   If the listing fails, the printer's internal SELF TEST
should be executed, however the SELF TEST does not verify the proper
operation of the printer System Bus interface. The intent of listing
information to the printer from the 64100 station is to verify this
interface as well as internal printer operations.

4-8. Editing a New File

4-9. The storage and retrieval of information on the disc memory may now be verified. Perform the following steps:

A. Depress the ⌐ edit ⌐ softkey, followed by [RETURN].

    The STATUS LINE should indicate "EDITING NEWFILE".

B. Type in the following message: "The quick brown fox jumped over the lazy dog's back. 0123456789±" Several lines should be entered. End each line by [RETURN].
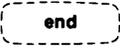
C. Depress the ⌐ end ⌐ softkey, followed by a name for this file. (eg. TEST)

D. The system has now left the edit mode and returned to the system monitor.   The file has been stored on the disc.

    Retrieve the file by depressing the ⌐ edit ⌐ softkey, followed by the file name choosen in step C (TEST). Depress [RETURN].
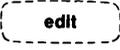
E. Observe that the CRT displays the file exactly as entered in step B.

F. When finished inspecting this file, press the COPY, TO PRINTER softkeys followed by [RETURN].

    The file should be listed to the printer. Check for proper characters.

G. After these steps, press the END softkey, followed by [RETURN].

NOTE

This same storage/retrieval procedure may be performed using other 64100 stations on the system bus. This is suggested to provide a more complete check-out.

4-10. Another way in which the printer may be checked on the system bus is by listing a directory of files.
   A. Depress the right-most softkey (--ETC--) until the
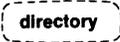
   (directory)   softkey appears on the far left.

   B. Depress the following softkeys in the order indicated (Note that some softkeys will not appear until previous softkeys are pressed).

   (directory) (all files) (all users) (list file) (printer)

   C. Depress (RETURN).
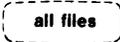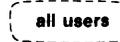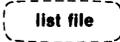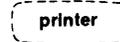
   D. The printer immediately begins printing a directory of all files resident in the disc memory. Inspect the printout to ensure that characters, spacing, line feeds, etc. have functioned properly.

4-11. Troubleshooting

4-12. Troubleshooting the HP64000 at the system level is intended to isolate the faulty system component. At that point, the mainframe, disc, or printer service manual should be referenced, in order to repair the defective circuit. The approach to troubleshooting follows the concept of building outward upon a known good kernel. First, with only the power cord connected, the ROM based Mainframe PV is exercised. After successful completion, the disc memory is connected to the verified development station via the system bus. Ensuing paragraphs outline procedures to verify communications across the system bus, and interpret the results. The Disc PV and Initialization Routines should then be performed, an in-depth explanation of the messages is contained in this section. With the basic system established, the Printer PV, and finally Option Board PV can be run. Additional development stations can be added, but Mainframe PV should run on them before connection to the system bus.

4-13. Mainframe Verification

4-14. Explanation of how to run Mainframe PV, and illustrations of the displays obtained, are included in section II of this manual. If any errors are encountered, refer to the Mainframe Service Manual, to troubleshoot the faulty circuit in the development station.

4-15. System Bus

4-16. In order to test the system bus, the disc memory is connected to the previously verified development station. It must be noted that the System Bus test included in the Mainframe PV, does not provide loop-back testing. The communications processor itself (PHI chip) and circuitry beyond it are not exercised, and even if defective, may still allow the test to pass. A problem may also reside in the bus cable or in the disc memory. The following paragraphs should identify which of those components is defective.

   A. Disconnect all devices from the System Bus except for the disc memory and the Master Controller 64100.

      Check to insure that the Disc Memory is at System Bus address 0, CPU #0, and UNIT SELECT 0. (SEE SECTION II, INSTALLATION.)

      Turn the disc memory power ON and set the disc drive RUN/STOP switch to RUN. Wait for the DRIVE READY message to appear on the disc Operator Control Panel. (Check that the 13037 power switch is ON.)

      Set the 64100 SYSTEM CONTROL SOURCE switch to LOCAL MASS STORAGE.

      Turn the development station power ON. After the CRT warms up, a flashing inverse-video message will appear, "WAITING FOR CARTRIDGE".

      Insert the 64800 cartridge into the tape transport. Wait for load to complete.

      The CRT display will now contain the following list of devices on the System Bus.

         ADRS   DEVICE, CURRENT SYSTEM BUS CONFIGURATION

          0   13037 DISC CONTROLLER
                   UNIT 0 7906 DISC MEMORY

          2   THIS   64100

      Check that the address and device are recognized properly as in the example.

B. Various failure modes can be determined from the display. Following is a list with suggested troubleshooting procedures.

  i. No devices respond with addresses in the ADRS column. Problem is either in the 64100 rear panel board or PHI chip. Mainframe PV did not completely check out these components. Refer to Mainframe Tab for troubleshooting.

 ii. Only Adrs "2" "THIS 64100" responds. ADRS "0" "13037 DISC CONTROLLER" is not seen. Problem could be either in the 64100 (rear panel board or PHI chip), System Bus Cable, 12745 HP-IB Interface Board (in 13037 Controller) or the 13037 Controller.

The problem may be further isolated as follows:

Turn power OFF for the devices.

Disconnect System Bus Cable from the Disc Memory and reconnect it to the 2631 Printer.

Set the Printer Rear Panel Switches to (0000100). System Bus address = 1, LA = 0, SRQ EN = 0.

Turn Printer power ON. Set the printer ON LINE.

Turn the 64100 power ON.

Reload the 64800 System Software Cartridge into the tape transport as before.

Wait for the CRT to display the System Bus Configuration.

ADRS   DEVICE, CURRENT SYSTEM BUS CONFIGURATION

1   2631   PRINTER

2   THIS   64100

When the bus configuration is displayed, the 2631 Printer should be listed as well as "THIS 64100".

If the Printer is not recognized, then the original problem seems to be device independent, (ie. neither the disc memory or printer are seen). Hence the problem area narrows down to either the 64100 rear panel board, PHI chip, or the System Bus Cable. Refer to Mainframe Tab for either the rear panel board or PHI chip.

NOTE

If the 64100 System includes a second 64100 station and not a printer, the 64100 station may be used in a similar manner that the printer was. (Ensure that the second station is configured as NON-CONTROLLER).

If the printer is recognized then the problem is particular to the Disc Memory. Refer to paragraph 4-17.

iii. ADRS "2", "THIS 64100" responds and ADRS "0", "13037 DISC CONTROLLER" responds but the message "UNIT 0 79XX DISC MEMORY" does not appear below the controller message. The problem is in the disc memory. Refer to paragraph 4-17.

C. Once the communication link between the Master 64100 station and the disc memory is established, devices may be added onto the System Bus in a systematic procedure, each time checking to see if that new device is recognized. Keep in mind the following points:

i. Each device must have a unique System Bus address setting. (Printer = 1, 64100 station = 2-7). Two units at the same address will cause a message of DEVICE NOT RECOGNIZED.

ii. Each device must be powered ON after its address switch is set. The Master Controller 64100 must be powered ON after all other devices.

iii. Each added System Bus Cable is as much a potential problem area as each added device.

iv. System Bus connections must be "daisy-chained" (ie. only two cables connected at any one point.). The Master Controller 64100 must terminate the chain.

v. Maximum System Bus Cable length is 20 meters.

4-17. Disc Memory

Problems in the Disc Memory seperate into five failure modes: (1) Disc DRIVE FAULT message appears on the disc Operator Control Panel, (2) System Bus does not recognize 13037 Controller but recognizes other devices. (See Paragraph 4-16), (3) System Bus recognizes 13037 Controller but not the attached disc drive, (4) System Bus recognizes both the Controller and Disc but Disc Memory not performing correctly (eg. data errors), (5) The disc had performed successfully as System Memory, but currently has directory problems, or inability to use a known file. The "soft fix" or "hard fix" function of the Disc Utility program should be used. Following are detailed explanations.

A. DRIVE FAULT message appears on the disc Operator Control Panel. The indicator is illuminated when a fault occurs physically within the disc drive, and will appear at power on.

Four LED's (two red, one green and one yellow) provide a detailed indication of what type of DRIVE FAULT occurred. They are located on the front edge of the A4 Control Board in the card cage at the right rear of the disc drive. When illuminated, these LED's may be viewed from the front of the disc drive through the cartridge access door (while shut).

When a DRIVE FAULT occurs, immediately observe which LED's are illuminated. The fault indicators may be cleared by toggling the RUN/STOP switch. Observe whether the DRIVE FAULT returns or if DRIVE READY appears.

One type of drive fault may easily be corrected without extensively troubleshooting the disc drive. If a single green LED illuminates a drive fault known as an "Interlock Fault" has occurred. Check the following:

1. Reseat all boards in the disc drive card cage.
2. Check for blown fuses on the rear of the disc drive.

Refer to the Disc Service Manual for further troubleshooting.

B. A failure to communicate with the 13037 Controller where communication with any other device on that same System Bus Cable can occur, should be troubleshot in the following areas.

i. Ensure that the Controller rear panel power switch is ON.

ii. Check cable from System Bus connector on rear panel of 13037 Controller to right most edge connector or HP-IB interface board (top board in controller card cage.)

iii. Check that the terminator PCA in the Multi-Unit cable bracket assembly on the rear of the disc cabinet is installed properly. (Viewing the bracket from the cabinet rear, Pin 1 should be left most.)

iv. Reseat all PCAs and the two flat cable assemblies in the Controller.

v. Lastly, selectively swap boards in the Controller to isolate the problem. Especially check the HP-IB interface board as this is the most likely failure.

