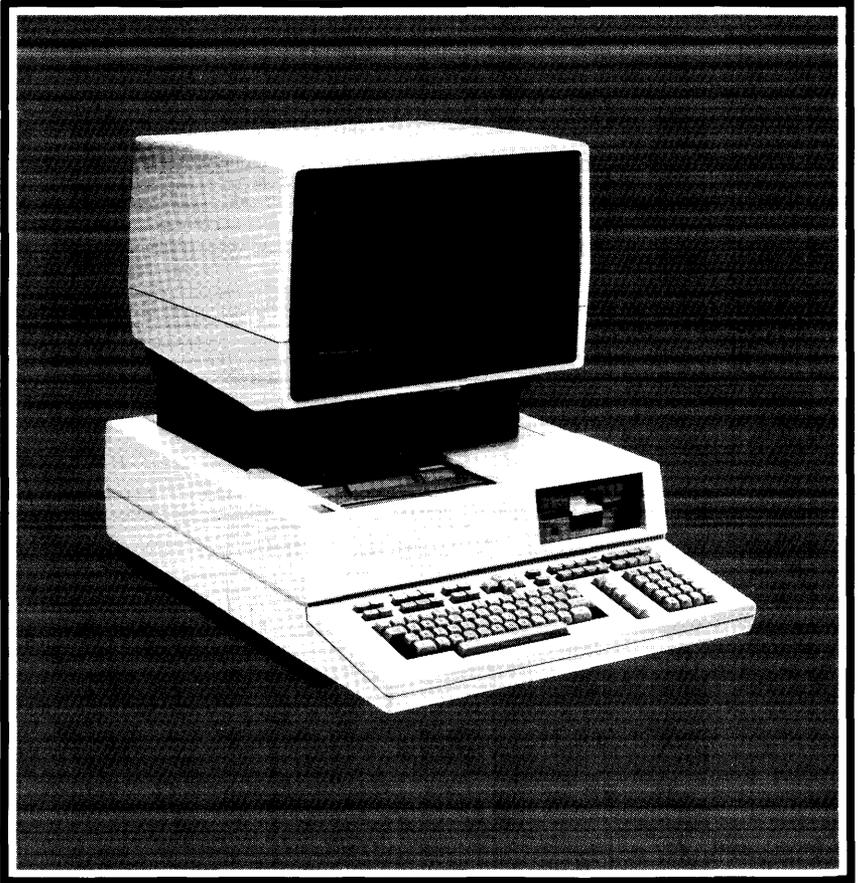


# 9020 CE Handbook



# 9020 CE Handbook

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## Note

This handbook is ONLY for the use of HP-qualified Service Personnel.

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## Printing History

New editions of this manual will incorporate all material updated since the previous edition. Update packages may be issued between editions and contain replacement and additional pages to be merged into the manual by the user. Each updated page will be indicated by a revision date at the bottom of the page. A vertical bar in the margin indicates the changes on each page. Note that pages which are rearranged due to changes on a previous page are not considered revised.

The manual printing date and part number indicate its current edition. The printing date changes when a new edition is printed. (Minor corrections and updates which are incorporated at reprint do not cause the date to change.) The manual part number changes when extensive technical changes are incorporated.

August 1984...Edition 1. Replaced the 9020 CD Handbook, 09020-90039, and all updates.

January 1984...Edition 1 with updates.

April 1985...Edition 1 with update merged.

July 1985...Update.

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### WARRANTY

A copy of the specific warranty terms applicable to your Hewlett-Packard product and replacement parts can be obtained from your local Sales and Service Office.

# 9020 Product Information

**Chapter**
**1**

## Product Information

### Features

- 32-bit CPU and full 32-bit internal and external data paths.
- Add-on performance with multiple CPUs.
- Up to 10 Mbytes RAM.
- 36 Mbyte/second memory processor bus.
- Four internal HP-CIO slots expandable to 20.
- Virtual memory with 500 Mbyte address space.
- Single-user or multi-user system.
- HP-UX Operating System with FORTRAN 77, Pascal, or C languages; or BASIC Language System.
- Error correcting and self-healing memory.
- High-performance interactive graphics.
- Broad range of peripherals.

### Central Processor Unit

- 32-bit single chip composed of 450,000 transistors.
- Direct address range of 500 Mbytes.
- Supports IEEE Floating Point Format.
- Instruction set of 230 operation codes.
- 18 MHz clock rate with micro-instruction cycle time of 55 ns and memory cycle time of 110 ns.
- Typical execution times:

(CPU without math chips)

Load register from memory .....	550 nanoseconds
64-bit floating point multiply .....	10.34 microseconds
32-bit integer multiply .....	2.92 microseconds
64-bit floating point add .....	5.94 microseconds

(CPU with math chips)

Floating point math chips decrease program time by performing math functions in hardware chips. Improvement: 1.4 times faster (overall). Twice as fast on B1D program.

### Memory

- 256 Kbyte RAM finstrates, 512K byte polystrates, or 1M byte polystrates.
- RAM memory expandable to 2.5 Mbytes.
- Single-bit error detection and correction.
- Double-bit error detection.

### I/O Processor

- Supports 8 I/O channels with DMA capability on every channel.
- Two additional IOPs and their associated 97098A I/O Expanders are supported.
- Nominal IOP bandwidth of 900 Kbytes/second.
- Maximum IOP bandwidth of 5.1 Mbytes/second.

## Real Time Clock

- Provides date and time of day.
- Accuracy to within 2 minutes/month within 0°C to 45°C.
- Battery-maintained up to 30 days nominal and 10 days worst case.

## System Components

Component	9020A	9020B	9020C	9020AS	9020AT
CRT	Standard Color	Monochromatic	High Performance Color	Standard Color	Standard Color
Keyboard	ASCII Standard				
RAM (std.)	512K byte		1.0 Mbyte		1.5 Mbyte
RAM (opt.)	Up to 10 Megabytes (256K, 512K, and 1M Boards)				
Mass Storage	5¼" Flexible Disc		10M byte Fixed Disc 5¼" Flexible Disc	5¼" Flexible Disc (CS 80 Disc/Tape is Required)	
Thermal Printer	Optional		Standard		
CPU	Single is standard, up to 2 additional are allowed				
IOP	Single is standard, up to 2 additional I/O Expanders are allowed				
System Software	Optional-BASIC or HP-UX (single or multi-user HP-UX) HP BASIC is single-user)		HP BASIC and 2D-3D Graphics-Standard (HP BASIC is single-user)	HP-UX (single-user), FORTRAN 77, Pascal, Graphics, DGL, Graphics AGP.-standard	
HP-IB	Optional			Standard	

## CRT Display Specifications

	Standard Color	High-Performance Monochromatic	High-Performance Color
Screen size	12.2 in. (310mm)	12.2 in. (310mm)	13 in. (330mm)
Screen brightness	50 Hz = 27 ft.-Lamberts 60 Hz = 31 ft.-Lamberts	To 30 ft.-Lamberts	To 40 ft.-Lamberts
X-Ray emission	<0.5 mR/hr.	<0.5 mR/hr.	<0.5 mR/hr.
Refresh rate	50 or 60 Hz	60 Hz	60 Hz
Maximum altitude	15,000 ft.	15,000 ft.	15,000 ft.
Screen capacity	26 lines x 80 characters	26 lines x 80 characters	26 lines x 80 characters
Dot spacing	.017 in. (.428mm)	.013 in. (.328mm)	.013 in. (.343mm)
Character matrix	7 x 9 characters in a 9 x 12 cell	7 x 9 character font in a 9 x 12 cell	7 x 9 character font in a 9 x 12 cell
<b>Graphics</b>			
No. of colors	16 displayed from 4,096	Monochrome	8 pure, 4,913
Raster size	8.5 in. x 6.4 in. (216 x 162.5mm)	7.24 in. x 5.86 in. (184 x 149mm)	7.55 in. x 6.14 in. (192 x 156mm)
Array size	512 x 390 dots	560 x 455 dots	560 x 455 dots
Dot resolution	.017 in. (.42mm)	.013 in. (.33mm)	.013 in. (.34mm)
Linearity	<2.5% full screen	1.5% full screen	<2% full screen
<b>Cursor</b>			
Plotting mode	Full screen or small crosshair	Full screen, small crosshair or blinking underline	Full screen or small crosshair
Letter mode	None	Blinking underline	Blinking underline
Character editing	Overstrike	Overstrike	Overstrike
<b>Light Pen</b>			
Min. intensity for pick of single pixel	N/A	10 ft.-Lamberts (white, blue, or green)	10 ft.-Lamberts (white, blue, or green)

## Internal Thermal Graphics Printer Specifications

The internal printer offers the following features:

- True overprinting.
- Printing enhancements such as inverse (white characters on black), underline, overline and 150% tall in any combination.
- Capability to dump graphics from CRT (pixel-by-pixel). BASIC only.
- Seven user-definable characters.
- Standard character sets are: US ASCII and Line Drawing, HP Roman Extension or Katakana.
- Programmable vertical pitch, lines per page and top/bottom margin.

Line width	80 columns
Print speed	Up to 450 lines/minute
Character sets	Roman Extension or Katakana
Graphics resolution	560 dots/line, 77 dots/inch (vertical and horizontal)
Plot speed:	
Nominal plot	0.49 inches/second (12.5 millimetres/second)
Plot all pixels on	0.15 inches/second (3.8 millimetres/second)
Character matrix	5 x 7 dots (7 x 12 field)
Paper dimensions	8.27 inches x 197 feet (210 millimetres x 60 metres)
	8.5 inches x 200 feet (216 millimetres x 61 metres)
Paper types	Black or blue print, perforated, fan fold, 330 sheets per package.

## Internal Flexible Disc Specifications

Capacity	270,336 bytes user available (formatted), less file directory allocation
Media	5.25 inches (133 millimetres) double-sided/double density disc
Average media life	More than 2.5 million revolutions (140 hours rotating), stops when not accessed
Tracks per disc	70 total, 35 per side, 66 user available
Sectors per track	16
Bytes per sector	256
Average access time	300 milliseconds
Maximum access time	425 milliseconds (assumes no data errors)
Average throughput	16 kbytes/second (interleave factor of 1)

## Internal Fixed Disc Specifications

Capacity	9.896 Mbytes (formatted), less directory file allocations
Number of platters	2
Number of tracks	1224 (306 cylinders x 4 heads); 1208 user available
Sectors per track	32
Bytes per sector	256
Average access time	85 milliseconds
Maximum access time	205 milliseconds (assumes no errors detected)
Average throughput	115 kbytes/second (interleave factor of 4)

## Keyboard Options

ASCII (standard), French, German, Spanish, Katakana, and Swedish/Finnish.

## System Software

### HP BASIC

HP Product No.	Software
97050A	BASIC Language System (single-user)
97052A	BASIC 2D/3D Graphics
97053A	IMAGE/QUERY-9000 DBMS
97056A	BASIC Asynchronous Terminal Emulator
97058A	Shared Resource Management
98354	HP-FEM II Finite Element Modeling (Eur. only)
98355	HP-DESIGN Software (Eur. only)

### HP-UX

HP Product No.		Software
Single-user	Multi-user	
97070A	97080A	HP-UX Operating System
97071A	97081A	FORTRAN 77 Compiler
97072A	97082A	HP Pascal Compiler
97073A	97083A	IMAGE-9000 DBMS
97074A	97084A	HP-UX GRAPHICS DGL
97075A	97085A	HP-UX GRAPHICS AGP
	97076A	Asynchronous Terminal Emulator
97077A	97087A	RJE Communications Software
98163A	98183A	HPSPICE Circuit Simulation
	2285A	Local Area Network
	97086A	Applications Migration Package

## Accessories Supplied

The following items are supplied with the 9020:

Installation and Test Manual .....	HP Part Number 09020-90013
Flexible Disc Media .....	2 each, 256K byte
Special Function Key Overlays .....	2 blank, HP Part Number 7120-3107
System Functional Test Manual .....	HP Part Number 09020-11031

If 9020A, C, R or T is ordered, add:

Fuse .....	2110-0051 for 100 – 120 Vac
	2110-0056 for 220 – 240 Vac

If optional thermal printer is ordered, add:

	HP Part Number
Paper Tray .....	09855-67951
For Opt. 590:	
Thermal Paper (8½inch wide, black-on-white, 1 package of 330 sheets) .....	9270-0640
For Opt. 591:	
Thermal Paper (210 millimetres wide, black-on-white, 1 package of 330 sheets) .....	9270-0642

## Accessories Available

### Thermal Printer Paper

(4 packs/box, 330 sheets/pack)	
8½ inch wide, black on white.....	9270-0640
8½ inch wide, blue on white .....	9270-0641
210 millimetres wide, black on white.....	9270-0642
210 millimetres wide, blue on white .....	9270-0643
5¼ inch Flexible Discs (box of 10).....	92190A
Flexible Disc Head Cleaner Kit.....	92193A
Power Line Conditioner .....	35030A
Workstation Table .....	92213A

## User Documentation

### BASIC Manuals

HP Part No.	Description
97050-90000	BASIC Programming Techniques
97050-90005	BASIC Language Reference
97050-90015	BASIC Condensed Reference
97050-90045	BASIC Software Configuration
97050-90090	Where Do I Start With BASIC?
97052-90000	BASIC Graphics Programming Techniques
97050-80020	HP BASIC Manual Package (includes all above manuals)
97050-90102	BASIC Software Manual Catalog
97053-90000	IMAGE/Data Base Programming Techniques
97053-90001	QUERY User's Guide
97053-90002	Data Base Design Kit
97056-90000	HP BASIC Asynchronous Terminal Emulator User's Manual

### HP-UX Manuals

HP Part No.	Description
09000-90007	HP-UX Reference
97073-90006	IMAGE HP-UX Reference Supplement
98680-90025	Introducing the UNIX System by McGilton & Morgan
97089-90004	HP-UX Concepts and Tutorials (4 Vols.)
97089-90048	HP-UX System Administrator's Manual
97080-90093	Unpacking Instructions for the HP 9000 Series 500 Computers
92836-90005	Structured FORTRAN 77 Programming by Pollack
97081-90001	FORTRAN/9000 Reference
92832-90002	Programming in Pascal by Grogono
97082-90001	Pascal/9000 Reference
97082-90002	Programming in Pascal with Pascal/9000
97084-90002	DGL/AGP Demonstration Instructions
97089-90000	The C Programming Language by Kernighan & Ritchie
97086-90001	Applications Migration Reference
97086-90002	Applications Migration Users Guide
97059-90000	HP-UX Local Area Network (LAN) User's Guide
97059-90001	HP-UX LAN Node Manager's Guide
97076-90001	HP-UX Asynchronous Communications User's Guide
97077-90011	RJE Synchronous Data Communications User's Guide
97084-90000	DGL Programmer Reference
97084-90001	DGL Supplement for the Series 500
97084-90026	Graphics/9000 Device Handlers Manual
97085-90000	AGP User's Guide
97085-90001	AGP Supplement for the Series 500
97085-90005	AGP Reference
98680-90021	Fortran Comparison Notes
98680-90045	HP-UX Portability Guide

## Service Documentation

HP Part No.	Description
09020-80038	Service Documentation Package (includes 09020-90013, 09020-90037, 09000-90040, Sales and Support Offices List (5955-6587), 98770A Color Graphics Display Service Manual (98770-90031), 98780A Monochromatic Display Service Manual (98780-90030), and 2-inch binder (9282-0989)).
09020-90013	Installation and Test
09020-90037	Service Manual
09020-90035	CE Handbook
09000-90040	Series 200/500 Site Preparation Manual
97060-90030	HP 97060A Graphics Processor Service
97062-90020	HP 97062A Color Output Interface Installation and Service
97098-90020	HP 97098A I/O Expander Installation and Service
27132-91001	HP 27132A HP-CIO Technical Reference Manual
09020-11031	System Functional Tests

## Tools List

HP Part No.	Description
8710-0899	#1 Pozidriv screwdriver
8710-0900	#2 Pozidriv screwdriver
8730-0001	Flat-blade screwdriver
8720-0015	5 16-inch wrench
8710-0881	1 8-inch Allen hex key
8710-1164	4 millimetre Allen hex key
8720-0006	7 16-inch nutdriver
8710-0004	Longnose pliers
5040-7433	Keycap puller
09855-67004	Power supply discharge tool
9300-0794	Antistatic kit
09815-20602	Paper Spindle tool
09020-10010	Test Pack

## Safety Considerations

### WARNING

SWITCH POWER OFF AND UNPLUG POWER CORD FROM AC OUTLET BEFORE REMOVING ANY ASSEMBLY. LETHAL VOLTAGES ARE PRESENT INSIDE THE COMPUTER. OBSERVE ALL WARNING LABELS.