   C. When the System Bus recognizes the 13037 Controller but the
      controller does not see an attached disc drive, possible problem
      areas include:

   i. DISC DRIVE. The DRIVE READY message must appear and the DRIVE
      FAULT message must not be present. If a DRIVE FAULT occurs,
      refer to failure mode "D" at the beginning of paragraph 4-17.
      After ensuring that all boards are seated securely, selective
      board swap should be tried.

  ii. DRIVE/CONTROLLER INTERFACE. Check the Multi-Unit cable from
      the 13037 Device Controller board to the terminator bracket
      assembly on the rear of the disc cabinet. Check the cable from
      the terminator PCA to the I/O sector board in the disc drive
      card cage. (A problem in the data cable from the Controller to
      disc will not cause this failure mode).

 iii. 13037 CONTROLLER. Check and reseat all cable connectors behind
      controller front cover. Try reseating all boards. Lastly,
      selectively swap boards to isolate problem.

   D. When both the Disc Controller and drive communicate to the
      System Bus, but the Disc Memory is not performing correctly,
      perform the Disc Initialization outlined in paragraph 2-81, of
      the Installation section. Errors reported during initialization
      are explained in detail in the following paragraphs, with an
      explanation on each test. Figure 4-1 outlines the flow of the
      disc boot-up procedure for all models of disc. The formatting
      stage is somewhat different between the discs, and requires two
      seperate flowcharts. The testing phase is the same for all
      discs. The disc initialization procedures outlined in section
      II cover the "fmt & tst" operation. These functions may be
      selected independently.

      FORMAT - This routine will initialize the disc for use in a
      64000S System. It is recommended that testing also be done in
      order that faulty tracks may be marked "defective".

      TEST - A series of tests are performed on the disc and its
      controller circuitry, and any errors are reported on the CRT.
      An explanation of the errors is included in this section,
      immediately following the format and test flowcharts.
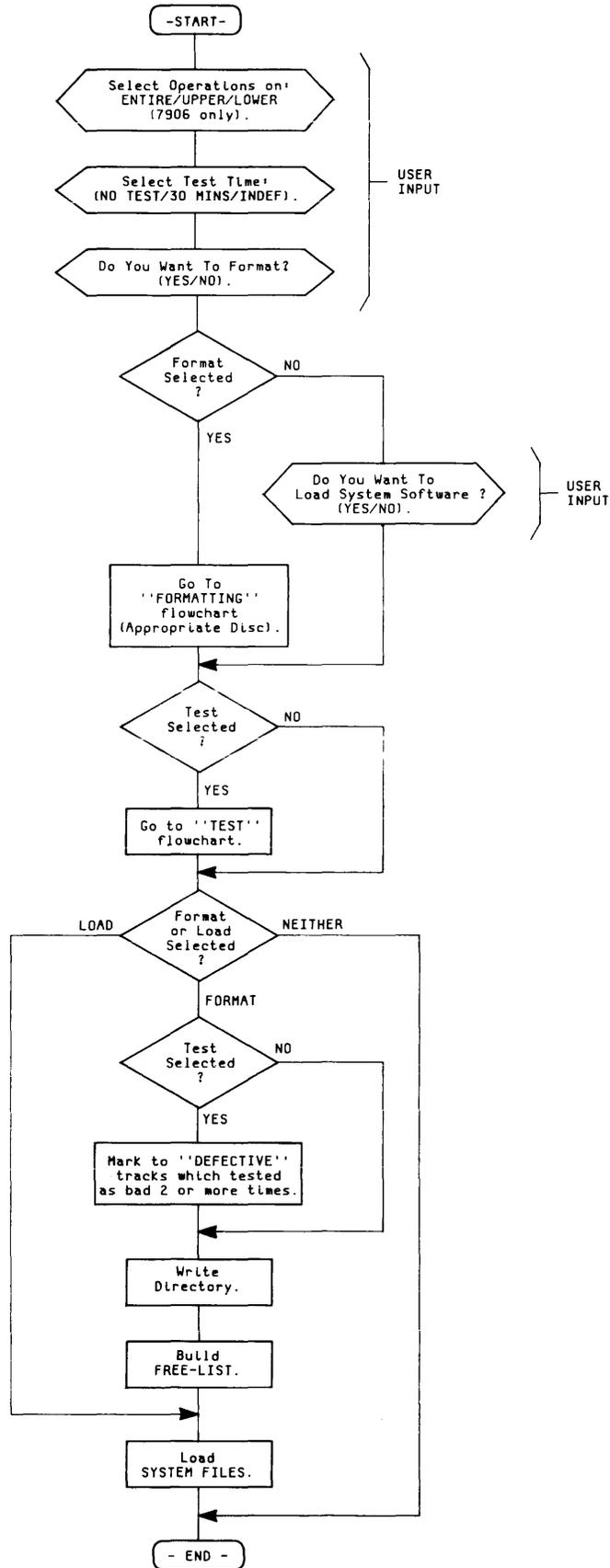
Figure 4-1. Disc Boot-Up Procedure

From ''Disc Boot-Up Procedure''

Format
Selected
?

YES

READ SECTOR.

NO ── Good CRC?

YES

NORMAL,
SPARED, ── Status=??

PROTECTED

Defective

Increment to
next track.

Mark entire track
as ''NORMAL''.

Mark entire track
as ''DEFECTIVE'' and
''point to self''.

Whole
Disc   ── NO
Checked
?

YES

Return to ''Disc Boot-Up Procedure''.
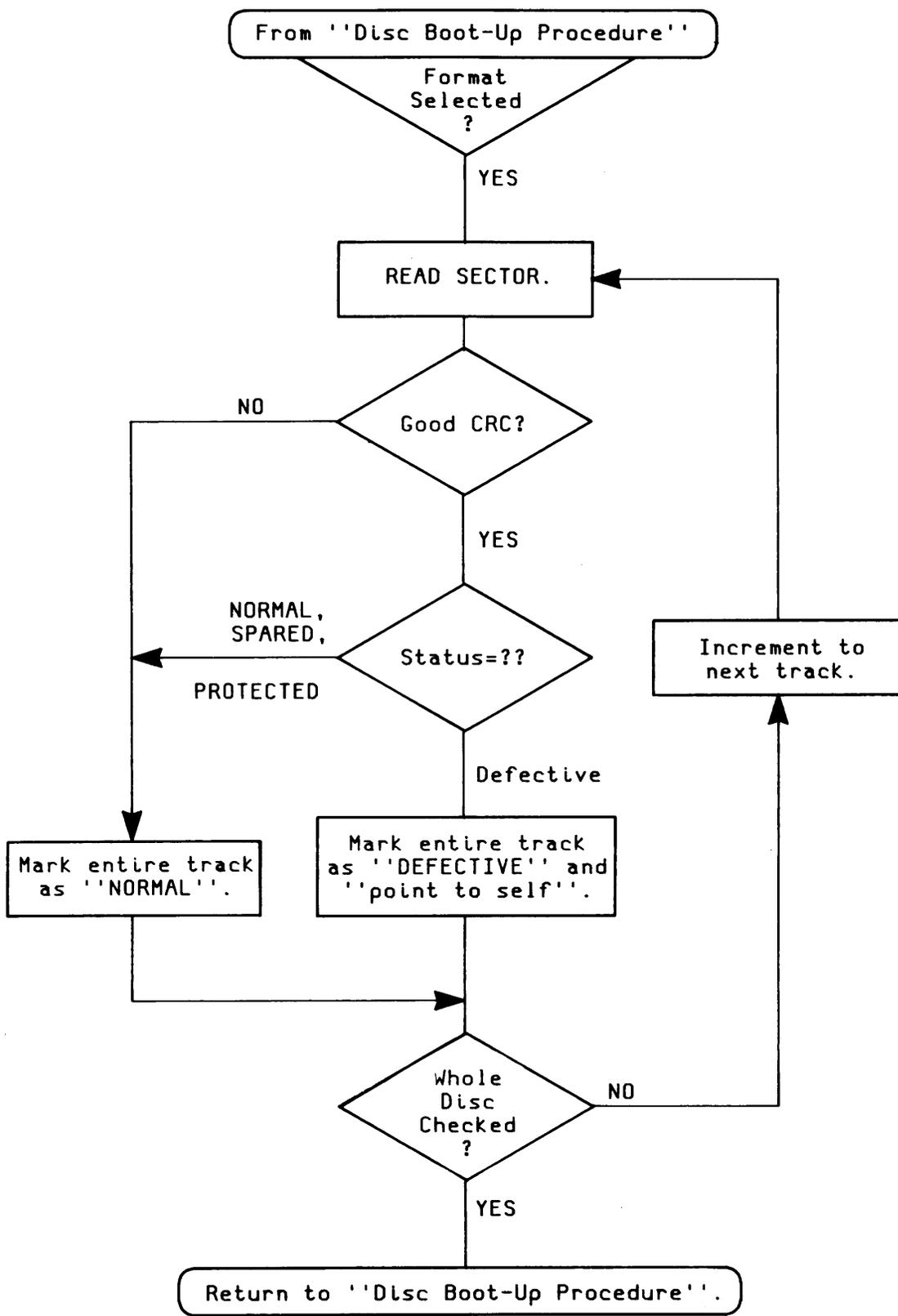
Figure 4-2. MAC Disc Formatting Flowchart
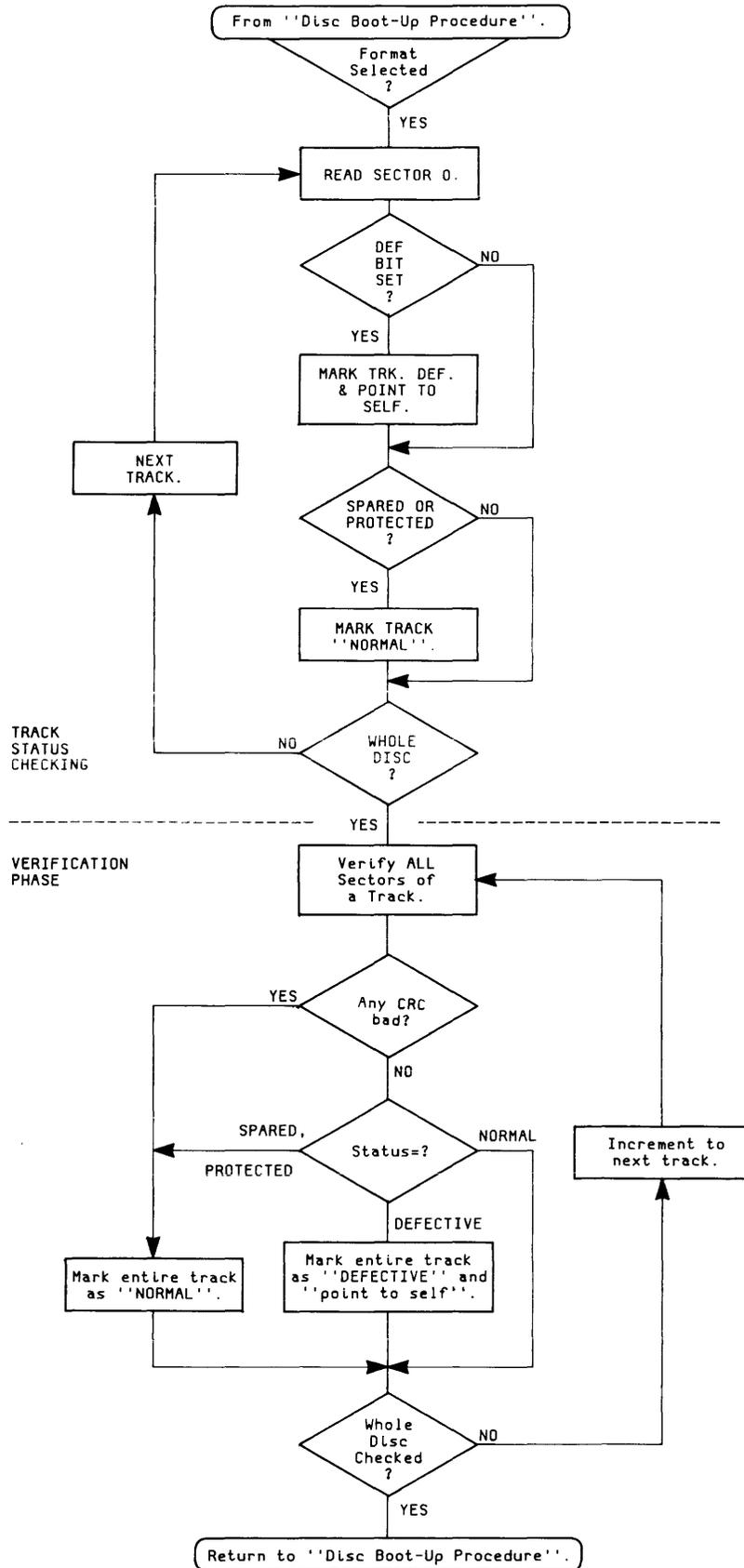
Figure 4-3. 7910 Disc Formatting Flowchart

From ''Disc Boot-Up Procedure''.

Test
Selected
?

YES

Select (from system spares)
a track for READ/WRITE testing.

VERIFY next 41 tracks of disc data
(tracks marked NORMAL only).
Log errors as
''DISC DATA ERRORS''.
Display cylinder and head address at error.
Update ''MEGABYTES VERIFIED''.

Perform a timed seek
to the selected spare track.

Perform timed seek back to
the next track (from the
selected spare track).

Initialize BUFFER1 and write 16 sectors
on the selected spare track.

Read back the 16 sectors into BUFFER 2.
Compare BUFFER2 with BUFFER1.
Repeat this ''read/compare'' four times.

Receive Errors =
Receive Errors + 1.

1,2,3   # of Errors =?   4

Transmit Errors =
Transmit Errors + 1.

0

Update ''I/O MEGABYTES VERIFIED''.

HAS
TEST TIME
ELAPSED
?

NO

YES

Return to ''Disc Boot-Up Procedure''.

Figure 4-4. Disc Test Flowchart

i. MEGABYTES VERIFIED. Successively verifies 1/2 megabytes of data beginning at cylinder zero. Data is read and CRC (cycle reduncancy check) verified for all sectors, all heads.

A failure of the CRC to verify is logged as a DISC ERROR on the display. The cylinder, head, and number of times a data error is found on this track appears to the right of the display. Normally this portion of the display is blank.

The CRC circuitry is physically in the 13037 Controller. Hence a DISC ERROR failure should be troubleshot in the Disc Drive, Disc Controller, or connections between them: Here are some suggestions:

a. Eratic DISC ERRORS, (ie. an inconsistent pattern of cylinders reporting Data Errors) is more likely to be a problem in circuitry or connections rather than a problem on the disc media. The Controller ECC board should be checked as well as other Controller and disc circuitry. Refer to Disc Service Manuals.

NOTE

If errors seem to be heat sensitive (eg. after 13037 has been on a long time) then especially check 13037 fans and ECC board.

---

b. Data errors reported consecutively for every cyclinder beginning at 0 for a particular head points to a likely bad head. Otherwise, the problem may be the Read/Write Preamp or I/O Control Board in the disc drive.

c. Data errors appearing repetively for certain tracks is an indication that the disc media may be defective for those tracks. For some reason these tracks were not marked defective when the disc was originally formatted on the 64000 system. Tracks on which data errors are repetively found may be marked defective and excluded from the FREE LIST, thus keeping the system software from ever accessing them.

NOTE

The 64000 System does not use "sparing" in the Disc Memory.

NOTE

The testing phase can locate more than 10 tracks
which give data errors. However, if FORMATTING has
been selected, the FORMAT and system load will not
take place if more than 10 defective tracks are
found. This number of defective tracks indicates
that something major is wrong with either the disc
media, disc alignment, or disc circuitry.

---

ii. MEGABYTES OF I/O. This test checks out the entire I/O link
    from the 64100 Master Controller station to/from the actual
    disc storage media. A unique bit pattern is written (once
    every two timed seeks) to an unused track on the disc.
    (Typically this is track 410 but always is the highest numbered
    track in the FREE LIST). This bit pattern is read back four
    times, each time checking it against a stored buffer of the
    transmitted information.   .

    If all four reads of a pattern are bad, a TRANSMIT ERROR is
    logged; if three, two or one reads are bad, a RECEIVE ERROR is
    logged. Check the following items when errors are reported:

a. If DISC ERRORS are also occuring, there is a problem between
   the disc controller and disc storage media. Refer to "a.
   MEGABYTES VERIFIED" for troubleshooting hints.

b. If no DISC ERRORS are reported, the problem is likely to be
   one of the following:

       "Noisy" environment. Check that the entire 64000 system is
       on one circuit breaker and that no heavy machinery is also
       sharing the line. The System Bus cable may also be picking
       up RF interference if sources are nearby.

       The 64100 station Mainframe PV, System Bus test, does not
       completely check the output of the HP-IB PHI chip on the
       I/O board and the HP-IB transceivers or the rear panel
       board. These may cause I/O errors to be logged.

       System Bus Cable may be damaged.   Try replacing with
       another cable.

       13037 Controller may have problems. Especially check HP-IB
       interface board. If the problem seems to be heat sensitive
       suspect the ECC board first. Check that both Controller
       fans are operating at full speed, by powering down the
       controller and watching the spin-down time of the fan. It
       should exceed 20 seconds.

iii. TIMED SEEKS. After every 1/2 megabytes verified, a seek is
      performed to the inner track where the I/O write and reads are
      performed. Each direction of travel, to and from, this track
      increments the TIMED SEEKS counter by one. As the area of the
      disc where verification is being performed gets nearer and
      nearer the highest track number, the seeks become consecutively
      shorter. In this manner, an entire range of seeks is performed
      for a thorough testing.

      A failure to complete a seek within the required time limit
      causes the display to log a SEEK ERROR. If failures occur,
      refer to the Disc Service Manual for checking and adjusting the
      seek time.

E. When the disc had performed successfully as System Memory, but
    currently has directory problems, or the inablility to use a
    known file, then the "soft fix" or "hard fix" function of the
    Disc Utility program should be used.

To activate the System Disc Utility Module, the 64800A tape must be
loaded by booting-up from local mass storage, which will produce the
following display:

BOOT IN PROGRESS   WAITING FOR CARTRIDGE

Inserting the cartridge into the tape drive will produce the System
Disc Utility Display.

```
                        SYSTEM DISC UTILITY

        WARNING:  All other stations should be powered off.
        If soft fix is run the printer (if any) should remain on.

        Options:

        format......Format the disc

        test........Test the disc

        fmt & tst...Format the disc and test.  Mark defective tracks

        soft fix....Fix file linkages

        hard fix....Read and write each disc sector  (Not available for 7910)


        STATUS: Awaiting selection _____ 0:01



         format    test    fmt & tst  soft fix  hard fix _____  _____  __end__
```

Figure 4-5. System Disc Utility Display

(soft fix) - The soft fix routine repairs incorrect linkages. It should be utilized when errors such as "DISC FULL" occur when the disc is not full.

press (soft fix)

```
┌─────────────────────────────────────────────────────┐
│  WARNING: This program is used to correct soft       │
│  errors in the 64000 file management structure.      │
│  When a conflict exists between two files only one    │
│  will remain intact. The other will be partially     │
│  or completely deleted.                              │
│                                                       │
│  IMPORTANT: This program should be run from the      │
│  Master Controller. All other development stations   │
│  should be turned off. Do not reset this program     │
│  if corrections are being made.                      │
│                                                       │
│                                                       │
│                                                       │
│                                                       │
│  STATUS: MAKE SURE ALL OTHER STATIONS ARE POWERED OFF _____ 0:02 │
│                                                       │
│  # of disc to be examined? _                         │
│                                                       │
└─────────────────────────────────────────────────────┘
```

Figure 4-6. Soft Fix Warning Display

Select a disc # to be examined, and press [RETURN]

The command line will display: Make corrections?
                                        NO   YES

If "no" is selected, the errors will be listed, but corrections will not be made. In this case an "abort" soft key will allow the user to exit the soft fix.