### PRIMARY WIRING CHANGE WARNING

AFTER MAKING A PRIMARY WIRING CHANGE, PERFORM CONTINUITY TEST BETWEEN POWER CORD GROUND AND METAL CHASSIS. RECORD RESULTS ON REPAIR ORDER.

### POWER SUPPLY WARNING

WHEN POWER SUPPLY IS REMOVED FROM COMPUTER, YOU ARE EXPOSED TO LETHAL VOLTAGE FROM POWER SUPPLY CAPACITORS. WAIT AT LEAST 15 MINUTES AFTER POWER IS SWITCHED OFF BEFORE REMOVING SUPPLY, OR DISCHARGE SUPPLY WITH THE POWER SUPPLY DISCHARGE TOOL.

# 9020 Environmental/Installation/PM

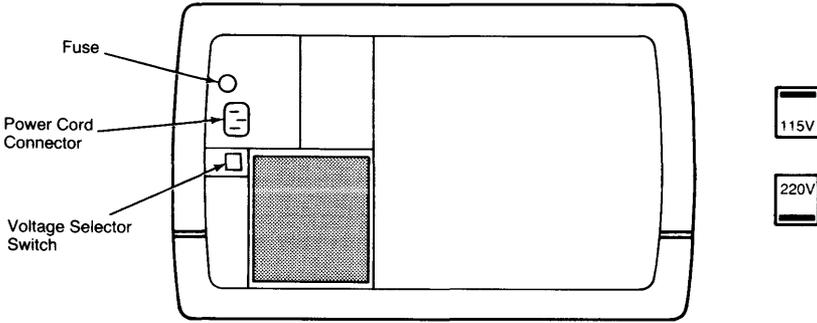
**Chapter**
**2**

## Environmental

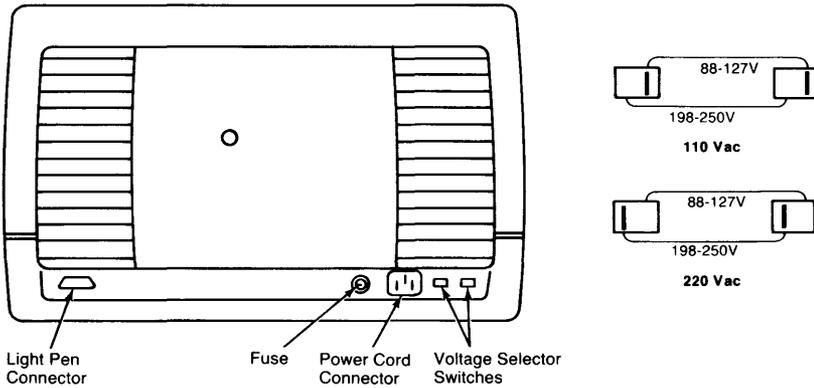
Width .....	21.75 inches (55.2 centimetres)
Depth .....	29 inches (73.6 centimetres)
Height .....	24.5 inches (62.2 centimetres)
Net Weight:	
9020A .....	137 pounds (62.1 kilograms)
9020B .....	121 pounds (55 kilograms)
9020C .....	163 pounds (74 kilograms)
Shipping Weight:	
9020A .....	168 pounds (76.2 kilograms)
9020B .....	152 pounds (69 kilograms)
9020C .....	194 pounds (88 kilograms)
Temperature:	
Operating .....	10° to 40°C (with disc media)
Storage .....	-40° to 75°C (flexible disc media excluded)
Slew Rate (10-Mbyte Winchester) .....	10°C per hour
Humidity .....	20-80% RH non-condensing (maximum wet bulb, 25.5°), machine operating
Altitude .....	15,000 feet (570 mbars barometric pressure), machine operating
Voltages .....	90-125 Vac or 189-250 Vac
Line Frequency Range .....	48-66 Hz
Current Requirements .....	12.0 A at 108 Vac 8.0 A at 198 Vac 15.0 A at 90 Vac (Japan)
Power Dissipation .....	850 Wats (2900 BTU/hr.)
Vibration (peak-to-peak amplitude deflection) .....	0.125 inches at 5 to 10 Hz 0.060 inches at 10 to 25 Hz 0.015 inches at 25 to 55 Hz

## Installation Procedure

1. Unpack the computer.
2. Position the computer. Leave about 6 inches of space at back of computer and 6 inches at top.
3. Install the display. Check display voltage selector switches and fuse.



9020A Display



9020C Display

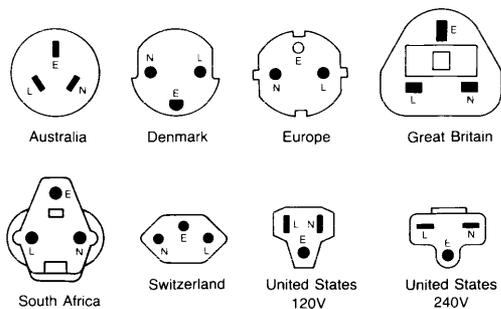
### Fuse for 9020A Display

Voltage Rating	Fuse Rating	Part Number
250V	5A NB	2110-0010

### Fuse for 9020C Display

Voltage Rating	Fuse Rating	Part Number
100,120V	10A NB	2110-0051
220,240V	6A NB	2110-0056

4. Connect display power cord to power cord connector on back of display (9020A/C/R/T only), and connect mainframe and display power cords to power source.



Country	Display P/N	Mainframe P/N	Opt.	Voltage
Australia	8120-1369	09855-60601	901	250V, 6A
Denmark	8120-2956	09855-61606	912	250V, 6A
Europe	8120-1689	09855-61602	902	250V, 6A
Great Britain	8120-1351	09855-61605	900	250V, 6A
South Africa	8120-4211		917	250V, 10A
Switzerland	8120-2104	09855-61604	906	250V, 6A
United States	8120-1378	09855-61600	903	110V, 10A
United States	8120-0698	09855-61603	904	220V, 10A

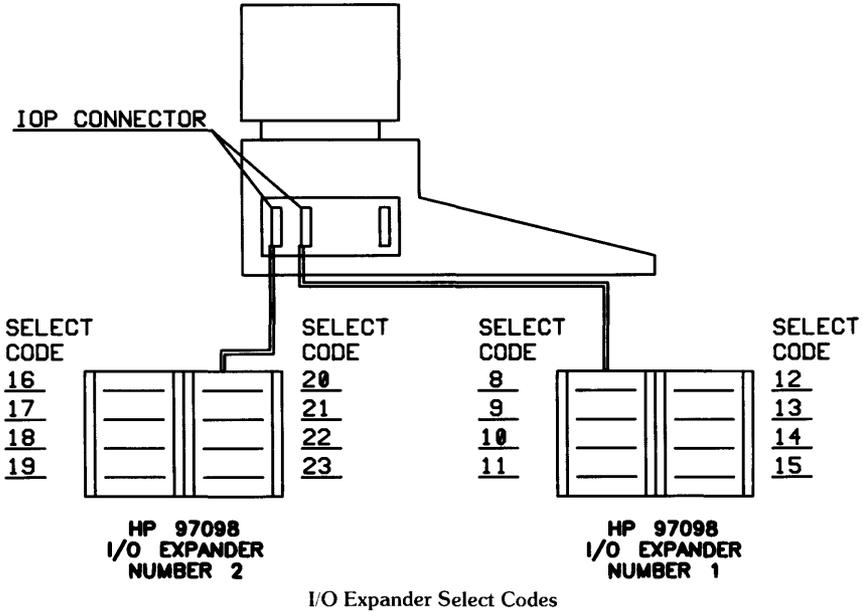
NOTE: Plugs are viewed from connector end. Shape of molded plug may vary within country.

Power cords supplied by HP have polarities matched to the power-input socket on the computer:

- L = Line or Active Conductor (also called "live" or "hot")
- N = Neutral or Identified Conductor
- E = Earth or Safety Ground

### Power Cords

5. Check switch settings of interface cards (Chapter 7).
6. Install interface cards and connect the cables.
7. Install and connect the peripheral devices.
8. Connect the HP 97098A I/O Expander(s) (If applicable).



9. Install paper in printer.

**Printer Paper Part Numbers**

Print Color	Paper Size	Part Number
Black	8.5 x 11 inch	9270-0640
Blue	8.5 x 11 inch	9270-0641
Black	210 x 290 mm	9270-0642
Blue	210 x 290 mm	9270-0643

**Preventive Maintenance**

There are no scheduled preventive maintenance procedures.

## **FINSTRATE INSTALLATION INSTRUCTIONS FOR HP-QUALIFIED PERSONNEL:**

Start on page 2-6 (RAM/CPU), or 2-7 (IOP) and follow the instructions that apply to the installation you are performing. For example, if you are installing a 2nd IOP in a 520 computer you would start on page 2-7, and perform all steps that begin with: (ALL), (ALL 2nd IOP), (ALL EXCEPT 520-3rd IOP), (520), (520 ONLY), and (520-2nd IOP).

ALL RAM and CPU Instructions start on 2-6.

ALL IOP Instructions start on 2-7.

When completed with the installation of the finstrate, Insert the following pages in your CE Handbook (after page 2-4 of either the 9020 or 9030/9040 section).

## RAM/CPU FINSTRATE INSTALLATION

1. **(ALL)**  
TURN THE POWER OFF AND DISCONNECT THE POWER CORD.
2. **(520)** Open the left door.  
**(530)** Remove the front panel.  
**(540)** Remove the front bottom panel.
3. **(530/540 ONLY)**  
From the front of the computer, remove the Radio Frequency Interference (RFI) shield by loosening the six thumbscrews.
4. **(ALL)**  
Open processor stack door.

---

### CAUTION

ELECTROSTATIC DISCHARGE DAMAGE CAN OCCUR IN THE FOLLOWING STEPS. FOLLOW THE PRECAUTIONS IN CHAPTER 4 OF THE SERVICE MANUAL.

DO NOT TOUCH EDGE CONNECTOR OR FINSTRATE PLANE. HOLD FINSTRATE BY EJECTORS OR SIDE EDGES ONLY. HANDLING FINSTRATE INCORRECTLY COULD CAUSE ELECTROSTATIC DISCHARGE DAMAGE. WHEN INSTALLING FINSTRATE, HOLD BY EJECTORS AND MOVE AIR CONTROLLER OUT OF THE WAY WITH THE SIDE EDGE OF THE FINSTRATE.

---

5. **(ALL)**  
Install the finstrate in the first unoccupied slot from the bottom. DO NOT LEAVE EMPTY SLOTS BETWEEN FINSTRATES.
6. **(ALL)**  
Close the processor stack door. Firmly tighten thumbscrews to prevent RFI radiation. Replace the label that is used as a seal for the processor stack door (Part Number 5180-5201).
7. **(530/540 ONLY)**  
Replace RFI shield.
8. **(520)**  
Close left door.  
**(530)**  
Replace front panel.  
**(540)**  
Replace the front bottom panel.
9. **(ALL)**  
Connect power cord to ac outlet.

## IOP FINSTRATE INSTALLATION

### WARNING

OBSERVE ALL WARNINGS AND SAFETY PROCEDURES IN THE COMPUTER SERVICE MANUAL. LETHAL VOLTAGES ARE PRESENT IN THE COMPUTER.

1. **(ALL)**  
TURN THE POWER OFF AND DISCONNECT THE POWER CORD.
2. **(520 - 2nd IOP)**  
Remove the left door.  
**(520 - 3rd IOP)**  
Open the left door. Remove the I/O expander cable from the I/O EXPANDER 1 slot on the processor stack door (if connected).  
**(530)**  
Remove front panel.  
**(540)**  
Remove both front panels and flip-top cover.
3. **(520 - 2nd IOP)**  
Remove the trim piece on the left side of the computer by loosening the two #2 Pozidriv screws (Figure 1). The screws do not have to be completely removed to remove the trim piece.  
**(520 - 3rd IOP)**  
Continue with next step.  
**(530/540)**  
Remove top and bottom covers from System II enclosure. From the front of the computer remove the Radio Frequency Interference (RFI) shield by loosening 6 thumbscrews.

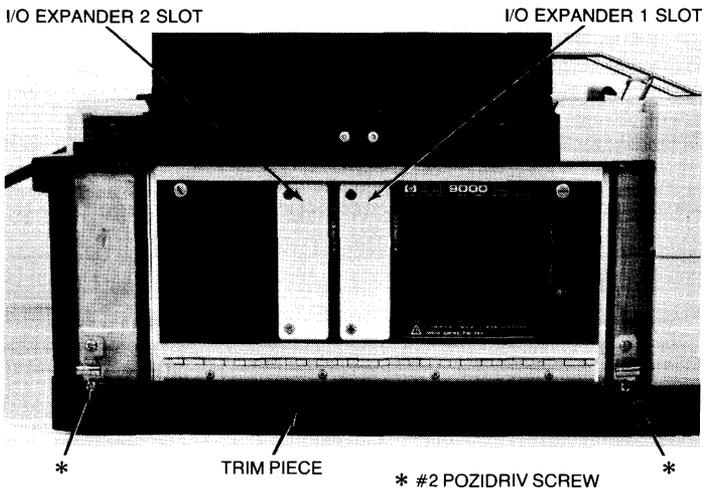


Figure 1. Model 520 Computer Stack.

4. **(520 ONLY)**

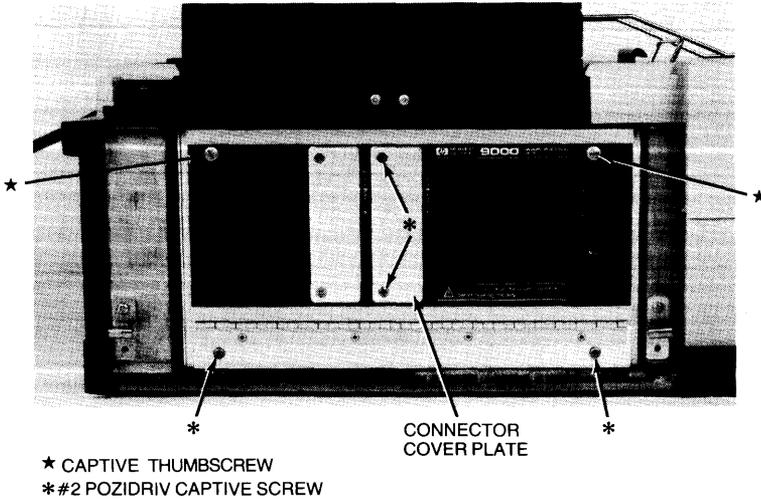
Remove the flat metal plate covering the appropriate I/O EXPANDER connector slot by removing the two #2 Pozidriv screws (Figure 2):

(2nd IOP) I/O EXPANDER 1.