If "yes" is selected, the errors will be corrected. The "abort" soft key will not be available, and the program must not be halted under any circumstances.

Press (yes)

If the printer is on during the soft fix routines, a list of errors will be printed out. Active files, recoverable files, and finally free pages will be checked. These three catagories will appear in the listing.

DISC FIX UTILITY

Invalid data on directory parameter sector
ACTIVE FILE ERRORS:

        FILE NAME   TYPE   FIRST   LAST   NUMBER   DIRECTORY
                                      PAGE   PAGE   PAGES   SECTOR

RECOVERABLE FILE ERRORS:

        FILE NAME   TYPE   FIRST   LAST   NUMBER   DIRECTORY
                                      PAGE   PAGE   PAGES   SECTOR

FREE LIST ERRORS:

Figure 4-7. Disc Fix Utility Printer Listing

Along with the file name and error, the file type is indicated by a number corresponding to the following meanings:

     2: source
     3: reloc
     4: absolute
     6: emul_com
     7: link_com
     9: prom
    10: asmb_sym
    12: link_sym

Additional types represent various system files. Also listed will be the first and last pages of the file, the length of the file (in pages), and the directory sector listing the file. The next line will indicate the error, and the page on which the error occurred. Below is a list of the errors reportable, and their meanings. Note, however, that if the message "WARNING: FILE IS UNUSUALLY LARGE" appears, this is not necessarily an error. The user should verify that the file should indeed be as large as the size listed. This message will occur for all files larger than 25 pages. Thus, the soft fix routine may be run without corrections if the disc is nearly full, and the user wishes to know if there are any large files which may be purged. In this case, the soft fix routine may be aborted after it finishes checking the active files.

LIST OF ERROR MESSAGES REPORTABLE BY THE SOFT FIX ROUTINE:

WARNING: FILE IS UNUSUALLY LARGE.
    See discussion above.
ILLEGAL FILE NAME
    A file was found in the directory with an illegal name. The file
    will be deleted if corrections are being made.
FIRST PAGE IS INVALID
    The directory pointed to an invalid page. The file will be deleted
    if corrections are being made.
FIRST REVERSE LINK IS NOT - 1
LAST FORWARD LINK IS NOT - 1
THERE IS A FORWARD LINK ERROR
THERE IS A REVERSE LINK ERROR
THERE IS A FILE SIZE ERROR
FIRST PAGE IS ALREADY ALLOCATED
LAST PAGE IS ALREADY ALLOCATED
FORWARD LINK SHOULD NOT BE - 1
REVERSE LINK SHOULD NOT BE - 1
FORWARD LINK PAGE IS INVALID
LAST PAGE IS INVALID
ILLEGAL FORWARD LINK
    The above indicate that an error was found with the specific file.
    Fix will attempt to fix the file but the file may be incorrect or
    truncated.
FREE PAGE IS ALREADY ALLOCATED
    This is the free list error which will only show up if corrections
    are not being made. Soft fix should probably be run with
    corrections.

After the errors are listed to the printer, the status is displayed as follows:

```
Errors                    1

File entries deleted      0

Files                     0

File pages                0

Recoverable pages         0

Free pages                0

Total free pages          0

Total pages               0




STATUS: Checking active files, directory sector 0028  _____  8:50

 -

 _abort___ ____ ____ ____ ____ ____ ____ ____ ____
```

Figure 4-8. Soft Fix Directory Status Display

At this point the Disc Utility Soft Key Menu will reappear, offering the choices "format/test/fmt&tst/soft fix/hard fix/" and "end".

(hard fix) - The hard fix routine, used for correcting hard data errors, reads each sector of disc and writes it back. Encountering errors during the "TEST" routine is cause for running "HARD FIX". The "HARD" FIX" routine should also be run if there is difficulty in reading or writing the disc, as indicated by the message "RETRYING DISC N" (where N is the disc number), or by the inability to use the display, with the message:

        FILE NOT FOUND. FILE display:HP

The hard fix capability is not available for 7910 discs.

Press (hard fix)

The development station CRT will display the message:

> # of disc to be examined ?

Make a selection and press ⟦RETURN⟧ .

The status line will indicate:

> STATUS fixing cyclinder 0

During "HARD FIX", if there are any errors on the disc the message "RETRYING DISC N" will be displayed. This message is normal.

At the completion of the hard fix routine, the status line will indicate "Awaiting Selection", and the Disc Utility Soft Key Menu will reappear, offering the choices "format/test/fmt&tst/soft fix/hard fix" and "end". Exiting the System Disc Utility module by pressing the "end" soft key will load the operating system, unless the cartridge has been removed from the tape drive. After that, any additional system software tapes may be loaded. The rear panel "SYSTEM CONTROL SOURCE SWITCH" should be set back to "System Bus (Disc)" and the station repowered, in order to conduct normal operations.

4-18. Option Performance Verification

4-19. Option test provides performance veification and software-based troubleshooting assistance for the Emulation, Analysis, and Emulation Memory option boards. As option test consists of disc-based files, a basic system containing a Master Controller Development Station and a Logic Unit 0 Disc must be operational (installed and verified) before option test can be used.

4-20. Printer

4-21. The printer contains a SELF TEST routine which may be initiated if problems internal to the printer are suspected. The self-test feature is a GO/NO GO check to verify proper operation of the unit and as a diagnostic tool to aid in the problem location.

4-22. To perform self-test from the operator control panel or keyboard the unit must be off-line with no existing fault conditions. Press and release the SELF TEST switch to activate the self-test routine. When the switch is pressed, the following occurs:

   A. ROM's and RAM's are tested. A check sum is performed on the ROM's, but the character set is not tested. A test of the RAM's and the real-time clock is also run. An audible tone sounds if all tests function correctly.

B. Servo movement is checked. If the carriage is not in the "home" position (column 1), the carriage will first drive to the left. From the "home" position the carriage will drive right to the right crash stop, then reverse and drive to the "home" position again.   The unit checks to ensure that the servo drives the carriage from one side to the other within eight seconds. The following conditions must be satisfied to sound the tone a second time:
   1. Servo drive time not exceeded.
   2. Column count must be within bounds (column 1 at "home", columns 135-145 at right crash stop).
   3. Direction bit is correct.

C. Test the I/O. The self-test program tests the I/O, dependent on which I/O option is installed.

D. The power-on routine is initiated and the unit is reset to all power-on default conditions.   The I/O power-on is handled individually and is not executed until self-test termination.

E. The primary character set is printed. (See the sample printout below.)   The order of the printing test is: two lines at 6 LPI (normal), two lines at 8 LPI, one line each of compressed, expanded, and auto-underline modes, display functions is set, then the full primary character set is printed, followed by a carriage return and a line feed. The printout will actually contain more than one line for the expanded mode and the display functions mode.

NOTE

The second line will try to access the alternate character set.   If present, it will be displayed; if not, a full blank line will be printed.

4-23. In addition to the self-test feature of the unit, the power electronics PCA has three LED's which serve as visual indicators of possible problems in the supply voltage circuits. These LED's are located top center on the board.   If any of the LED's are extinguished, the fuse for that particular supply voltage should be checked.   A dim lamp may be an indication of circuitry problems. Refer to table 4-1 for failure indications provided by the LED's.

Table 4-1. Troubleshooting Hints

PROBLEM	PROBABLE CAUSE
POWER ON indicator not illuminated	1. Power cord not connected. 2. Line fuse in power module is bad. 3. No current from power outlet. 4. Indicator light is bad (fan will operate). 5. Front Switch Panel or Keyboard cable is disconnected.
Print quality erratic, very light or smudged.	1. Print head out of adjustment. 2. Ribbon cartridge needs replacing. 3. Print head needs cleaning. 4. Print head bracket on carriage assembly is loose. 5. Bent of improperly seated screw.
Missing dots or ragged characters.	1. Print head out of adjustment. 2. Print head needs cleaning. 3. Bad print head. 4. Printer/Raster Logic PCA is bad. 5. Servo speed too high. 6. Encoder out of adjustment.
Paper does not advance.	1. Paper not properly loaded; check tractors and paper alignment. 2. Paper perforations damaged. 3. Paper is catching on box. 4. Bad paper drive circuitry (Printer/Raster Logic PCA, Power Electronics PCA, stepper motor). 5. Paper guide too tight. 6. Bad "0" ring in paper drive clutch.
Paper tearing or seperating on multi-part forms.	1. Paper binding or dragging; check paper path. 2. Multi-part forms not entering unit through the bottom opening. 3. Print head needs adjustment. 4. Paper guide too tight.
Circuit breaker trips.	1. Print head movement obstructed (paper jammed, ribbon jammed, excessive friction on guide bars). 2. Servo drive motor bad. 3. Defective print structure or leadscrew (excessive friction on guide bars).

Table 4-1. Troubleshooting Hints (Cont'd)

Fails ROM/RAM test of Self-Test.	1. Control PCA is bad. 2. Memory information circuits on I/O Interface PCA bad. 3. Clock circuits on Printer Logic PCA bad. 4. Power Electronics PCA is bad.
Fails servo movement check of Self-Test.	1. Circuit breaker tripped, reset and try again. 2. Printer/Raster Logic PCA bad. 3. Power Electronics PCA bad. 4. Control PCA bad. 5. Servo motor, leadscrew, guide rail or carriage may be bad or binding. 6. Encoder PCA bad or needs alignment.
Fails I/O test or power-on routine portion of Self-Test.	1. I/O Interface PCA bad. 2. Control PCA bad. 3. Power Electronics PCA bad.
Printing portion of Self-Test fails or is bad.	1. Print head or associated fuses on Power Electronics PCA are bad. 2. Power Electronics PCA bad. 3. Printer/Raster Logic PCA bad. 4. Control PCA bad. 5. Encoder PCA bad or Encoder alignment needed. 6. I/O Interface PCA bad.
+5 LED off or noticeably different intensity.	1. Check fuses on Power Electronics PCA. 2. Check +5 source. 3. Replace Power Electronics PCA. 4. Check crimps in cables P10 and P16.
+12 LED off or noticeable different intensity.	1. Check fuses on Power Electronics PCA. 2. Check +12 V source. 3. Replace Power Electronics PCA. 4. Check crimps in cables P10 and P16.
-12 LED off or noticeably different intensity.	1. Check fuses on Power Electronics PCA. 2. Check -12 V source. 3. Replace Power Electronics PCA. 4. Check crimps in cables P10 and P16.

Table 4-1. Troubleshooting Hints (Cont'd)

Power fuses open repeatedly.	1. Print head coil is shorted (F1, F2). 2. Servo motor is shorted (F3, F4). 3. Ribbon cable to head is bad. 4. Servo cable to head is bad. 5. Static turns on SCR (CR10) and blows fuse (F1).
Random dots missing in characters.	1. Check encoder alignment. 2. Check servo speed adjustment. 3. Dirty head. 4. Too much head to platen gap.
Random shifting of left margin in and out.	1. If shift is by dot columns, check encoder alignment. 2. If shift is by complete characters, check encoder alignment and head location circuits (Printer/Raster Logic PCA and Control PCA). 3. Check crash stops. 4. Check for static.
Occasional stepping of left margin to the right.	1. Static electricity from paper being stacked on floor. Stack paper in grounded catcher. 2. Intermittent left crash stop. 3. Bad Printer Logic PCA. 4. Bad Control PCA. 5. Noisy motors. 6. Be sure stand or table is grounded to the unit chassis ground. 7. Encoder alignment drifting.
Print density (darkness) varies between left and right sides of platen.	1. Loose head or bracket. 2. Defective print structure. 3. Defective head.
Character tilted (not vertical.	1. Loose head or bracket. 2. Defective head. 3. Defective bracket.
Top or bottom dots missing.	1. Head bracket bent or tipped up or 2. Bad head. 3. Bad power PCA.

SECTION V

ADJUSTMENTS

5-1. Introduction

5-2. There are no adjustments that apply directly to the system. There are various address and mode settings at the system level, and these are described in table 2-1, List of Selectable Settings, since they relate to installation.

SECTION VI

REPLACEABLE PARTS

6-1. Introduction

6-2. This section contains information concerning replaceable parts.
The only replaceable parts at the system level are the HP-IB cables
and the Field Service Kit. Other cables and extender boards are
repeated here for convenience.

6-3. Parts are organized under the following headings:
       (1) System
       (2) Development Station
       (3) 12745A HP-IB Adaptor
       (4) 13037C Disc Controller
       (5) MAC Disc Drives

6-4. Ordering Information

6-5. To order a part listed in the replaceable parts list (Table 6-1),
quote the Hewlett-Packard part number, indicate the quantity required,
and address the order to the nearest Hewlett-Packard office (refer to
Sales and Service offices listed at the back of this manual).

6-6. Direct Mail Order System

6-7. Within the USA, Hewlett-Packard can supply parts through a direct
mail order system. Advantages of using this system are:

    1. Direct ordering and shipment from the HP Parts Center in
       Mountain View, California.

    2. No maximum or minimum on any mail order (there is a minimum
       order amount for parts ordered through a local HP office when
       the orders require billing and invoicing).

    3. Prepaid transportation (there is a small handling charge for
       each order).

    4. No invoices (to provide these advantages, a check or money
       order must accompany each order).

6-8. Mail-order forms and specific ordering information are available
through your local HP office. Addresses and phone numbers are located
at the back of this manual.

Table 6-1. Replaceable Parts

Part Number	Description
(1) System:	
Model 10833A	Cable, HP-IB, 1m (3.28 ft)
" 10833B	" " 2m (6.56 ft)
" 10833C	" " 4m (13.12 ft)
" 10833D	" " 0.5m (1.64 ft)
Model 64930A	Kit, Field Service (same as 64001 opt930)
(2) Development Station:	
64100-61605	Cable, Extender
64100-66510	Board, Extender, Mainframe
64100-66512	Board, Extender, Display Driver
64151-61602	Cable, High Speed Bus, 2 Connector
64151-61603	" " 3 Connector
64151-61604	" " 4 Connector
64151-61605	" " 5 Connector
(3) 12745A HP-IB Adaptor:	
12745-60002	Cable, HP-IB to Interface Card
12745-60004	Cable, Interface Card to Controller Card
(4) 13037C Disc Controller:	
13037-60021	Cable, uP Card to Error Correct Card
(5) MAC Disc Drives:	
07905-60039	Terminator PCA
07905-60041	Cable, Disc Drive Interconnecting
07905-80010	Cable to Cable Adaptor
Model 13013B	Cable, Multi-Unit, 3.60m (12 ft)
" 13013B-001	" " 1.83m (6 ft)
" 13013B-002	" " 5.49m (18 ft)
" 13013B-003	" " 2.44m (8 ft)
Model 13213B	Cable, Disc Data, 3.05m (10 ft)
" 13213B-001	" " 7.62m (25 ft)
" 13213B-002	" " 15.24m (50 ft)
" 13213B-003	" " 22.86m (75 ft)
" 13213B-004	" " 1.83m (6 ft)

SECTION VII

MANUAL BACKDATING

7-1. Introduction

7-2. Manuals provide backdating information so that the manual may be adapted to instruments with earlier serial prefix numbers. Since the HP64000 System is not serialized, no backdating is required.

7-3. The components of the HP64000 System are serialized, and backdating information can be found in the appropriate mainframe, disc, or printer manual.

SECTION VIII

THEORY OF OPERATION

8-1. Introduction

8-2. This section contains the system diagram description, the table of system mnemonics, and the table of status line error messages. For detailed circuit description, refer to the appropriate system component service manual.

8-3. System Block Diagram Description

8-4. Basic 64100A Mainframe

8-5. The heart of the basic mainframe is the central processing unit (CPU). Also referred to as the host CPU in order to distinguish it from the emulation processor, the CPU operates partly from read-only memory (ROM) located right on the CPU board. The 16-bit data bus (part of the CPU bus) also interfaces through the motherboard to the display controller board, where the CPU RAM is located. This RAM is utilized as program memory while segments of the operating system are swapped in from the disc for use, and then back out again. This mechanism allows extensive software to be used because only part of the operating system need be in RAM at any one time, while the rest is stored on the massively expansive hard disc. The other function performed by the CPU is that of I/O processor. Connected across the I/O bus to the I/O controller board, which communicates to the devices on the system bus through the I/O rear panel board, the CPU has access to the disc memory for the storage and retrieval of information, and to the printer for hard-copy listings.

8-6. The display controller board uses a small part of the CPU RAM, which it houses, as display memory. Here, the characters intended for display on the CRT are stored. Since this memory is dynamic RAM, the display controller also contains refresh circuitry. The display functions themselves are controlled by the large-scale display processor. Character information is passed on to the display driver board, where CRT control circuitry and high-voltage power supply reside.

8-7. The I/O controller is connected to both the CPU bus and the I/O bus. Interface is provided for the keyboard, which must be connected to the I/O controller. The I/O controller that houses the HP-IB processor (PHI chip), which communicates on the system bus, and the RS-232-C processor, is also connected to the I/O rear panel board where boot-up source and HP-IB address switches as well as the HP-IB and RS-232-C connectors are located.

8-8. The basic mainframe also contains a high-efficiency power supply providing the necessary voltages for operation. Replaced as a unit, this module is swapped out in the event of failure, on an exchange basis.

8-9. Cassette Tape Unit

8-10. While the tape controller board plugs into the CPU bus via the motherboard connections, it must also be attached to the I/O bus cable. Based on the large-scale tape control processor, the controller operates the tape drive unit on the mainframe front panel. Accepting an HP cassette tape, at least one station in a network of stations, printer and disc, must have a tape drive unit, in order to load operation system files, as well as to provide back-up storage for the disc.

8-11. Internal Logic Analyzer

8-12. The internal logic analysis board provides monitoring of program flow, and can initiate breakpoints under given conditions. Forty bits wide by two-hundred and fifty-six bits deep, the 7MHz capable analyzer can work interactively with the emulation subsystem, providing breakpoints from trace specifications, or single-stepping the program.

8-13. High-Speed Emulation Memory System

8-14. Providing memory space from 8K bytes to 64K bytes for the emulation processor, the emulation memory system provides powerful capabilities for logic development. The design of the memory mapping provides maximum flexibility in interleaving emulation and user memory space. The dual port architecture allows the emulation memory to be displayed and modified dynamically. The memory control board (also called the static RAM controller) performs the read and write functions to the emulation memory board (sometimes called the static RAM board) itself. Up to four memory boards may be operated from one controller.