(3rd IOP) I/O EXPANDER 2.

**(530/540)**

Continue with next step.



**Figure 2. Series 500 Computer Stack Door Removal.**

5. **(ALL EXCEPT 520 - 3rd IOP)**

Loosen the two #2 Pozidriv captive screws at the bottom of the processor stack door (Figure 2).

**(520 - 3rd IOP)**

Continue with next step.

6. **(ALL EXCEPT 520 - 3rd IOP)**

Remove the processor stack door by loosening the two captive thumbscrews (Figure 2).

**(520 - 3rd IOP)**

Open processor stack door.

---

**CAUTION**

DO NOT TOUCH EDGE CONNECTOR OR FINSTRATE PLANE. HOLD FINSTRATE BY EJECTORS OR SIDE EDGES ONLY. HANDLING FINSTRATE INCORRECTLY COULD CAUSE ELECTROSTATIC DISCHARGE DAMAGE. WHEN INSTALLING FINSTRATE, HOLD BY EJECTORS AND MOVE AIR CONTROLLER OUT OF THE WAY WITH THE SIDE EDGE OF THE FINSTRATE.

---

7. **(ALL - 2nd IOP)**  
Move all finstrates above slot 2 up one slot.  
**(ALL - 3rd IOP)**  
Move all finstrates above slot 3 up one slot (Slot 3 is first accessible finstrate without removing door).
8. **(520 - ONLY)**  
Remove cable clamp from processor stack door by removing two #1 Pozidriv screws.
9. **(ALL)**  
Slide the IOP finstrate into the appropriate slot without seating finstrate into the motherboard. Open the connector gate (Figure 3):  
(2nd IOP) Slot 3.  
(3rd IOP) Slot 4.

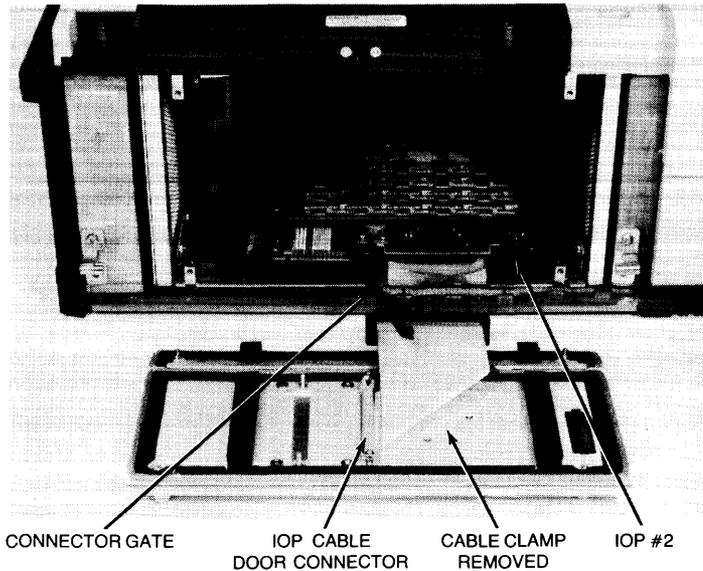


Figure 3. Series 500 Computer IOP Installation.

10. **(520)**

Place IOP cable door connector over studs on ends of appropriate I/O EXPANDER connector slot, and tighten connector to door with two nuts (Figure 3):

(2nd IOP) I/O EXPANDER 1 slot.

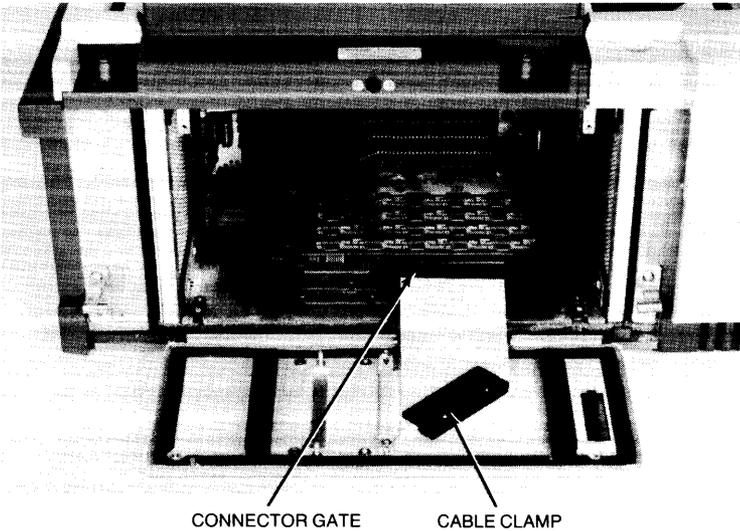
(3rd IOP) I/O EXPANDER 2 slot.

**(530/540)**

Continue with step 12.

11. **(520 ONLY)**

Install cable clamp on door so that it holds cable(s) in position (Figure 4).



**Figure 4. Series 500 Computer Stack Door.**

12. **(520)**

Connect the IOP cable finstrate connector to the IOP finstrate with cable pointing down. Close the connector gate and seat the finstrate into the motherboard connector (Figure 4).

**(530/540)**

Route IOP cable through base plate. Connect IOP cable finstrate connector to finstrate. Close connector gate and seat board into motherboard connector.

13. **(ALL EXCEPT 520 - 3rd IOP)**

Install processor stack door with two captive #2 Pozidriv screws at bottom.

**(520 - 3rd IOP)**

Continue with next step.

## 14. (ALL)

Close processor stack door. Tighten thumbscrews to prevent Radio Frequency Interference (RFI) radiation. Replace the label that is used as a seal for the processor stack door (Part Number 5180-5201).

---

**CAUTION**

ENSURE THE I/O EXPANDER CONNECTOR ON THE PROCESSOR STACK DOOR IS COVERED, AS EXPLAINED IN THE NEXT STEP, TO PREVENT RFI RADIATION.

---

## 15. (520)

Attach I/O expander cable(s) to the appropriate I/O EXPANDER connector (Figure 5), or cover connector with plastic connector cover (Figure 6).

**(530/540 - 2nd IOP)**

Route IOP cable along outside of base plate and attach IOP cable strain relief clamp to base with four #2 Pozidriv screws. Ensure cable is centered in clamp and is not pinched.

**(530/540 - 3rd IOP)**

Remove I/O cable strain relief clamp which holds 2nd IOP cable in place on outside of base plate. Route IOP cable along outside of base plate and attach IOP cable strain relief clamp to base with four #2 Pozidriv screws. Ensure cable is centered in clamp and is not pinched.

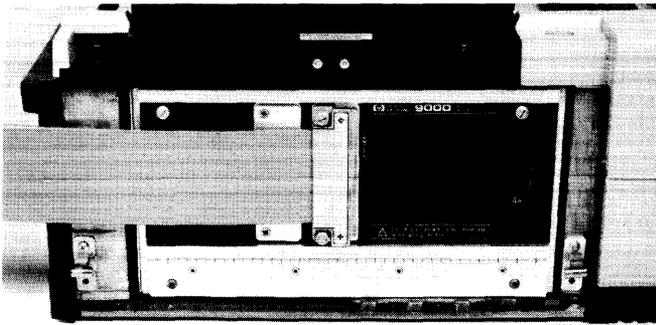


Figure 5. IOP Connector Attached to Door.

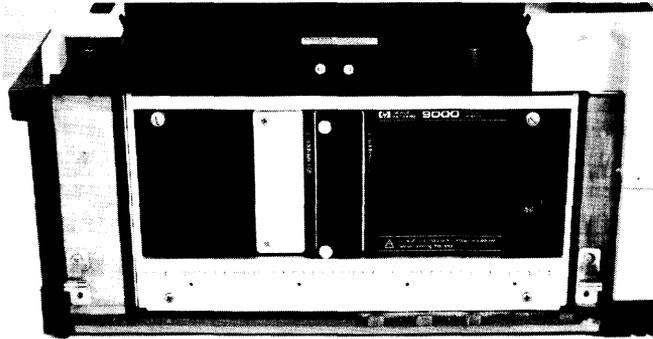


Figure 6. Plastic IOP Connector Cover.

16. **(530/540 ONLY)**  
Route cable between terminal block and base plate into enclosure.
17. **(530/540 ONLY)**  
Remove cover plate from appropriate IOP expander slot in the computer rear panel. Insert IOP cable connector into the appropriate slot and secure in place with two nuts on the posts: (slots viewed from rear.)
  - (530 - 2nd IOP) Upper slot.
  - (530 - 3rd IOP) Lower slot.
  - (540 - 2nd IOP) Right slot.
  - (540 - 3rd IOP) Left slot.

---

**CAUTION**

ENSURE THE I/O EXPANDER CONNECTOR ON THE PROCESSOR STACK DOOR IS COVERED TO PREVENT RFI RADIATION.

---

18. **(530/540 ONLY)**  
Attach I/O expander cable to connector on rear panel, or cover connector with plastic connector cover.
19. **(520 - 2nd IOP)**  
Replace the trim piece and the left door.  
**(520 - 3rd IOP)**  
Close the left door.  
**(530)**  
Replace RFI shield, top and bottom covers of System II enclosure, and front panel.  
**(540)**  
Replace RFI shield, top and bottom covers of System II enclosure, front panels and flip top cover.
20. **(ALL)**  
Plug the power cord into the ac outlet and switch on the power.

## 512K RAM Board Installation Information

### Instructions For HP-Qualified Personnel:

Follow the instructions that apply to the installation you are performing. For example, if you are installing the RAM card in a 520 computer you would perform the steps that begin with: (ALL), and (520).

### Load Board

Systems that are shipped from the Fort Collins Systems Division with 1 CPU, 1 IOP, and one 512K Byte RAM Board, will also have a Load Board in the slot that is adjacent to the RAM board (top occupied slot). If any other Finstrates, or RAM, is added to this configuration, the Load Board must be removed from the computer.

Any time the Processor Stack configuration is reduced to 1 CPU, 1 IOP, and one 512K Byte RAM Board, A Load Board (09855-66525) is required. Load Board (09855-66525) is a replaceable part.

### CE Handbook

When completed with the installation, insert this page and the following page in your CE Handbook (after page 2-12 of either the 9020 or 9030/9040 section).

### Part Numbers

512K Byte RAM (exchange)	97047-69805
(new)	5061-6805
Load Board	09855-66525

## 512K Byte RAM Board Installation

1. **(ALL)**  
TURN THE POWER OFF AND DISCONNECT THE POWER CORD.
2. **(520)**  
Open the left door.
- (530)**  
Remove the front panel.
- (540)**  
Remove the front bottom panel.
3. **(530/540 ONLY)**  
From the front of the computer, remove the Radio Frequency Interference (RFI) shield by loosening the six thumbscrews.
4. **(ALL)**  
Open processor stack door.

---

### CAUTION

ELECTROSTATIC DISCHARGE DAMAGE CAN OCCUR IN THE FOLLOWING STEPS. FOLLOW THE PRECAUTIONS IN CHAPTER 4 OF THE SERVICE MANUAL.

DO NOT TOUCH EDGE CONNECTOR OR BOARD PLANE. HOLD BOARD BY EJECTORS OR SIDE EDGES ONLY. HANDLING THE RAM BOARD INCORRECTLY COULD CAUSE ELECTROSTATIC DISCHARGE DAMAGE. WHEN INSTALLING THE RAM BOARD, HOLD BY EJECTORS AND MOVE AIR CONTROLLER OUT OF THE WAY WITH THE SIDE EDGE OF THE BOARD.

---

5. **(ALL)**  
Remove the Load Board (09855-66525) from the Processor Stack, if it is present and at least one RAM board is installed. The load board will no longer be required. It is the property of the customer.
6. **(ALL)**  
Install the new RAM board in the first unoccupied slot from the bottom. DO NOT LEAVE EMPTY SLOTS BETWEEN BOARDS.
7. **(ALL)**  
Close the processor stack door. Firmly tighten thumbscrews to prevent RFI radiation. Replace the label that is used as a seal for the processor stack door (Part Number 5180-5201).
8. **(530/540 ONLY)**  
Replace RFI shield.
9. **(520)**  
Close left door.
- (530)**  
Replace front panel.
- (540)**  
Replace the front bottom panel.
10. **(ALL)**  
Connect power cord to ac outlet.

# 1 Megabyte RAM Board Installation

## Instructions

Read the following information then follow the instructions that apply to the installation you are performing. For example, if you are installing the RAM Boards in a 520 computer you would perform all steps that begin with: (ALL), and (520).

## RAM Boards

1 Megabyte RAM Boards can only be installed in pairs. Any combination of 256K, 512K, and pairs of 1 Megabyte boards can be used.

## Load Board

If a system is shipped with 1 CPU, 1 IOP, and one 512K RAM Board, it will also have a Load Board (09855-66525) in the top occupied slot. When the 1 Megabyte RAM Boards are added to the stack, the Load Board is no longer required and must be removed (assuming the 512K RAM board remains in the system).

When the only RAM boards in the stack are 1 Megabyte RAM boards, a load board is required if there are six or less. The load board should be removed when there are more than six 1 Megabyte RAM boards in the stack, or if there is a mixture of 256K, 512K, and 1 Megabyte RAM boards in the stack.

Any time the Processor Stack configuration is changed so that it contains one of the above configurations, a Load Board is required. The load Board (09855-66525) is a replaceable part in spares. If the load board is used it must be in the top **OCCUPIED** slot of the Processor Stack. Do not leave any empty slots between finstates or boards.

## Boot Loader ROM

When the Processor Stack contains 1 Megabyte RAM Boards, Boot Loader ROM Rev. B (09020-80001) must be used, and UNIX 4.0 or Basic 2.0 software must be used.

Boot Loader ROM 09020-80000 can be used with UNIX 4.0 or Basic 2.0 (or any previous software versions) as long as the stack **DOES NOT** contain a 1 Megabyte RAM Board.

Boot Loader ROM Rev. B (09020-80001) can be used with any RAM configuration but **MUST** use UNIX 4.0 or BASIC 2.0 software (any earlier versions of software cannot be used with this boot loader).

## Access Times

When the 1 Megabyte RAM Boards are installed in a computer, the access times will be slower. The customer may notice this slower process time during operation.

## System Functional Test

The previous SFT tests (Part Number 09020-10010 Rev. 2.0) are not compatible with the BASIC 2.0 Operating System. The updated version of the SFT must be used with this operating system.

The 4.0 HP-UX Operating System contains the same System Functional Tests (SFT) as the previous HP-UX. They are located in the CE utilities dictionary.

## Part Numbers

1 Megabyte RAM Board (exchange)	97046-69704
(new)	5061-7704
Boot Loader ROM *	09020-80000 (Rev. A)
	09020-80001 (Rev. B)
Load Board	09855-66525

\* See BOOT LOADER ROM on the previous page for part number applicability. When ordering the ROM, the serial number and model number of the computer **must** be given to the individual taking the order.

## CE Handbook

When completed with the installation, insert these pages in your CE Handbook (after page 2-14 of either the 9020 or 9030/9040 section).