8-15. Microprocessor Emulation Subsystem

8-16. Comprised of two parts, the emulation controller, and the emulation probe (pod), the emulation subsystem replaces the microprocessor in the prototype circuit, serving all of the functions of that processor, but also providing the important interface to the development system. Interfacing to the development system allows not only for use of the assembler programs and internal emulation memory so that debugging of software can begin before the target system is even built, but also allows use of powerful Pascal compilers, the internal logic analyzer, and the editor which allows for programs to be changed so easily. The nearest HP sales office should be contacted for the microprocessors currently supported by emulation subsystems.

BASIC 64100A MAINFRAME   OPTION CARDS

```
                                                          EMULATION
                                                           PROBE  ──────► USER SYSTEM
                                                           (POD)

                                                                          POD CABLE
```

CRT

```
                                                                          EMULATION BUS

KEYBOARD   DISPLAY          TAPE      PROM          EMULATION
           DRIVER           DRIVE     PROGRAMMER    CONTROLLER
                                      MODULE

                    I/O BUS

                                                   INTERNAL
                                                   ANALYSIS

I/O        DISPLAY     CPU       TAPE      PROM
CONTROLLER CONTROLLER            CONTROLLER CONTROLLER
           CPU        CPU
           RAM        ROM

POWER                                              EMULATION
SUPPLY                                             MEMORY
                                                   CONTROLLER
                    CPU BUS                         (STATIC RAM
                                                   CONTROLLER)    EMULATION
                                                                  MEMORY
I/O                                                               (STATIC RAM)
REAR PANEL
BOARD                                              MEMORY BUS

HP-IB CONNECTOR
RS-232-C                     SYSTEM BUS ──────►  TO ADDITIONAL DEVELOPMENT STATIONS
PORT

DISC     PRINTER
MEMORY
```
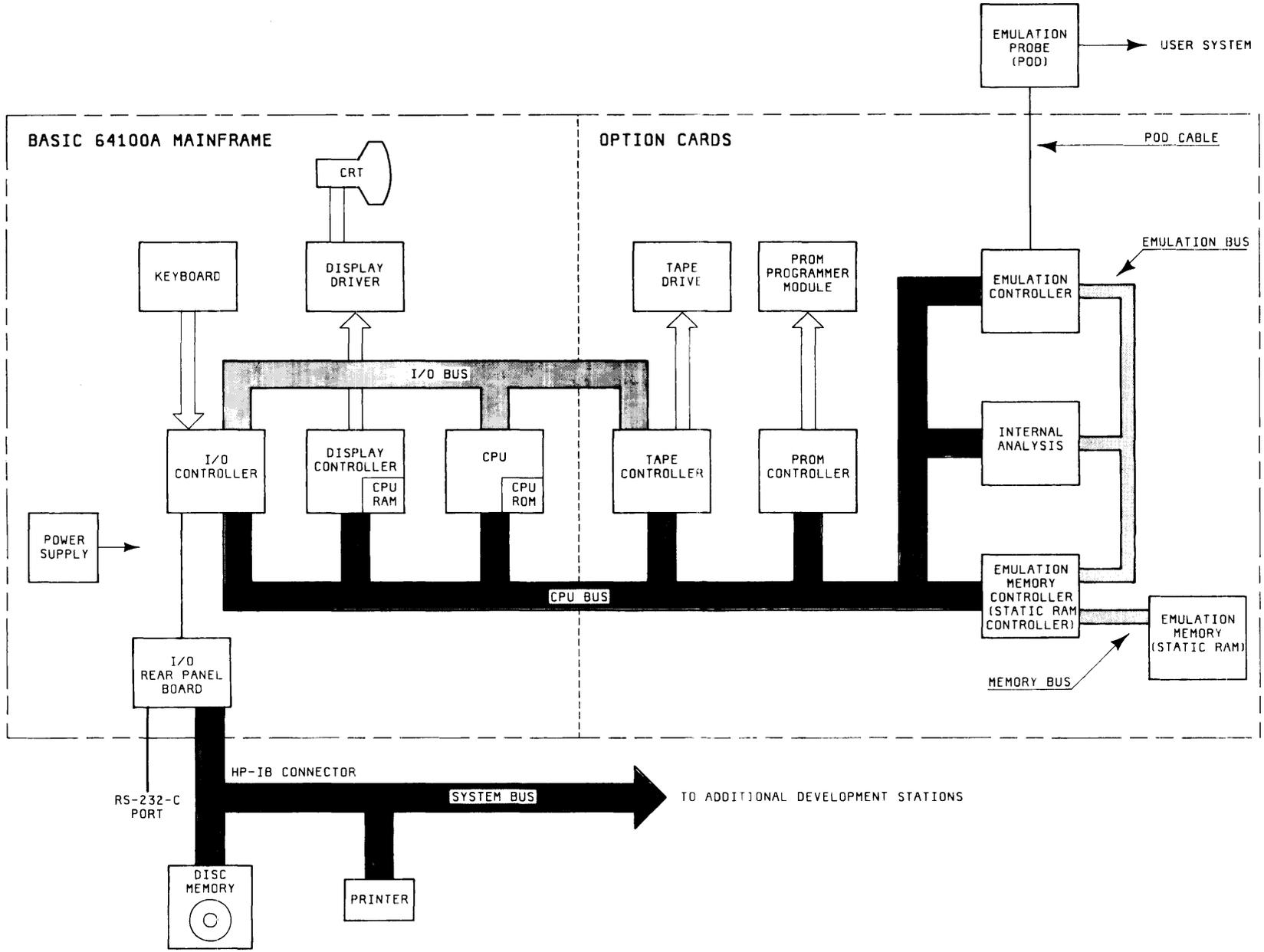
Figure 8-1. HP 64000 Logic Development System Block Diagram

8-17. PROM Programmer

8-18. The PROM programmer is in two parts, the controller which accepts the data to be programmed, and latches it until the appropriate time, and the programmer module which actually contains the socket for the prom. The controller operates a wide variety of programmer modules, each of which may support many PROMs. Operated from the CPU bus, the PROM programmer provides the necessary means of creating firmware from the tested programs.

8-19. Disc Memory

8-20. For system memory, the HP64000 utilizes state-of-the-art fixed media storage. As a hard disc based system using an HP-IB based system bus, the HP64000 provides a shared data resource. Files created by one user are available to another user. The massive amounts of memory available with hard-discs allows for networking, such that six development stations and a printer may operate with one disc. Powerful operation system software is possible, because only segments of the operating system are actually in a development station at a given time, while the rest resides on the disc. By swapping this software in and out, extended capabilities are realized.

8-21. The conventional type of discs within the multi-access-controller (MAC) disc drive family, provide storage capabilities from 20M bytes to 120M bytes of data. Based on the 13037C Disc Controller, 7906, 7920, or 7925 disc drives may be used with up to eight drives operating from one controller. Due to the constraints of the system bus, a 12745 HP-IB Adaptor card must by used.

8-22. Utilizing Winchester-head technology, the 7910H disc drive provides 12M bytes of formatted storage capability, and is HP-IB compatable. Unique in concept, the heads fly very close to the disc surface (approximately 17 microinches), and actually take off from, and land on, the surface of the disc, in an area at the center of the disc, designated the landing zone. The other unusual feature of the 7910 is the disc format. The servo information for head positioning, is contained in the inter-sector gaps embedded throughout both disc surfaces. Other discs typically dedicated an entire disc surface to servo code.

8-23. System Printer

8-24. The system printer connected to the system bus, provides hard-copy listings of files or directories. The high quality print, and high reliability of both the 2608 and 2631 printers, enhances system performance. Both models are HP-IB compatable and can accept standard 15 inch "computer paper." Self test procedures are initiated from a single button operation. User convenience is highlighted by operation with easy-to-use cartridge ribbons on both units.

8-25. Mnemonic and Status Message Tables

8-26. The following two tables provide system information of general interest. Table 8-1 gives a description for each of the system mnemonics, and identifies the system component to which the mnemonic relates. Table 8-2, in four parts, gives descriptions for the status messages which may appear on the development station display.

Table 8-1. System Mnemonics

Status	Message
CPU#	(Used with MAC discs only; set to 0). Switch setting made on HP-IB adaptor card, 12745A, so that disc controller 13037C knows which CPU is requesting a data transfer. HP64000 Operating System Software requires that CPU# 0 be selected.
HP-IB Address	Switch selectable setting from 0 through 7 (in binary format 000 - 111). This is the System Bus Address, and each number may correspond to only one system component. The disc which will contain the Operating System Software must be located at HP-IB Address 0 (additional discs may use addresses 2 through 7). The printer must be located at address 1. Development Stations may be located at any unused address 2 through 7.
LDS	LOGIC DEVELOPMENT SYSTEM - Array of devices used to develop the software and hardware necessary to operate a logic system. Primarily aimed at the design of microprocessor products. The HP64000 System is an LDS.
L.U. #	LOGICAL UNIT # - Software designated identifier for a given disc unit. The Operating System Software may only be loaded at L.U.0. 7906 Disc Drives which are formatted separately (upper/lower) will occupy two Logical Unit Numbers.
MAC Discs	MULTI-ACCESS CONTROLLER DISC DRIVE FAMILY - The heart of the MAC family is the 13037C Disc Controller, which may control up to eight separate disc drives. The controller identifies each of the drives by reading the Unit Select switch setting. With the HP64000 System, one disc must be set to Unit Select # 0. The controller interfaces to the system bus via HP-IB Adaptor card, 12745A, which must have the CPU # switch set to 0. This switch is read by the controller to identify which CPU is requesting a data transfer, but with the HP64000 system only one CPU interface card is allowed, and it must be at CPU # 0.
MASTER CONTROLLER	An HP64100 Development Station set to Master Controller. This selection is made on the I/O Rear Panel board, by the placement of two jumpers inserted into IC sockets. Each system must have one and only one Master Controller, and it must be physically located at the end of the system bus daisy-chain (although its HP-IB address may be any unused address from 2 through 7). The Master Controller must contain a cassette tape drive unit in order to load the Operating System Software Tape, 64800A.

Table 8-1. System Mnemonics (Cont'd)

Status	Message
SYSTEM BUS	The HP64000 System Bus is the HP-IB. Interface in the Development Stations consists of the I/O Control board which contains the active circuitry, and the I/O Rear Panel board to which the HP-IB cable connects. The 7910 Disc Drive contains HP-IB interfacing internally, and the MAC Disc Family utilizes a 12745A HP-IB Adaptor Card which plugs into the disc controller. The printers are also directly HP-IB compatable. Bus addresses are switch selectable, and the HP64000 System requires a disc to be at address 0, the printer at address 1, and all Development Stations and any additional discs to be at addresses 2 through 7.
SYSTEM CONTROL SOURCE	Two Development Station Rear Panel switches which select the source for boot-up. Turn the Development Station power switch off, select the desired System Control Source setting, and turn the power back on. This will cause the CPU to read these rear panel switches and take appropriate action. The possible settings are: PERFORMANCE VERIFICATION (1 1) - This selection initiates PV from ROM internal to the Development Station. See Section IV, PV and Troubleshooting. LOCAL MASS STORAGE (1 0) - Loads from the Cassette Tape. This mode is used to load the Operating System Software, HP64800A. See Section II, Installation. ROM (0 1) - When selected, allows for operating the CPU from internal ROM. This mode is not used at this time. SYSTEM BUS (disc) (0 0) - Provides for booting up from the disc located at HP-IB address 0. Once the cassette tape has been loaded onto the disc using the Local Mass Storage mode, this System Bus selection is the mode for normal operation.
UNIT SELECT #	(Used with MAC discs only; Set to 0). Switch setting from 0 through 7 located on the drive unit itself, read by the 13037C Controller to identify different drive units. In the HP64000 system one drive must be Unit Select 0.

Table 8-2. Status Line Messages

GENERAL
These messages may appear on the "Status Line" in various programs under system operation and have the same meaning in all cases.

Status Message	Meaning
PAUSED (to initiate RESET press RESET again)	The RESET key has been pressed once. Pressing any other key resumes normal operation.
CAPS LOCK on	All alphabetic keys default to upper case.
CAPS LOCK off	All alphabetic keys default to lower case.
INSERT CHAR on	Characters typed will be inserted at special blinking ( ) cursor.
INSERT CHAR off	Normal non-inserting operation resumed.
Recall buffer empty	No valid commands have been issued since boot-up.
I/O Bus wait	The 64100 station displaying this message is waiting for a network resource.
I/O Bus reset	The master controller station displays this message when it has had to assert control to gain access to a network resource.
Waiting for printer	The 64100 station displaying this message is waiting for another station which is using the printer.

Error Message	Meaning	Corrective Action
End of file file=FILE:type	A premature end of file was encountered.	Regenerate file in question.
Illegal disc file=FILE:type	There is no disc with LU number on this file.	Attach appropriate disc or reference valid disc LU number.
File not found file=FILE:type	The file is not on disc.	Reference valid file.
File exists file=FILE:type	The file exists (the error implies attempt to create by same name).	Purge file, if unwanted, or create new file.
Disc full file=FILE:type	The disc is too full to work with named file.	Purge unwanted files.

Table 8-2. Status Line Messages (Cont'd)

GENERAL		
These messages may appear on the "Status Line" in various programs under system operation and have the same meaning in all cases.		
Error Message	**Meaning**	**Corrective Action**
Directory full file=FILE:type	The file cannot be created, directory full.	Purge unwanted files.
Corrupt file	File Name: userid: type is corrupt The disc links are bad.	Bring the source file into the editor to recover the maximum amount of the file. Other file types may be recreated from the source file, via the system.
Retrying disc N	One of the following has occurred in access-ing disc LU# N: Seek check Head just reloaded Transmission error Cylinder, Head, Track compare error Data error Illegal track access Head off track Write to unprotected track	Wait for retry to recover itself. If it does not, re-boot system and disc. If trouble continues, call HP service representative.
Disc N down	Disc with LU# N is in one of the following states: Power off Drive fault Heads not loaded Unit not present Busy Read has timed out	Check disc LU# N for error indications.
Printer down	The printer is powered off or off line.	Check printer.
Recovered	The system has recover-ed from one of the last three conditions.	None.
File name:HP not present	The system software by this name is not on disc LU=0.	Boot from appropriate system software tape.

Table 8-2. Status Line Messages (Cont'd)

GENERAL		
These messages may appear on the "Status Line" in various programs under system operation and have the same meaning in all cases.		

Error Message	Meaning	Corrective Action
Syntax error	The command just issued has a syntax error at the point where the cursor is located.	As the softkeys are labelled to indicate the valid syntax at the cursor position, modify command to reflect a valid choice.
Invalid input, question must be answered	A non-reproducable file which already exists is about to be overwritten and user permission is being requested.	Answer the question: "yes" - I do mean to overwrite the file. "no" - I do not want the file overwritten.

MONITOR	
These messages may appear on the "Status Line" when user is in the system monitor (mode at power-up).	

Status Messages	Meaning
Awaiting command userid " "	System is ready for commands and the default userid is " ".
Fri, 27 Feb, 1981, 11:40 (example)	Date or time command has displayed current system date and time.
Commands to file FILE until "log off"	Log_commands activated to file.
No·action taken	Log or copy command was aborted by user's choice not to purge existing file.
Copying	One file is being copied to another.
Transmitting record N	Record N of a file is being transmitted out over RS-232-C via copy.
Waiting for data	Copy from RS-232-C is waiting for data to be received.
Receiving record N	Record N of a file is being received over RS-232-C via copy.
Copy complete, N records transferred	Copy using RS-232-C complete.

Table 8-2. Status Line Messages (Cont'd)

MONITOR	
These messages may appear on the "Status Line" when user is in the system monitor (mode at power-up).	
Status Messages	**Meaning**
Copy complete, N records transferred (RS-232-C timed out)	Copy using RS-232-C ended by time out on received data.
Searching for files	Directory is searching disc for files.
Listing files	Directory is listing files to listfile.
Searching for user ids	Directory is scanning disc for all_userids.
Searching for recoverable files	Directory is reading recoverable file list.
Listing recoverable files	Directory is listing recoverable files to listfile.
End of directory, N files listed	Directory is complete.
Rewinding	Tape cartridge is being rewound.
Searching	Restore or verify is finding file on tape.
Waiting for input	Restore is waiting for response to question.
Storing FILE	File is being written to tape.
Verifying FILE	File on tape is being compared to disc.
Store complete, files stored=N of M	N of the M files meeting the qualifications given have been stored (for reason others were not restored, see listing).
Restore complete, files restored=N of M	N of the M files meeting the qualifications given have been restored (for reason others were not restored, see listing).
Verify complete, files verified=N of M	N of the M files meeting the qualifications given have been verified (for reasons others were not verified, see listing).
Reading directory	Tape command is reading tape directory.
Premarking directory	Store command is pre-marking tape directory.
Writing directory	Tape command is updating tape directory.
Tensioning tape	Tension command is tensioning tape.
Cartridge tension complete	Tensioning tape finished.

Table 8-2. Status Line Messages (Cont'd)

MONITOR

These messages may appear on the "Status Line" when user is in the system monitor (mode at power-up).

Error Message	Meaning	Corrective Action
Invalid to recover across discs	A recover has been attempted from one LU to another.	Revise command to use only one LU.
Invalid to rename across discs	A rename has been attempted from one LU to another.	Revise command to use only one LU.
File may not be appended to itself	A library command has the same file as source and destination.	Revise command to use two distinct file names.
Invalid time	An illegal time has been specified.	Revise time per HH:MM format.
Invalid date	An illegal date has been specified.	Revise date per Day/Mon/Year format.
Invalid disc number	A disc LU number not assigned was used.	Revise LU number to one currently assigned.
File not found	A file in the issued file management command does not exist.	Correct to an existing file name.
System error S1	The system has run out of available memory.	Reboot, if problem recurs frequently call an HP service representative.
Parameter & NAME not found	During execution of a command file, an undeclared parameter was found.	Examine command file and correct parameter name or declaration.
Maximum parameter name size exceeded	During read of PARMS statement in a command file, the maximum number of total characters in parameter names was exceeded.	Use shorter or fewer parameter names.
More parameters passed than declared	During invocation of command file, text for more parameters than declared was passed.	Declare additional parameter or correct text passed.

Table 8-2. Status Line Messages (Cont'd)

MONITOR

These messages may appear on the "Status Line" when user is in the system monitor (mode at power-up).

Error Message	Meaning	Corrective Action
"log_commands" not allowed in command file	A "log_commands" command was in a cmdfile.	Remove "log_commands" from command file.
Maximum parameter text length exceeded	The absolute maximum on length of text to be substituted for cmdfile parameters has been exceeded.	Shorten the number of ASCII characters in text being passed to cmdfile parameters.
Framing error	During copy from RS-232-C one of the following errors occurred: Receive/Transmit baud rate are different Parity error occurred Character length Number of stop bits wrong	Check for consistency in setup of RS-232-C transmitter and receiver.
Only source and list files may be copied to devices	The copy command does not allow files of type other than source or listing to be copied to the display or printer.	As other files are encoded in binary, listings do not make sense. Such files may be copied to other files or to RS-232-C.
Illegal directory or tape format	The data cartridge being read was created on another system which did one of the these: Did not adhere to the Standard Interchange Format (SIF) used by the 64000 system tape software. Used no directory or a directory format different from that of the 64000 tapes.	The information is obtainable from the tape only if the tape is in the SIF format. To avoid an imcompatable directory format, files must be referenced by file number (see restore and verify command description).
Disc number is invalid	An attempt was made to read the directory on a disc whose LU was not defined at power up.	If the disc was attached after power up reboot the system, otherwise correct command to a valid LU.