# RAM Board Installation

1. **(ALL)**  
TURN THE POWER OFF AND DISCONNECT THE POWER CORD.
2. **(520)**  
Open the left door.  
**(530)**  
Remove the front panel.  
**(540)**  
Remove both front panels and the flitop cover.
3. **(530/540 ONLY)**  
From the front of the computer, remove the Radio Frequency Interference (RFI) shield by loosening the six thumbscrews.
4. **(ALL)**  
Open processor stack door.

---

### CAUTION

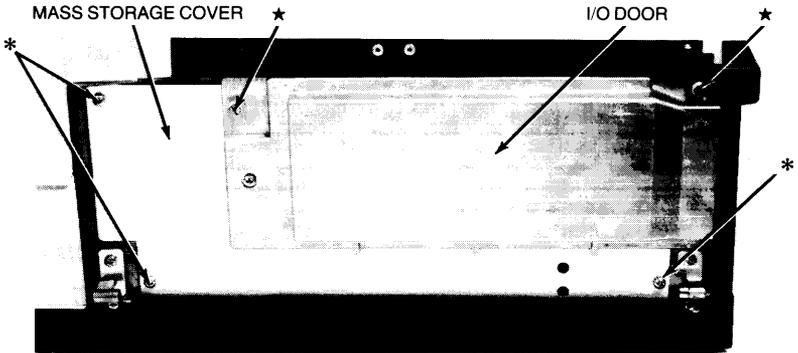
ELECTROSTATIC DISCHARGE DAMAGE CAN OCCUR IN THE FOLLOWING STEPS. FOLLOW THE PRECAUTIONS IN CHAPTER 4 OF THE SERVICE MANUAL.

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---

5. **(ALL)**  
Remove the Load Board (09855-66525) from the Processor Stack, if it is present.
6. **(ALL)**  
Install the RAM boards starting with the first unoccupied slot from the bottom. DO NOT LEAVE EMPTY SLOTS BETWEEN BOARDS. If a Load Board is required, install it in the next slot above the RAM. (see "Load Board" in the information at the front of the procedure.)
7. **(ALL)**  
Close the processor stack door. Firmly tighten thumbscrews to prevent RFI radiation. Replace the label that is used as a seal for the processor stack door (Part Number 5180-5201).

8. **(520)**  
Close the left side door.  
**(530/540)**  
Replace the RFI shield.
9. **(520)**  
Remove right side door.  
**(530/540)**  
Remove the top cover of the System II enclosure. The cover has one captive screw at the back of the box. Loosen the screw and slide the cover back and away from the box.
10. **(530/540 ONLY)**  
Disconnect the ac module cable and the service module cable.
11. **(520)**  
Remove three #2 Pozidriv screws from the mass storage cover (Figure 1).  
**(530/540)**  
Remove four #2 Pozidriv screws that attach the I/O lid. Remove the lid.



- \* #2 POZIDRIV MASS STORAGE COVER SCREW
- \* I/O DOOR CAPTIVE THUMB SCREW

**Figure 1. Removing Mass Storage Cover**

12. **(520 ONLY)**  
Loosen two captive thumbscrews on I/O door (Figure 1) and swing door open, allowing door to rest in open position.
13. **(520 ONLY)**  
Slide mass storage cover towards front cover of computer, disengaging cover from slot in front card guide.
14. **(520 ONLY)**  
Lift mass storage cover with attached I/O door up and away from computer.

15. **(520 With Bootstrap Loader Card)**

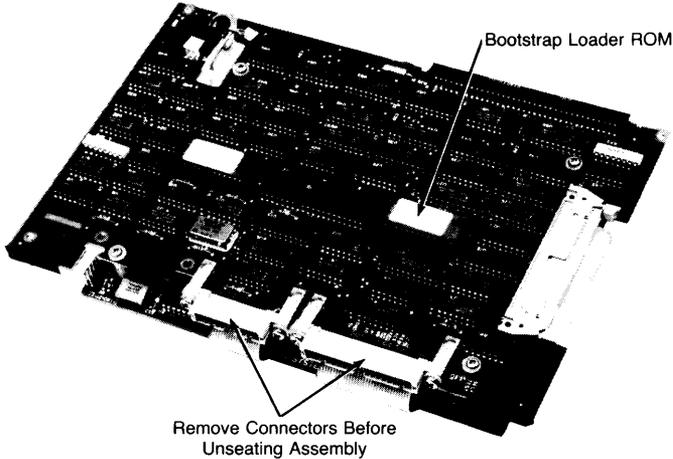
Remove Bootstrap Loader card and replace the Bootstrap Loader ROM with the new ROM. Use tool 8710-0585. Reinstall the card in the I/O card cage.

**(520 With Fixed Disc Drive Controller Assembly)**

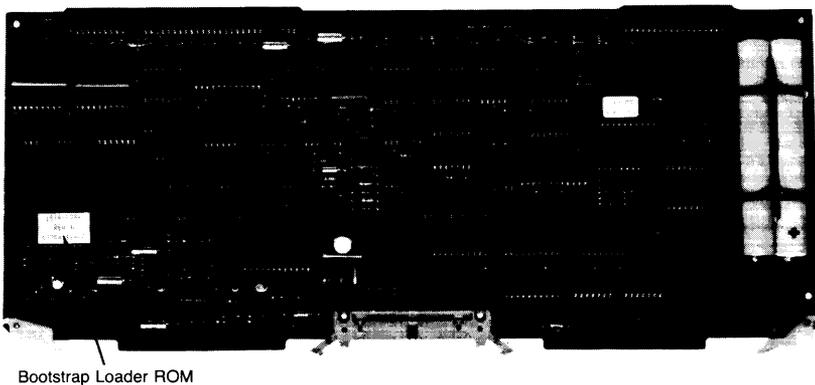
Remove both cable connectors from controller assembly. Remove controller assembly and replace the Bootstrap Loader ROM with the new one (Figure 2). Reinstall the card in the I/O card cage.

**(530/540)**

Remove the SCM and replace the Bootstrap Loader ROM with the new ROM (Figure 3). Use tool 8710-0585. Reinstall the card in the box.



**Figure 2. Fixed Disc Controller Assembly**



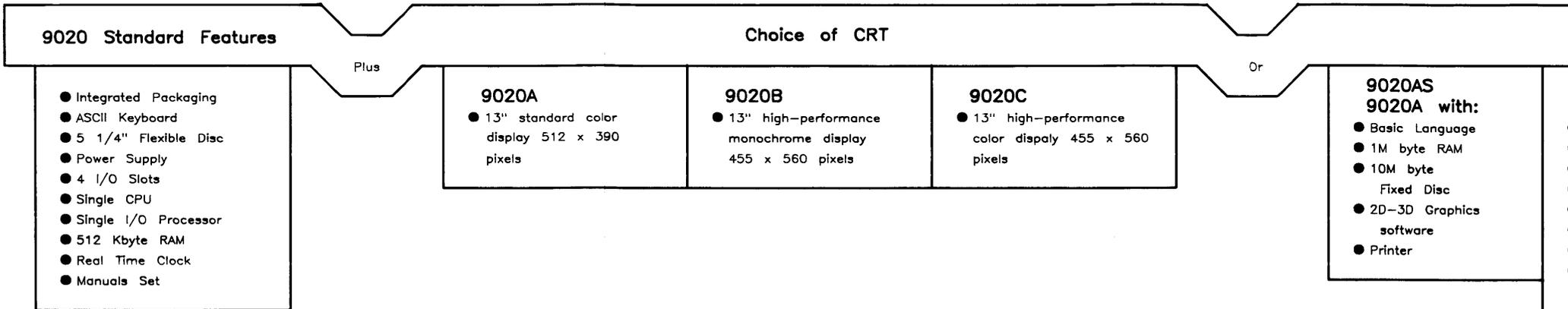
**Figure 3. 530/540 SCM Board**

16. **(520)**  
Reinstall mass storage cover and right side door.  
**(530/540)**  
Reinstall I/O lid and connect the ac module cable and service module cable.
17. **(530/540 ONLY)**  
Reinstall the top cover on the System II enclosure.
18. **(520)**  
Close the right side door.  
**(530)**  
Replace front panel.  
**(540)**  
Replace the flip top cover and both front panels.
19. **(ALL)**  
Connect power cord to ac outlet.



on	Chapter
	3





**I/O INTERFACE CARDS**

- HP-IB - 27110A/B
- GP-IO - 27112A
- RJE - 27122A (HP-UX)
- \* ● SRM - 27123A (BASIC)
- \* ● LANIC - 27125A
- ASI - 27128A (RS 232C)
- MUX - 27130A/B (HP-UX) (RS-232C) (8 Channel)
- Modem MUX - 27140A
- LAN - 2285A (HP-UX) (Uses HP-IB)
- Graphics Processor - 97060A
- RGB COLOR - 97062A (RS-343)

Display Alphanumeric  
 Display Graphics  
 I/O Slot 2  
 I/O Slot 3  
 I/O Slot 4  
 I/O Slot 5  
 Keyboard, Printer, RTC  
 Beeper  
 Internal Mass Storage

**Memory Processor Module Configuration**

-----	Optional	-----
---	MEMORY or 3rd IOP	---
---	MEMORY or 2nd IOP	---
-----	IOP	-----
-----	- CPU -	-----

I/O Expander  
 I/O Expander

\*Only one of these cards is allowed if I/O card cage is full and MPB is full.

**Options**

Options are published in the HP 9000 Series 500 Configuration Information and Order Guide.

**Supported Peripherals**

Due to constant change of the list of supported peripherals, this information is published separately. The HP 9000 Series 500 Configuration Information and Order Guide or periodic publications of the FSD TSE NEWSLETTER will have this information.

**Software Distribution Media**

BASIC is always distributed on 5 1/4" Flexible Disc; no option is necessary. HP-UX is always distributed on 1/4" tape; Opt. 022 must be specified on 9020 bundled systems and on 5-digit product number orders.

**Support S**

- Software Sup
- Training
- Documentation
- Service/Maint
- Software Con
- Site Preparat

**Choice of CRT**

**9020B**

- 13" high-performance monochrome display 455 x 560 pixels

**9020C**

- 13" high-performance color display 455 x 560 pixels

Or

**9020AS  
9020A with:**

- Basic Language
- 1M byte RAM
- 10M byte Fixed Disc
- 2D-3D Graphics software
- Printer

**9020AT  
9020A with:**

- HP-UX(Single User)
- 1.5M byte RAM
- Printer
- HP-IB
- FORTRAN
- HP Pascal
- Graphics/9000 DGL
- Graphics/9000 AGP

**Requires:**

- CS 80 Disc/Tape
- Media on Tape

**Memory Processor  
Module Configuration**

-----	Optional	-----
---	MEMORY or 3rd IOP	---
---	MEMORY or 2nd IOP	---
---	IOP	---
---	CPU	---

I/O Expander  
I/O Expander

meric  
er, RTC  
storage

**Peripherals**

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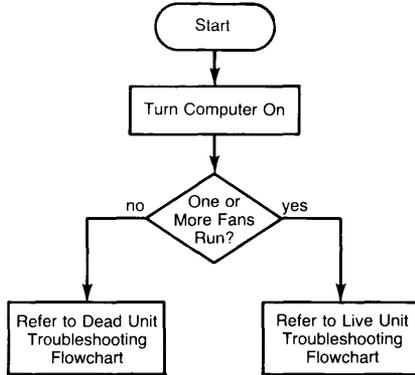
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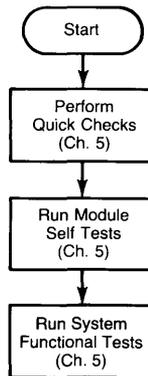
**Support Services**

- Software Support
- Training
- Documentation
- Service/Maintenance Requirements
- Software Consulting
- Site Preparation and Installation

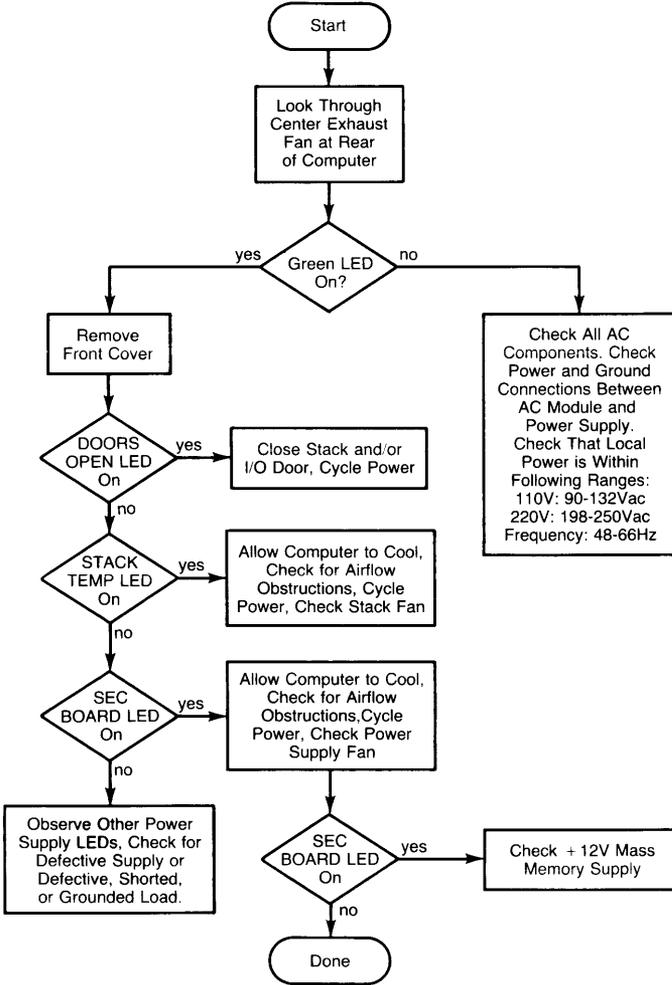
# 9020 Troubleshooting

**Chapter****4**

**Initial Troubleshooting Flowchart**



**Live Unit Troubleshooting Flowchart**



Dead Unit Troubleshooting Flowchart

# 9020 Diagnostics

Chapter

5

## Error Messages

Indication	Cause	Cure
Fast beep (0.5-sec. repeat rate)	Major module failure during system load.	Troubleshoot displayed error messages.
Slow beep (2-sec. repeat rate)	Insufficient memory for system being loaded.	Check stack self-test LEDs for RAM finstrate failures and replace defective RAM, if necessary. Verify that memory configuration is large enough for system being loaded.
Clock and date not set	Contents of real-time clock and non-volatile memory have been lost.	Set time/date with BASIC statement SET TIME/TIMEDATE or HP-UX command <i>date</i> .
System halted due to double bit memory error on MC NN CCCCCCCC  NN = MC# counting from stack bottom  CCCCCCCC = last healer content in hex for MC NN	Double bit error occurred. System halted.	Replace defective RAM.
System halted: Incompatible IOPs	Illegal combination of IOPs was found at powerup. IOPs of Rev. 2.1 and earlier are not compatible with IOPs of Rev. 3.0 and later.	Reconfigure IOPs to legal combination.
System halted: Insufficient memory to start system	Not enough memory for system.	Add RAM or reduce system.
System halted: System error	System fault.	Try new revision of operating system. Analyze system dump which has been displayed and/or printed.
Internal temperature approaching maximum; powerdown may occur without warning	Internal temperature above 51°C.	Protect programs and data because shutdown occurs at 97°C. Find and remove cause of overheating.

5-2 9020 Diagnostics

Indication	Cause	Cure
<p>Self test error 1: IO address DA, SA STATUS: XXXXXXXX</p> <p>DA = device address 0 = display alpha 1 = display graphics 6 = keyboard and printer 7 = internal mass storage</p> <p>SA = subaddress With DA = 6 0 = printer 2 = keyboard With DA = 7 0 = fixed disc 1 = flexible disc</p> <p>XXXXXXXX = error code in hex</p>	<p>Tables follow that list all error codes by device address (DA) and subaddress (SA), and defines them.</p>	<p>Refer to following tables.</p>
<p>Self test error 2: CHECKSUM for segment NN NN = the code segment in which the error occurred</p>	<p>An operating system failure.</p>	<p>Use different system discs or tape cartridge or replace defective RAM.</p>
<p>Self test error 3: XXXX NN XXXX = CPU#, IOP#, or MC# NN = the NNth of that finstrate type, from the bottom of stack</p>	<p>Finstrate failure.</p>	<p>System operation can continue provided that the failed finstrate is not required.</p>
<p>Self test error 4: Memory reduced to: NNNNNNNN bytes</p>	<p>Memory has been mapped out.</p>	<p>Replace defective RAM. System still runs with reduced RAM.</p>
<p>Self test error 5: Fewer finstrates were found than expected</p>	<p>The number of finstrates detected at powerup is smaller than the number recorded in NVM.</p>	<p>Ensure finstrate configuration meets system requirements. Change NVM as required. (If more finstrates were found than expected, NVM is automatically updated to match the actual configuration.)</p>

## 98760A Display Self Test Error 1 Error Codes

DA	SA	Error Code	Definition	Probable Causes
0		00000001	Flag line not asserted	} Alpha/interface board, I/O bus
0		00000002	Status line not asserted	
0		00000003	Control register failed	
0		00000004	Failed reset test	
0		00000005	Not responding to poll	
0		00000006	Status false during DMA transfer	Alpha/interface board
0		00000007	Timed out while waiting for DMA transfer	Alpha/interface board
0		00000008	Failed alpha memory test	Alpha/interface board
0		00000009	Channel end does not clear poll response	Alpha/interface board, I/O bus
1		00000001	Timed out while initializing GDC	Graphics/digital video board
1		00000002	Status line not asserted	Alpha/interface board, display modules
1		00000003	Control register fails readback	Alpha/interface board, I/O bus
1		00000004	Not responding to poll	Alpha/interface board, I/O bus
1		00000005	Channel end does not clear poll response	Alpha/interface board, I/O bus
1		00000006	Failed graphics memory test	Graphics/digital video board
1		00000007	Timeout while waiting for DMA transfer	Alpha/interface board, graphics/digital video board
1		00000008	Timeout while waiting for direct I/O transfer	Alpha/interface board, graphics/digital video board
1		00000009	GDC not functioning properly	Graphics/digital video board

## 98770A or 98780A Display Self Test Error 1 Error Codes

DA	SA	Error Code	Definition	Probable Causes	
0		00000001	Status line not asserted	} DIM, I/O bus	
0		00000002	Flag line not asserted		
0		00000003	FR0 failed loopback		
0		00000004	Weasel chip failed selftest		} DIM
0		00000005	FR8 failed loopback		
0		00000006	FR9 failed loopback		} DIM, I/O bus
0		00000007	FR10 failed loopback		
0		00000008	FR12 failed loopback		
0		00000009	FR1 failed loopback		
0		0000000A	Poll response asserted but not enabled		} DIM
0		0000000B	Poll response not asserted when enabled		
0		0000000C	Failed frame buffer memory test		} DIM, I/O bus
0		0000000D	Failed space substitution test		
0		0000000E	Failed display interrupt test		
0		0000000F	Failed synchronous startup test		
0		00000010	Failed window test	} DIM	
0		00000011	Failed reset test		
0		00000012	Timed out while waiting for interrupt	} DIM	
0		00000013	Status false during frame buffer transfer		
0		00000014	Timed out while waiting for DMA transfer		
1		00000001	Status line not asserted		
1		00000002	Flag line asserted when graphics disabled		
1		00000003	Poll line asserted but not enabled		
1		00000004	Flag line not asserted when graphics enabled		
1		00000005	Poll line not asserted when graphics enabled		
1		00000006	Graphics memory failure	} Graphics memory	
1		00000007	Rubber band memory failure		
1		00000008	Failed line drawing test		
1		00000009	Erase memory failure	} Graphics interface, DIM	
1		0000000A	Flag timeout while writing FR1		
1		0000000B	Flag timeout while writing FR0		
1		0000000C	Flag timeout while reading FR0		
1		0000000D	Timed out while waiting for DMA termination		

## Printer Self Test Error 1 Error Codes

DA	SA	Error Code	Definition	Probable Causes								
6	0	0000XX00	Status byte XX defined below.	} Logic board, I/O bus								
6	0	0000YY01	Timed out while waiting for printer to complete self test									
6	0	0000YY02	Flag did not go false after reading FRO									
6	0	0000YY03	Timed out while waiting for flag									
6	0	0000YY04	Failed loopback test									
6	0	0000YY05	Printer not responding to poll									
6	0	0000YY06	Printer failed self test									
6	0	0000YY07	Printer responds to polls when disabled									
6	0	0000YY08	Printer status false									
6	0	0000YY09	Printer enabled for poll response after reset									
6	0	0000YY0A	Keyboard PFW interrupt cannot be cleared									
XX = Printer status byte (hex) in following binary format:												
<table border="1" style="margin-left: 20px;"> <tr> <td>PSFL</td> <td>DSTF</td> <td>MSTF</td> <td>OOPP</td> <td>HDFL</td> <td>VHLO</td> <td>PTTH</td> <td>HDTH</td> </tr> </table>				PSFL	DSTF	MSTF	OOPP	HDFL	VHLO	PTTH	HDTH	
PSFL	DSTF	MSTF	OOPP	HDFL	VHLO	PTTH	HDTH					
where: PSFL = Power supply failure				Motor drive board								
DSTF = Dangerous self test failure; potential damage to printhead				Motor drive board								
MSTF = Don't care												
OOPP = Out of paper				Out of paper								
HDFL = Printhead control line failure; BURN and/or CLEAR line stuck high or low				Logic board								
VHLO = Printhead supply voltage too low				Motor drive board								
PTTH = Power transistor on motor drive board too hot				Motor drive board								
HDTH = Printhead too hot; temperature in printhead exceeded 70°C				Motor drive board, External heat source								
YY = Don't Care												

**Keyboard Self Test Error 1 Error Codes**

DA	SA	Error Code	Definition	Probable Causes
6	2	00000001	Failed loopback to FR15	Keyboard electronics board, I/O bus
6	2	00000002	Keyboard not responding to poll	
6	2	00000003	Keyboard failed self test	
6	2	00000004	Battery low condition detected	
6	2	00000005	Keyboard not responding with SRQ bit	
6	2	00000006	Keyboard not forcing status false	
6	2	00000007	Reading FR10 did not clear keyboard poll response	
6	2	00000008	Power fail warning bit set	

**Internal Disc Drives Self Test Error 1 Error Codes**

DA	SA	Error Code	Definition	Probable Causes
7	X	00000001	Timeout waiting for self test	Drive electronics, Drive, I/O bus
7	X	00000002	Failed poll response	
7	X	00000003	Status false failure	
7	X	00000004	Timeout in loopback	
7	X	00000005	Failed loopback	
7	X	00000006	Qstat timeout	
7	X	00000007	Flag line stuck	
7	X	00000008	Poll response stuck	
7	X	00000009	Bad power on qstat	

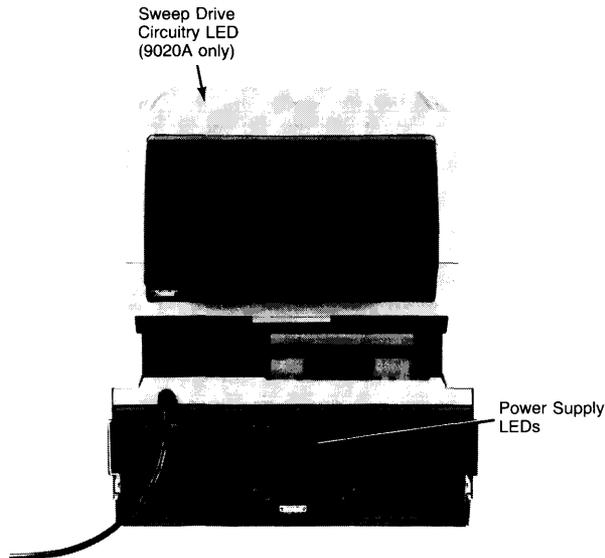
X = 0 for fixed disc drive  
 = 1 for flexible disc drive

## Quick Checks

The following quick checks can be performed independently of module self tests and other diagnostics.

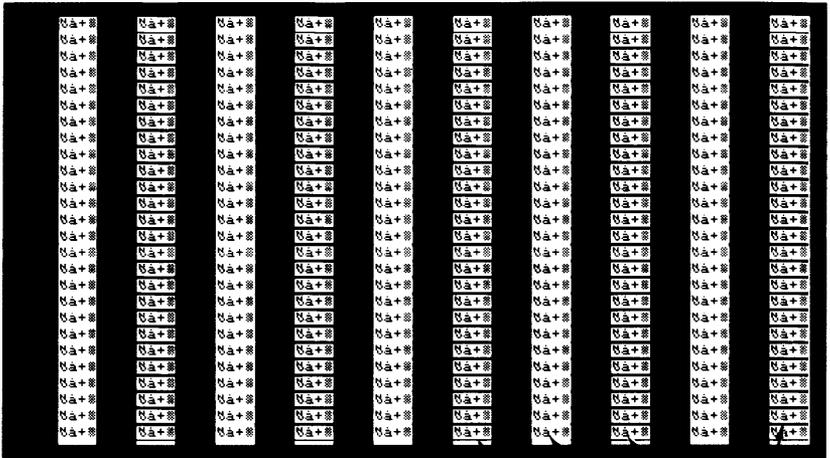
### Power Supply LEDs

LED	Indication When Lit/Action Required
Green	Power is applied, and bias voltage is available from primary board. (LED visible through center exhaust fan.)
Yellow	No failures have been detected. Failure detection circuitry is enabled. (LED visible through center exhaust fan.)
<b>DOORS OPEN</b>	I/O card cage door or processor stack door is open. <b>OV</b> also lights. Close door.
<b>STACK TEMP</b>	Processor stack temperature has exceeded 100°C. Check fans. Remove heat source.
<b>SEC BOARD</b>	+ 12MM mass storage power supply has failed or temperature in power supply assembly has exceeded 97°C. Check + 12MM mass storage power supply. Check fans. Remove heat source.
<b>PWR</b>	Peak primary current exceeded 9A. Check power supply. Check for short circuits.
<b>OV</b>	Used in conjunction with voltage LEDs; "on" indicates an overvoltage condition on one or more of the supplies or door open, "off" indicates an undervoltage condition. Close door. Check power supply. Check for short or open circuits.
- 19 - 12 - 2 3 5 6 12 19	Fault condition exists on the indicated supply. If the <b>OV</b> LED is also lit, an overvoltage condition is indicated. If the <b>OV</b> LED is not lit, an undervoltage condition is indicated. Check power supply. Check modules which use the faulty voltage (Chapter 9 - Power Distribution diagram). Check for short or open circuits.



Power Supply and Sweep Drive Circuitry LEDs



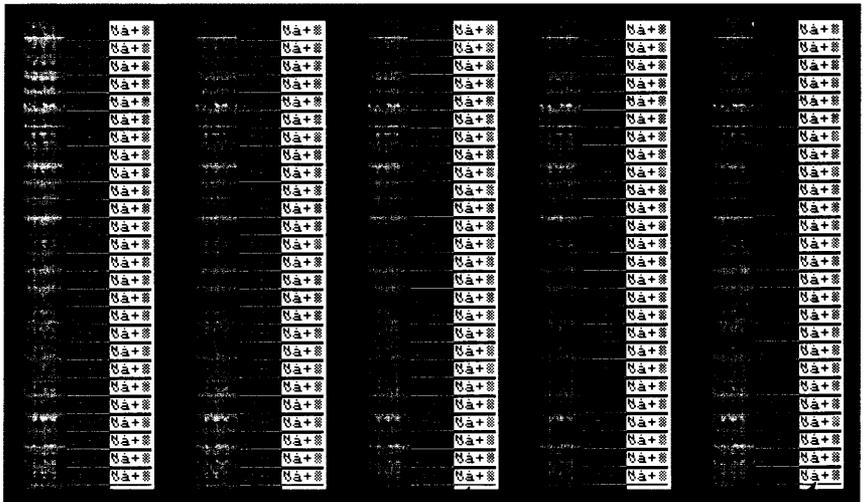


Blinking Underline

Blinking Characters

Blinking Overline

Test Pattern for the 9020B Display



Blinking Underline

Blinking Characters

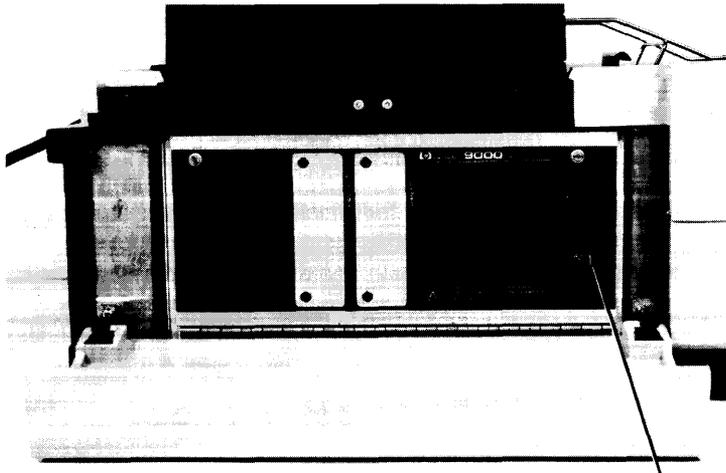
Test Pattern for the 9020C Display

## Module Self Tests

Module self tests are contained in the replaceable modules and are initiated on powerup. (The BASIC language system SCRATCH ALL or LOAD BIN command causes all module self tests except the processor stack tests to be executed. No equivalent HP-UX commands exist.) Successful completion of most tests is indicated by an LED turning on and then off. Because all modules are tested quickly and the LEDs are located in various places on the 9020, you must run the test for each module you wish to check.

### Processor Stack

Each finstrate has its own self test. Results are indicated by twelve LEDs associated with card slots 1 through 12. The LEDs are visible by removing the left cosmetic door and looking through the window in the stack door. Normal operation is all LEDs on, followed one or two seconds later by all LEDs off. An LED that won't turn on or that turns on and won't turn off indicates a failure of the corresponding finstrate.



Processor Stack  
Self Test LEDs

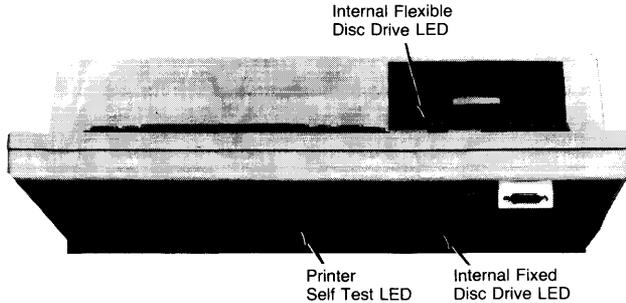
### Processor Stack Self Test LEDs

### Keyboard

This self test turns the **CAPS** LED on and off and turns the **PRINT ALL** LED on at powerup. The BASIC system then turns the **PRINT ALL** LED off and the **CAPS** LED back on. The HP-UX system turns both **PRINT ALL** and **CAPS** off.