Table 8-2. Status Line Messages (Cont'd)

MONITOR

These messages may appear on the "Status Line" when user is in the system monitor (mode at power-up).

Error Message	Meaning	Corrective Action
File(s) not found	Files requested to be written to a tape were not found on disc.	Revise the command to reference existing files.
Powerfail or bus reset	During a tape operation a powerfail or bus reset occurred aborting the operation.	Repeat the attempted operation.
Cartridge out	No data cartridge was detected following a tape command.	Insert data cartridge and re-issue command.
Servo failure	A servo failure in the tape drive was detected.	Check all cable connections to tape drive and tape control board. If problem continues contact an HP service representative.
Write protected	A command requesting a write of data to tape was issued and the write protect tab is in the protect position.	To write to the tape slide the black record tab in the direction indicated for record.
Device timeout	The tape drive hardware did not respond within correct time interval.	Check all cable connections to tape drive and tape control board. If problem continues contact an HP service representative.
Tape cartridge hardware not present	No tape control board was detected in the card cage of station on which a tape command was given.	Check connections of tape control board, if present issue command on station with tape hardware.
File to big for tape, split file into 2 pieces	A file with data length greater than tape capacity cannot be stored as a single file.	Modify file such that it does fit. Probably split a source or listing file in half.

Table 8-2. Status Line Messages (Cont'd)

MONITOR

These messages may appear on the "Status Line" when user is in the system monitor (mode at power-up).

Error Message	Meaning	Corrective Action
Tape's directory is empty	An attempt was made to read the directory of a tape whose directory is pre-marked but no files are stored on it.	The tape is empty and should now be accessed only by a store command.

EDITOR

These messages may occur on the "Status Line" when using the text editor.

Status Message	Meaning
Start of text	Start of file text reached on roll or page key.
End of text	End of file text reached on roll or page key.
Deleting	The delete command is executing.
Lines deleted N	The delete issued is complete and N lines were deleted.
Finding	The find command is executing.
Found in column: N	The specified string was found in column N of the current line on screen.
Replacing	The replace command is executing.
Strings changed: N	The replace command has modified N occurrences of the string.
Repeating	The repeat command is executing.
Lines added: N	Repeat is complete, N lines were added.
Autotab is now on	The autotab feature has been turned on.
Autotab is now off	The autotab feature has been turned off.

Table 8-2. Status Line Messages (Cont'd)

EDITOR	
These messages may occur on the "Status Line" when using the text editor.	

Status Message	Meaning
Retrieving	The retrieve command is executing.
Lines retrieved: N	Retrieve is complete, N lines were added.
Listing	The list command is executing.
Lines listed: N	List is complete, N lines were listed.
Range is now columns N thru M	All string searches will now locate only strings meeting specifications and whose first character is between columns N through M inclusive.
Range is now column N	All string searches will now locate only strings meeting specifications and whose first character is in column N.
Renumbering	The renumber command is executing.
Lines in text: N	Renumber is complete and the file contains N lines.
File not purged, edit resumed	User has chosen not to overwrite an existing source file and the edit has resumed pending and end or reset.
Positioning	The editor is positioning the current line to the line number specified.
Numbered line found	The specified line number has been found and is now the current line.
Merging	The merge command is executing.
Lines merged: N	Merge is complete and N lines were merged into edit file.
Copying	The copy command is executing.
Lines copied: N	Copy is complete and N lines were copied to an internal buffer.
Extracting	The extract command is executing.
Lines extracted: N	Extract is complete and N lines were moved from the edit file to an internal buffer.
Ending into FFFF:UUU	The text is being placed in the file FFFF:UUU the editor terminates.

Table 8-2. Status Line Messages (Cont'd)

EDITOR

These messages may occur on the "Status Line" when using the text editor.

Error Message	Meaning	Corrective Action
Invalid command	The command issued does not begin with the first word of a valid editor command.	Choose command from among choices displayed on softkeys.
Invalid file name	Syntax requires a valid file name.	Correct command at cursor to a valid file name.
Invalid string	The character string entered is syntactically wrong.	Correct string indicated by cursor.
Invalid line number	Syntax requires a valid line #.	Enter valid line # at cursor.
Invalid column	Syntax requires a valid column #.	Enter a valid column # at cursor.
Edit aborted, disc full	Insufficient free space available on disc to perform edit.	Purge undesired files.
Edit aborted, directory full	Insufficient free space available on disc to perform edit.	Purge undesired files.
Scratch file error, disc full	Insufficient free space available on disc to perform edit.	Purge undesired files.
Scratch file error, directory full	Insufficient free space available on disc to perform edit.	Purge undesired files.
Limit not found, no lines deleted	The <LIMIT> specified does not exist.	Enter a valid limit a at cursor.
String not found	This specified string or its default value was not found.	Enter a valid string at cursor.
Limit not found, no strings replaced	The <LIMIT> specified with the command does not exist. No replacement has been made.	Enter a valid limit with the command.
No destination file	The edit file is a new unnamed file.	A file name must be specified.

Table 8-2. Status Line Messages (Cont'd)

EDITOR		
These messages may occur on the "Status Line" when using the text editor.		

Error Message	Meaning	Corrective Action
Invalid input, question must be answered	This is the result of any input other than an answer to the "delete".	Enter a valid input to answer the question.
Line not present	The specified line number is not in the file.	Specify a valid line number of the file.
No merge file	<FILE> was not specified and there has been no previous merge command or there is no <FILE> as specified.	Specify a valid file for the merge command.
Invalid line specification	Line limits inverted.	Specify valid line limits.
File not found	Merge file does not exist.	Specify a valid merge file.
Limit not found, no lines copied	The <LIMIT> specified with the command does not exist; no lines have been copied.	Specify a valid limit.
Limit not found, no lines extracted	The <LIMIT> specified with the command does not exist, no lines have been extracted.	Specify a valid limit.
No text has been saved	There is currently no text in the temporary storage buffer; no text can be retrieved.	Copy or extract text into the buffer and then retrieve.
Invalid string	The string has been specified improperly. Delimiters may be missing or illegal character may be contained in the string.	Specify a string with legal characters deliminated by , " or ".

Table 8-2. Status Line Messages (Cont'd)

EMULATOR
These messages may occur on the "Status Line" when using the emulator.

General Emulator Status	

Status Message	Meaning
Ready*	Processor is ready to step/run
Stopped*	Processor stopped
Running*	Processor running
Single cycled*	Processor single cycled
Pseudo run*	Processor pseudo running
Single cycling*	Processor single cycling
Command causes pseudo run	Occurs when user specified real time execution only
Causes single cycling	Occurs when user specified real time execution only
Program loading	Loading program code in process
Program loaded	Loading program code completed
(* Optional processor dependent status)	
TRACE MESSAGE (appears to right of Processor message)	
Trace in process	Analysis is in process
Trace complete	Analysis is complete
Trace stopped	User stopped analysis

8080/8085 Processor Dependent Status	

Status Message	Meaning
Hold, slow clock	Processor in hold state
Halt, slow clock	Processor in halt state
Wait, slow clock	Processor in wait state
Reset, slow clock	Processor in reset state

When HOLD, WAIT, and RESET are all valid, and an error condition remains, it is likely that there is no clock.

Table 8-2. Status Line Messages (Cont'd)

EMULATOR
These messages may occur on the "Status Line" when using the emulator.

6800 Processor Dependent Status

Status Message	Meaning
Reset	Hardware signal/RESET
Halt	Hardware signal/HALT
Waiting for interrupt	Hardware signal BA
Three state control	Hardware signal TSC
Slow clock	See note below

When there is no clock, the emulator looks at the following hardware signals in order. /RESET, /HALT, BA, TSC. If any one of the signals is in the active state, the corresponding message is issued. If none of these signals are in the active state and there is no clock. the "Slow Clock" message is issued.

Z80 Processor Dependent Status

Status Message	Meaning
Reset	Hardware signal/RESET
Halt	Executed a HALT instruction
Wait	Hardware signal/WAIT
Bus Acknowledge	Hardware signal/BUSAK (Has been put in mode to wait for DMA)
Slow clock	Begun by instruction

When there is no clock, the emulator looks at the following hardware signals: /RESET, /WAIT. If any of those signals is in the active state, the corresponding message is issued. If none of these signals is in the active state and there is no clock, the "Slow Clock" message is issued.

Table 8-2. Status Line Messages (Cont'd)

EMULATOR
These messages may occur on the "Status Line" when using the emulator.

General Emulator Error Messages

Error Message	Meaning	Corrective Action
Illegal memory reference nnnnH last fetch nnnnH	Illegal memory reference at address nnnnH and last fetch was address at nnnnH.	Fix program code.
Illegal opcode nnH last fetch nnnnH	Illegal opcode of nnH and last fetch was at address nnnnH.	Fix program code.
Illegal memory request nnnnH	Illegal memory request at address nnnnH.	Do not make invalid access to memory.
Memory timeout	Emulation memory read/ write timeout.	Run option_test performance verification.
Not ready	Processor not ready - May be caused by slow clock or background code not available.	Verify target system clock if external clock. Reinitialize emulation system. Reload emulation system tape. Verify option_test performance verification.
Slow clock (Processor dependent status)	Processor slow clock - May be caused by no external clock or emulation hardware failure.	Verify target system clock has been selected or execute option_test performance verfication.