### Printer

An LED on the printer's logic board lights when its module self test detects a failure. The LED is visible through the air vents under the keyboard.



**Printer and Disc Drive LEDs**

### **Internal Flexible Disc Drive/Controller Card**

The first part of the self test checks the drive, the drive board, and the controller card. The LED on the front of the drive indicates successful completion when it turns on.

The second part of the test requires that an initialized disc be stored in the drive. This part of the test thoroughly checks the drive. If the test passes, the LED on the controller card turns on and off once. With the right cosmetic door open, the controller card LED is visible through the upper hole in the I/O cover plate.

### **Internal Fixed Disc Drive/Controller Assembly**

An LED on the drive is visible through the air vents under the keyboard. If this LED turns on, the controller assembly has successfully passed self test.

If the drive LED goes on, indicating the drive is being accessed, but the controller assembly LED fails to go off, a bad drive is indicated. With the right cosmetic door open, the controller assembly LED is visible through the middle hole in the I/O cover plate.

### **Bootstrap Loader Card**

The LED on the bootstrap loader card is visible through the middle hole in the I/O cover plate with the right cosmetic door open. If the LED turns on and then off, the bootstrap loader code has been properly downloaded to the system RAM. If the LED fails to turn off, the code has not loaded properly.

## **Self Test Supervisory Code (STSC)**

The STSC runs automatically after the module self tests on powerup. STSC verifies the integrity of the internal I/O bus, tests the interfaces on all of the internal modules, retests mapped-out memory blocks that previously failed the memory controller test, and reports the blocks that fail the retest. The code issues a message to the user in case of a failure.

The modules tested by the STSC are:

- Internal I/O bus
- Printer
- Keyboard
- Display interface module (9020B or 9020C)
- Alpha/interface and graphics/digital video boards (9020A)
- Internal flexible disc drive and controller card
- Internal fixed disc drive and controller assembly

## System Functional Tests (SFT)

### To Run HP-UX SFT:

1. If not previously done, install and verify the HP-UX operating system.
2. In response to the `login:` prompt, type: `root` and press **RETURN**. You are now the super-user.
3. Type: `cd /usr/Tests`.
4. Type: `start` and press **RETURN**.
5. From the menu that appears on the system console, select the test you would like to run, enter its number, and press **RETURN**.

### To Run BASIC SFT:

1. Load SFT TEST system boot discs.
2. Load SFT Mainframe Test Programs disc or SFT Peripheral Test Programs disc.
3. Type: `LOAD "TEST: INTERNAL",1` and press **EXECUTE**.

### BASIC Mainframe System Functional Tests

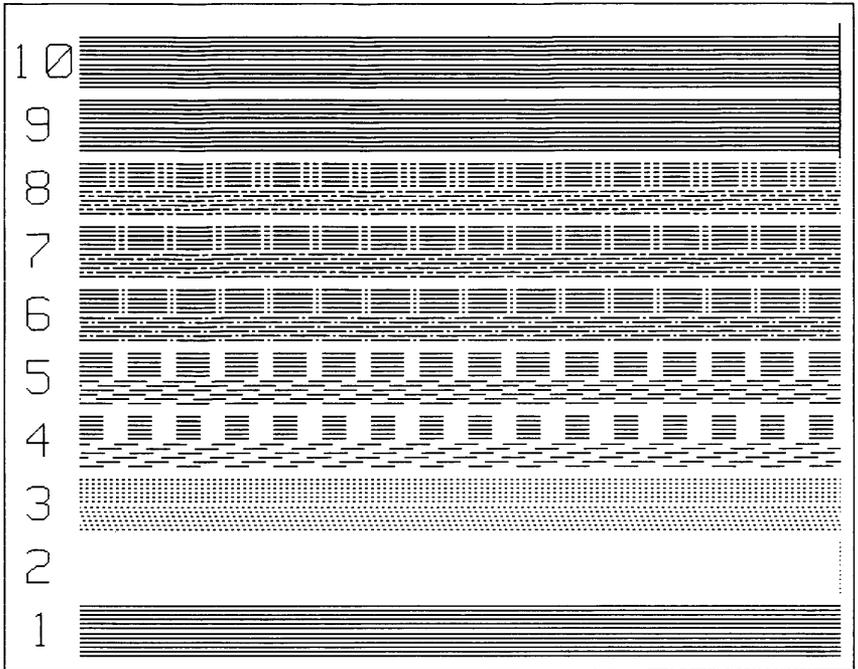
Test Name	Pass/Fail Indicator	Description/Requirements
PRINTER	<p>Compare printed output with pattern that follows.</p> <p>Test fails if output contains vertical white lines.</p>	<p>Hardware: 9020A, 9020B, or 9020C with built-in thermal printer</p> <p>STANDARD - tests the printer hardware.</p> <p>SOLID - tests the print head. Vertical white lines appearing in the output indicate a non-functioning thermal element in the print head.</p> <p>REVERSE - press <b>(8 24)</b> to reverse motion of paper feed mechanism: use paper advance key to advance paper. This is useful for removing paper which has become jammed in the printer.</p>
DISPLAY	<p>Check that characters and lines are sharp and clear.</p> <p>Lines should appear straight. (+)s should be in straight lines and equally spaced.</p>	<p>STANDARD - shows a variety of displays which you should use to check that the display is in focus. When testing the 9020C and characters are not sharp, try running the CONVERGE and STANDARD options of CGRAPHICS test.</p> <p>INTERACTIVE - verify that lines appear straight. The CRT Linearity Test uses a series of (+) characters to verify the display.</p>
KEYBOARD	<p>Message provided upon test failure only.</p>	<p>Verifies operation of the keyboard, real time clock, beeper, and non-volatile memory. Beeper test plays a musical scale when operating correctly.</p>
AGRAPHICS	<p>Message provided upon test failure only. If there is no display, check display intensity, power cord, and fuse.</p>	<p>Hardware: 9020A</p> <p>STANDARD - tests vector generation and graphics memory. No need to visually inspect display.</p> <p>INTERACTIVE - used to set the intensity of the three color guns of the display.</p>

## BASIC Mainframe Functional Tests (Continue)

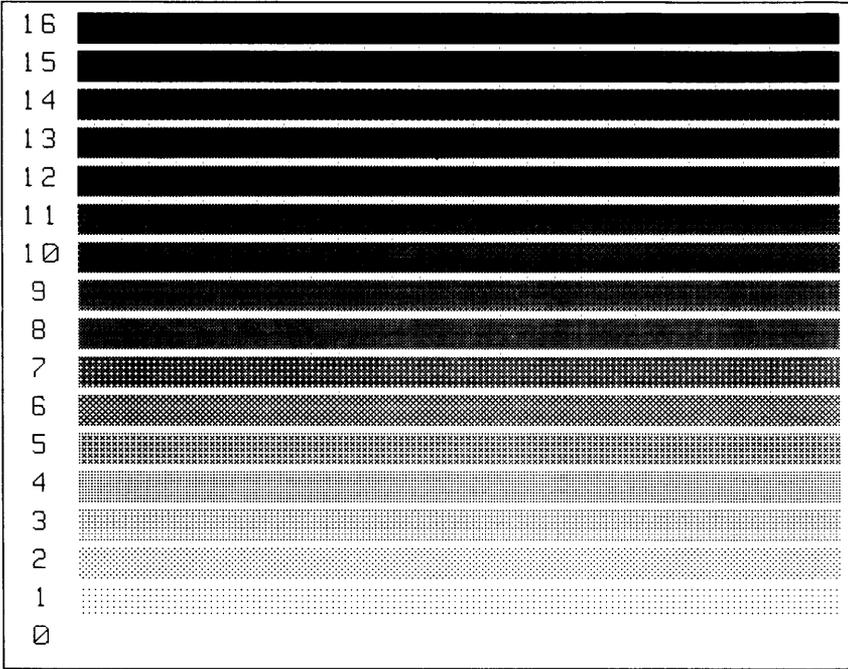
Test Name	Pass/Fail Indicator	Description/Requirements
BGRAPHICS	Compare displays with outputs that follow. Graphics memory test provides pass/fail message.	Hardware: 9020B Tests graphics hardware such as: cursor types, vector generation, arc generation, area fill capability, video mixer, LP bit (light pen bit), and graphics memory.
CGRAPHICS	Compare displays with output that follows. Graphics memory test provides pass/fail message.  Visually inspect for compliance with description.  If characters appear sharp and white, no convergence is needed.	Hardware: 9020C STANDARD - degausses the color display, tests vector generation (compare display to Graphics output that follows), and tests graphics memory. INTERACTIVE - The linearity test consists of a series of lines of identical characters. Check that the lines are equally spaced vertically on the display, and that the characters in each line are equally spaced from left to right edges of the display area. During the cursor test, eight horizontal bands are displayed. The colors from top to bottom are: blue, white, yellow, magenta (purple), red, green, cyan (light blue), and black (not visible). CONVERGE - used to converge the three color guns of the display. Use when characters on the display appear to have colored (red, green, yellow, etc) "shadows". Follow procedure detailed later in this chapter.
LTPEN	Error indicator described in test instructions.	Hardware: 9020B or 9020C with Light Pen option Verifies operation of the light pen and associated graphics hardware.
FLOPPY	Test System Error number provided. Refer to Chapter 10.  Test System Error number provided. Refer to Chapter 10.  Test System Error number provided. Refer to Chapter 10.	Hardware: 9020A, 9020B, or 9020C with built-in flexible disc drive STANDARD - tests ability of drive to create a file, write to a file, read from a file, and purge a file. EXTENDED - tests ability of drive to write to and read from many locations on the disc. This test <b>requires use of a blank, initialized flexible disc.</b> CLEANING - when used in conjunction with the HP 92193A Disc Cleaning Kit, cleans the read/write head of the computer's built-in flexible disc drive.



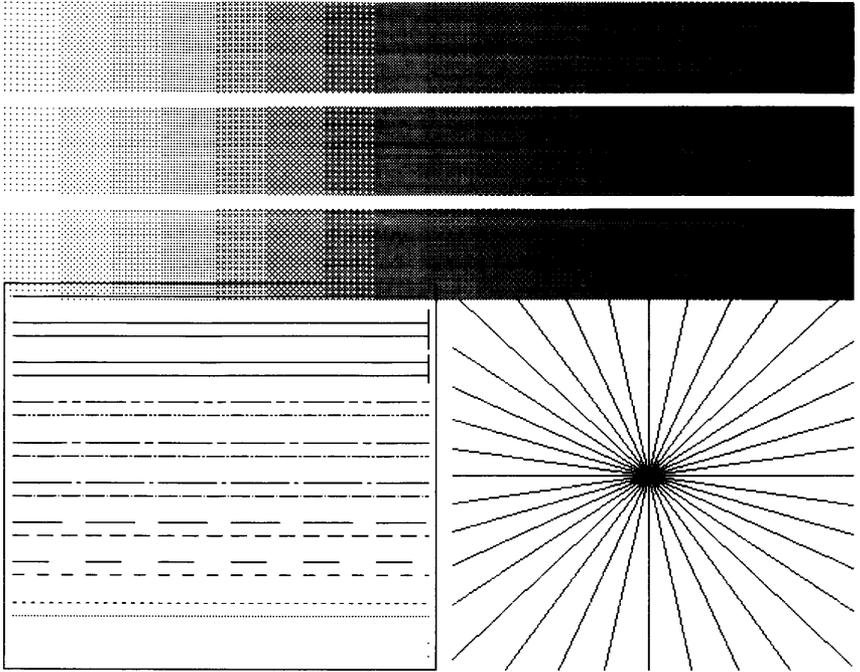
**BGRAPHICS Line Type Test**



BGRAPHICS Area Fill Test



**CGRAPHICS Vector Test**



### BASIC Peripheral System Functional Tests

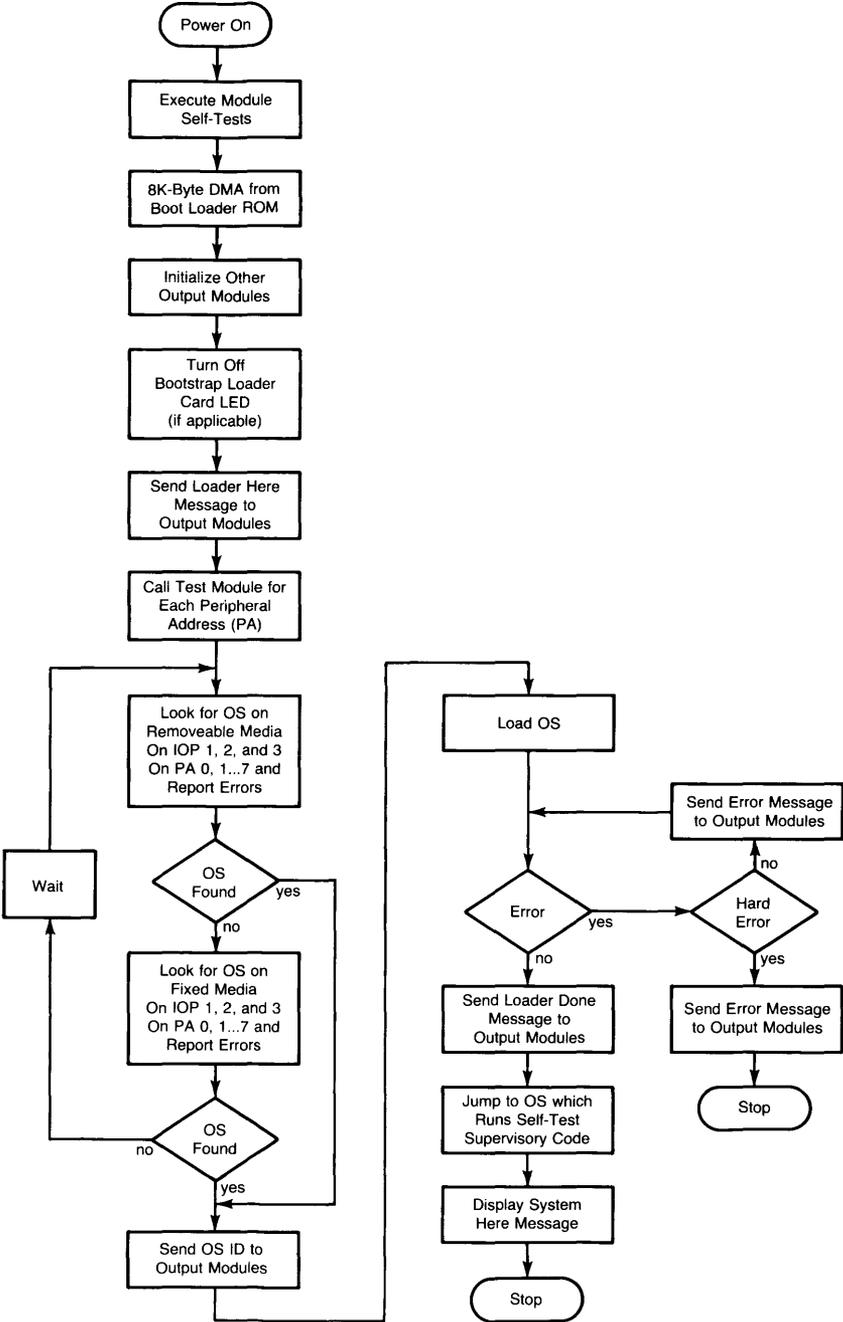
Test Name	Pass/Fail Indicator	Description/Requirements
CS80	Test System Error number provided. Refer to Chapter 10.	Hardware: 9020A, 9020B, or 9020C with any CS/80 Disc Drive (and interface). Tests ability of HP disc drive to create a file, write to a file, read from a file and purge a file. Data or programs stored on the disc are not affected by this test.
SS80	Test System Error number provided. Refer to Chapter 10.	This test is similar to the CS80 test, except that it interacts with disc drives that do not support all the features of CS/80 protocol (thus their identification by SS/80, a subset of the command set 1980 protocol). SS/80 drives include: HP 9122, 9125, 9133, and 9134.
9895	Test System Error number provided. Refer to Chapter 10.	Hardware: 9020A, 9020B, or 9020C with HP 9895 Flexible Disc Drive (and interface). Tests ability of HP 9895 flexible disc drive to create a file, write to a file, read from a file and purge a file. Data or programs stored on the disc are not affected by this test.
8290x	Test System Error number provided. Refer to Chapter 10.	Hardware: 9020A, 9020B, or 9020C with HP 8290x Flexible Disc Drive (and interface). Tests ability of HP 8290x flexible disc drive to create a file, write to a file, read from a file and purge a file. Data or programs stored on the disc are not affected by this test.
TAPE	Test System Error number provided. Refer to Chapter 10.	Test supported tape drives for file create, write, read, and purge operations. <b>Test destroys any existing data on the tape.</b>
9885	Test System Error number provided. Refer to Chapter 10.	Tests HP 9885 M/S flexible disc drive using a dedicated GPIO interface. Except for HP-IB address not applying, test operation is similar to other tests. <b>An initialized flexible disc is required for test.</b>
9121	Test System Error number provided. Refer to Chapter 10.	Tests HP 9121 disc drives. Test operation is similar to other flexible disc drive tests. <b>An initialized disc must be present in the drive 10. before the test is executed.</b>
SRM	Test System Error number provided. Refer to Chapter 10.	Tests SRM and interface by create a file, write, read, and purge. Provides more information about current status during operation than most tests in package.
HPIO	Test provides pass fail message upon completion.	Tests ability to write to and read from each I/O card. Does not perform comprehensive I/O card test.
ASI	Test provides pass fail message upon completion.	Hardware: 9020A, 9020B, or 9020C with HP 27128A Async. Serial Interface Tests the HP 27128A Asynchronous Serial Interface card by writing to and reading from the card. Provides a block of information describing the card and its configuration.
HPIB	Test provides pass fail message upon completion.	Hardware: 9020A, 9020B, or 9020C with HP 27110A HP-IB Interface Card Tests the HP 27110A HP-IB interface card by writing to and reading from the card. Provides a block of information describing the card and its configuration.

## BASIC Peripheral System Functional Tests (Continued)

Test Name	Pass/Fail Indicator	Description/Requirements
EXPRINTER	Compare printer output with pattern that follows.	Hardware: 9020A, 9020B, or 9020C with any supported HP-IB printer. Prints character pattern to specified external printer. HFIB – Formats test to match standard HP-IB printer protocol. Use this option for all standard HP-IB line printers. CIPER – Formats test for CIPER printers that use HP-IB interfacing, but support a special protocol that helps reduce bus congestion and provides more efficient data transfer. CIPER printers include HP 2608, 2566, and 2567. SERIAL – Formats data for printers that use standard RS-232C serial interfacing.
PLOTTER	Compare plotter output with pattern that follows.	Hardware: 9020A, 9020B, or 9020C with any supported Hewlett-Packard HP-IB plotter. Plots test pattern on specified plotter. If testing a multi-pen plotter, install pens such that: pen #1 = black, pen #2 = red, pen #3 = green and pen #4 = blue.
DIGITIZER	Test fails if display drawing fails to track stylus/puck movements.	Hardware: 9020A, 9020B, or 9020C with HP 9111 or HP 9874 Digitizer (and interface). Digitize (press stylus against the platen or press "D" on the 9874 puck) and move the stylus/puck around on the platen. A line which tracks the stylus/puck movements should be drawn on the display. No line is drawn when not digitizing. Press key $\left( \begin{array}{c} 8 \\ 24 \end{array} \right)$ to clear the screen and repeat test, or $\left( \begin{array}{c} 0 \\ 16 \end{array} \right)$ to exit.
GPIO	Message provided upon test pass/fail.	Hardware: 9020A, 9020B, or 9020C with HP 27112A GPIO Interface Card and its HP 1251-8003 Test Connector. Tests write/read to the HP 27112A GPIO Interface Card.
97060	Message provided upon test pass/fail.	Hardware: 9020A, 9020B, or 9020C with HP 97060 Graphics Processor. Tests the HP 97060 Graphics Processor for color synchronization.
97062		Hardware: 9020A, 9020B, or 9020C with HP 97062 Color Output Interface Card. Tests the HP 97062 Color Output Interface Card for color synchronization. If the colors and labels do not match check card connection.
RGB ALIGN	Not a test. For Test System Error Codes, refer to Chapter 10.	Alignment aid for setting up color displays connected to the HP 97060 Graphics Processor or the HP 97062 color interface card. Supports convergence and RGB intensity and balance setup. 97060 – For graphics Processor HP 97060. 97062 – For RGB interface HP 97062.



# Power-up Sequence Flowchart

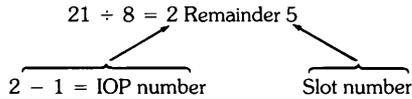


## System Loader Messages

Trailer NNNNN indicates Rev. A loader select codes.

Example:

Where: NNNNN is 21



Trailer SELECT CODE NN indicates Rev. B loader select codes; 0 through 7 = 1st IOP, 8 through 15 = 2nd IOP, and 16 through 24 = 3rd IOP.

### Messages

**Loader XXX** – Informational message identifying the revision of the system loader. This message is usually followed by a single line message identifying the operating system the computer is attempting to load.

**Testing Memory...** – Informational message that follows the “Loader XXX” message indicating that the loader is performing memory tests and configuring memory. This can take up to 15 seconds.

**Looking for System...** – Informational message that follows the “Testing Memory...” message indicating that the loader is searching for an operating system.

**Please mount next volume.** – Informational message. The loader is ready to load another portion of the operating system. Mount the volume containing an unloaded portion of the operating system. Volumes may be mounted in any order without affecting the loading process.

SYSTEM NOT FOUND; WILL RETRY: XXX  
SYSTEM NOT FOUND; WILL RETRY IN XXX

– Unable to find an operating system on any mass storage device. The loader will attempt to find an operating system again in XXX seconds. Possible causes: mass storage device not powered up, no media in mass storage device, wrong disc in disc drive, computer or mass storage device hardware failure, media failure, incompatible loader/system revision numbers, etc.

BAD SYSTEM FILE: NNNNN  
BAD SYSTEM FILE: SELECT CODE NN

– Operating system loaded. However, an error has been detected in the operating system code during loading. Possible causes: corrupt system, media failure, mass storage hardware failure, or computer hardware failure.

INSUFFICIENT USABLE MEMORY: XXXX  
NOT ENOUGH USABLE MEMORY; TOTAL IS XXXX

– The amount of usable memory is too small to load the operating system. The total amount of good memory is “XXXX” bytes. However, the amount of memory available for the Rev. A operating system is “XXXX” minus 32K bytes. The amount of memory available for the Rev. B operating system is “XXXX” minus 98 304 bytes. Possible causes: corrupt system or hardware (memory) failure.

BAD CARD OR DEVICE: NNNNN  
 BAD CARD OR DEVICE: SELECT CODE NN

– Informational message. A hardware failure has been detected (interface card or mass storage device did not pass the Module Self-Test). The loader continues searching for an operating system. Possible causes: bad interface card or mass storage device.

DEVICE NOT READY: NNNNN  
 VOLUME NOT MOUNTED: NNNNN  
 MEDIA/DEVICE NOT READY: SELECT CODE NN

– While loading. The media (Volume) was removed from the device (e.g., a floppy disc was pulled out of a disc drive), the device went offline, or a hardware problem caused the device to become “not ready”.

DMA FAILED: NNNNN – Data did not transfer properly from the mass storage device to the computer. Possible cause: Mass storage device hardware failure or computer hardware failure.

UNRECOVERABLE DATA: NNNNN  
 UNRECOVERABLE DATA: SELECT CODE NN

– Part of the operating system is not readable. Possible causes: media failure or mass storage device hardware failure.

END OF VOLUME: NNNNN  
 END OF VOLUME: SELECT CODE NN

– Attempt to address or read past the end of a volume. Possible causes: corrupt system, media failure or mass storage device hardware failure.

CTRLR/UNIT FAULT: NNNNN  
 CTRLR/UNIT FAULT: SELECT CODE NN

– Hardware passed initial self-test. However, it failed while being used to load the operating system. Possible causes: computer (interface card) hardware failure or mass storage device hardware failure.

ID TIMEOUT: NNNNN  
 ID TIMEOUT: SELECT CODE NN

– Mass storage device failed to respond fast enough while attempting to load from it. Possible cause: computer hardware failure or mass storage device hardware failure.

CS80 DEVICE: NNNNN  
 CS80 DEVICE: SELECT CODE NN

– Indicates a mass storage device hardware failure.

TAPE DEVICE: SELECT CODE NN – Usually indicates a tape device (HP 7970, HP 7974, HP 7978) hardware failure. Can also indicate a failure on the HP 27110A HP-IB Interface (or the Internal HP-IB interface). Tape errors covered are: “Command Rejected”, “Interface Busy”, “Rewinding”, “Tape Runaway”, “Data Timing Error”, and “Command Parity Error”.

HPIB CARD: NNNNN  
 HPIB CARD: SELECT CODE NN

– Transaction to the indicated HPIB interface card was terminated due to a probable interface card failure.

KBD/SCM NOT FOUND. – Indicates a keyboard failure.

## 5-24 9020 Diagnostics

BAD ID BUS: NNNNN

BAD ID BUS: SELECT CODE NN

– Indicates a computer hardware failure on the computers first IOP.

BAD NVM: NNNNN

BAD NVM: SELECT CODE NN

– Indicates that Non-Volatile Memory failed its self-test. Possible cause: computer hardware failure.

BAD RTC: NNNNN

BAD RTC: SELECT CODE NN

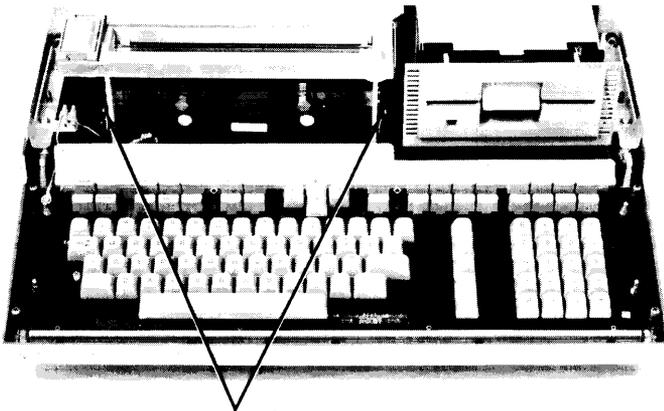
– Indicates that the built in Real Time Clock is not operating correctly.

# 9020 Adjustments

**Chapter****6**

## Print Quality

The internal thermal printer has two adjustment cams, one on each side of the printer. To obtain maximum print quality, loosen the cam lock bolts on both sides, adjust the cams while printer is operating for maximum print quality, and tighten the lock bolts.



Adjustment Cams  
and Lock Bolts

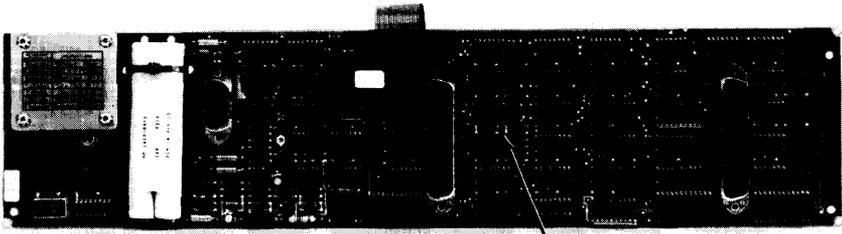
### Print Quality Adjustment

## Keyboard Language Resistors

The keyboard can be configured to one of several languages. Reconfigurations can be done in the field. To reconfigure a keyboard, change resistors on keyboard electronics board and change keycaps.

To change resistors:

1. Turn off computer and unplug power cord from ac outlet.
2. Remove keyboard from computer and place keyboard upside down on an antistatic surface.
3. Determine current configuration by noting the placement of the language resistors. Determine desired configuration according to table. A "1" indicates a resistor is installed at that location; a "0" indicates there should be no resistor at that location. Add and/or remove resistor(s) to match the desired configuration. Resistor part number is 0698-3441.



Language Resistors

### Keyboard Language Resistors

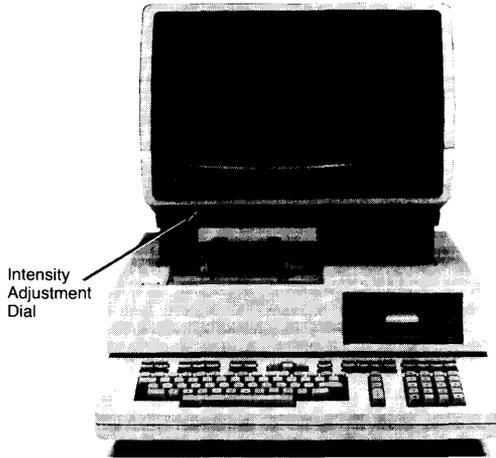
#### Keyboard Language Resistor Configurations

	R16	R17	R23	R24
English (ASCII)	1	1	1	1
Katakana (Japanese)	1	1	0	1
Svenska (Swedish)	1	0	1	1
Suomeks (Finnish)	1	0	1	1
Espanol (Spanish)	1	0	0	1
Deutsch (German)	1	1	1	0
Francais (French)	1	1	0	0

## CRT Displays

### Intensity Adjustment

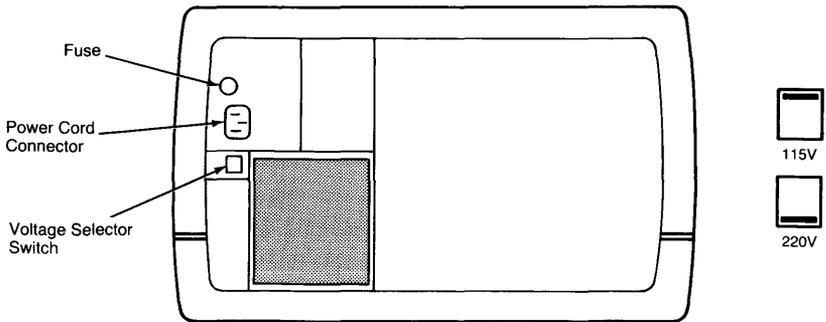
The intensity adjustment dial is located in the same place on all 9020 CRT displays.



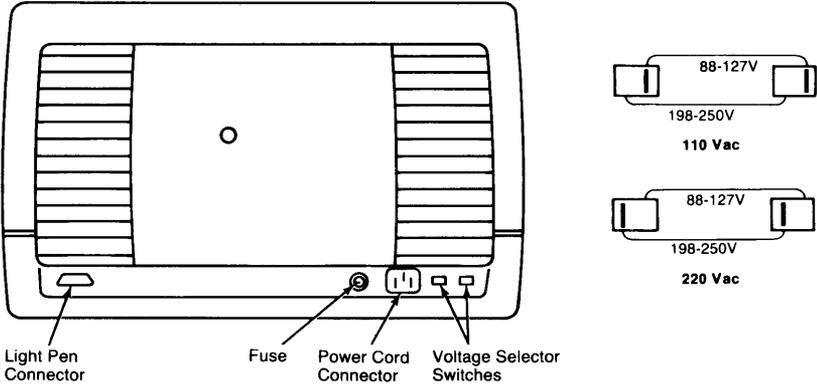
Intensity Adjustment Dial

### Voltage Selection (9020A and 9020C)

The 9020A and 9020C color displays have voltage selector switches on the back. The switches can be set so that the display operates on one of two nominal line voltages, as indicated by the drawings.



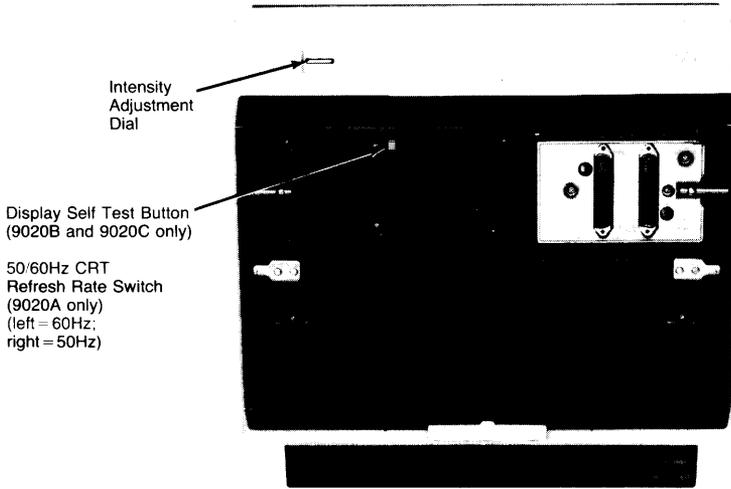
9020A Display



**9020C Display**

### CRT Refresh Switch (9020A)

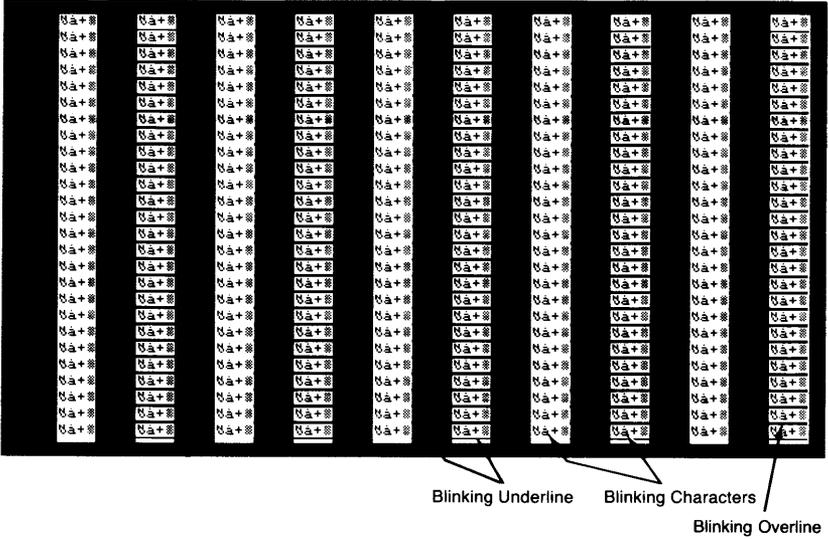
The 9020A has a CRT refresh switch mounted underneath the display. The switch has two positions: 50 Hz and 60Hz. The switch should be set to match the local line frequency. As you face the front of the display, 60 Hz is selected with the switch to the left and 50 Hz is selected with the switch to the right.



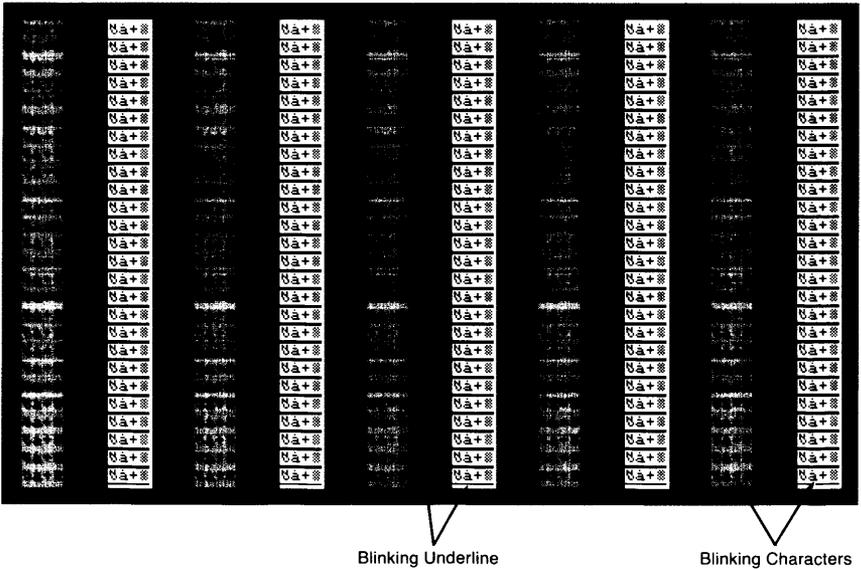
**Display Self Test or Refresh Switch and Adjustment Dial**

### Self Test Switch (9020B and 9020C)

The 9020B and 9020C have a self test switch mounted underneath the display. Pressing the switch displays a test pattern. The pattern is displayed as long as the switch is pressed. When the switch is released, the pattern is no longer displayed.



Test Pattern for the 9020B Display



Test Pattern for the 9020C Display

### Aligning the 9020A Display

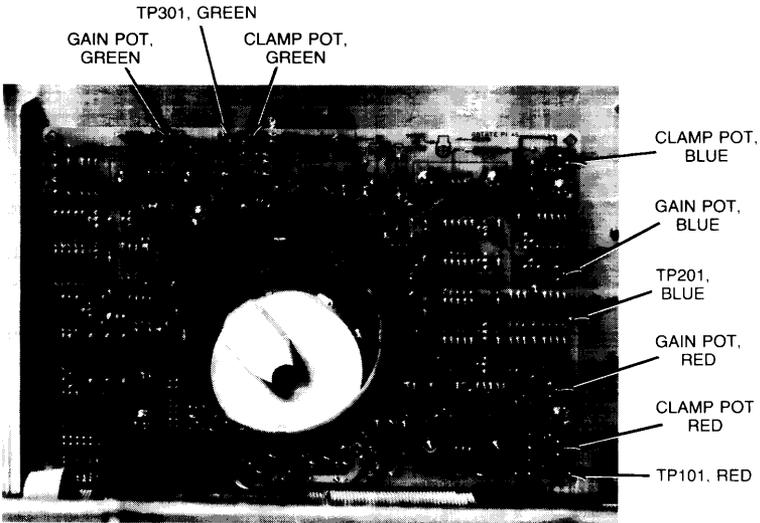
1. Load the TEST operating system using the System Functional Test discs.
2. Load the mainframe test disc and select AGRAPHICS, INTERACTIVE.
3. Step through the procedures as directed.

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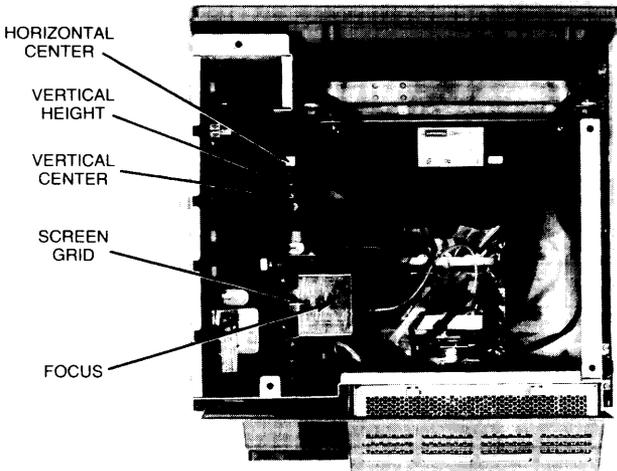
**Note**

The video board contains all clamp pots, gain pots, and test points. The sweep board contains the screen grid adjustment, as well as several other adjustments.

---



**9020A Video Board Pots and Test Points**



**9020A Sweep Board Adjustments**

## Converging the 9020C Display

1. Run the System Functional Tests using the MAINFRAME TEST PROGRAMS disc. Select the test for color graphics (CGRAPHICS) then select the CONVERGE option.
2. Open the door located just to the right of the screen (on the display case) to expose 39 alignment locations and the alignment tool; the 39 alignment locations are organized in rows by adjustment number (13 in all) and in columns by color (red, blue, and green). Remove the alignment tool from inside the door by pressing its top.
3. A small white plus sign ( + ) is displayed in one area. Additionally, the number 1 appears along the right hand edge of the display to remind you of the row of alignment locations you should use to adjust the convergence. Use the alignment tool to merge (if necessary) the red, blue, and green pluses by turning the appropriate control for the color you are moving. For example, adjusting the alignment location in row one, column one (the red column), moves the red plus.

Adjusting the alignment locations causes the pluses to move across the screen according to the following rules:

- a. the red plus moves along a line from lower left to upper right.
- b. the blue plus moves along a vertical line.
- c. the green plus moves along a line from upper left to lower right.

You may find that the easiest way to merge the pluses is to first merge the red and green pluses together (forming a yellow plus). Next merge the blue plus (which now lies directly above or below the yellow plus) into the yellow plus, forming a white plus.

---

### Note

If the character displayed is a white plus with shaded (colored) edges rather than completely separated pluses, very little adjustment is needed. Even when the three colored pluses are correctly merged, a small amount of colored "fringing" may appear around the edges. This is normal.

---

4. After you are satisfied with the adjustment for alignment location one, press **(8 24)**. Another white plus appears; this is for alignment location 2. Adjust locations 2 through 13 in the same manner as indicated in step 3 above.
5. If you are not satisfied that all pluses are properly merged, steps 3 through 4 may be repeated as many times as necessary. When you are completely satisfied that the display is converged, press **(0 16)** to exit the routine.

## 6-8 9020 Adjustments

# 9020 Peripherals

**Chapter**
**7**


---

**CAUTION**

DO NOT OVERLOAD THE POWER SUPPLY BY USING MORE HP 27123A, HP 27125A, OR HP 50961A INTERFACE CONNECTIONS THAN CAN BE SUPPORTED.

---

An HP 9020B with a 10-megabyte winchester disc drive must not have more than one of the following I/O cards installed in it if the MPB and I/O card cages are full. An additional card may be added for each MPB or I/O slot that is unoccupied. Because these interface cards can power external devices, they may exceed the per-slot power budget specified by the HP-CIO standard. Therefore, consider them to take the power of two interface cards. The I/O cards concerned are:

- HP 27123A when powering an HP 98028A SRM MUX.
- HP 27125A LAN/500 Link Interface.
- HP 50961A Option 500 (27123A with SRM Coax Adapter).

## Select Codes

Select Code	Usage
0	Display Alphanumeric
1	Display Graphics
2	I/O Slot #2
3	I/O Slot #3
4	I/O Slot #4
5	I/O Slot #5
6	Keyboard, Printer, Real-Time Clock, Beeper, Optional Input Device
7	Internal Mass Storage

## HP-CIO Interface Cards

### HP 27110A/B Standard HP-IB

#### Features

- IEEE-488-1978 compatible.
- Supports DMA with two modes of performance: High Speed Mode for operation with fixed discs or other high-speed peripherals, and Standard Mode for instruments and slower peripherals.
- Supports up to 14 device loads.
- Selectable HP-IB controller or slave capabilities and parallel poll capabilities (BASIC Language System only).
- Built-in hardware self-test.

#### Configuration

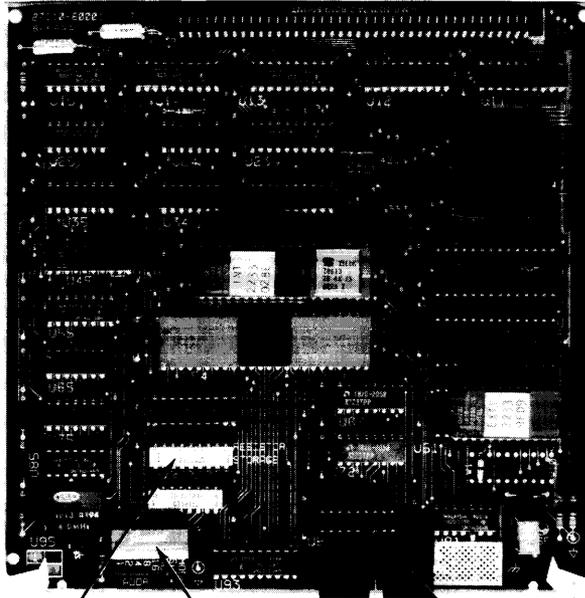
The normal switch settings are shown in the next figure.

The switch functions are:

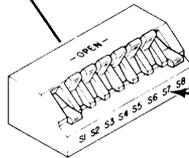
- S1-S5: Address 30 (decimal); S1 is Least Significant Bit
- S6: System Controller On
- S7: Normal Speed
- S8: Test Mode 1

High-speed devices can run on a normal-speed bus, but run slower than their capacity. Normal-speed devices cannot run on a high-speed bus. The following are examples of high-speed devices:

- disc drives
- 7971A tape drive
- 2608S and 2631B/G printers



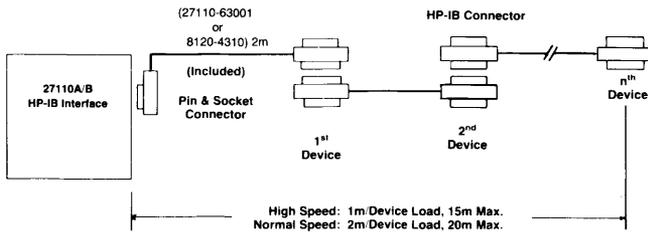
LOAD RESISTOR PACK  
IN NORMAL-SPEED POSITION  
OR IF **NOT** SYSTEM CONTROLLER  
IN HIGH SPEED



MOVE LOAD RESISTOR PACK  
HERE FOR HIGH-SPEED OPERATION  
AND SYSTEM CONTROLLER

- S7:
- UP FOR NORMAL SPEED
  - DOWN FOR HIGH SPEED

### HP 27110A/B HP-IB Interface Card



### HP 27110A/B HP-IB Interface Cabling

**HP-IB Cables**

<b>Product Number</b>	<b>Length (in metres)</b>
*92220R	0.3
10833D	0.5
10833A	1.0
*82977A	1.0
10833B	2.0
*82977B	2.0
10833C	4.0
8120-3448	6.0
8120-3449	8.0

\* Right Angle Connector

**HP 27112A General Purpose I/O (GPIO) 16-Bit Parallel****Features**

- Choice of programmable operating modes (clocked or transparent) for ease of use with instrumentation.
- Supports +5V level on all input and output signals, plus an optional +12V level on output signals.
- Programmed data detection for either positive true or ground true levels.
- Independent 16-bit input and output buses and storage registers.
- Two control and two status lines.

**Configuration**

The normal switch settings depend on which peripheral device is connected to the GPIO. The 9885M/S Flexible Disc Drive and the 97060A Graphics Processor require the GPIO switch settings shown in the next figure.

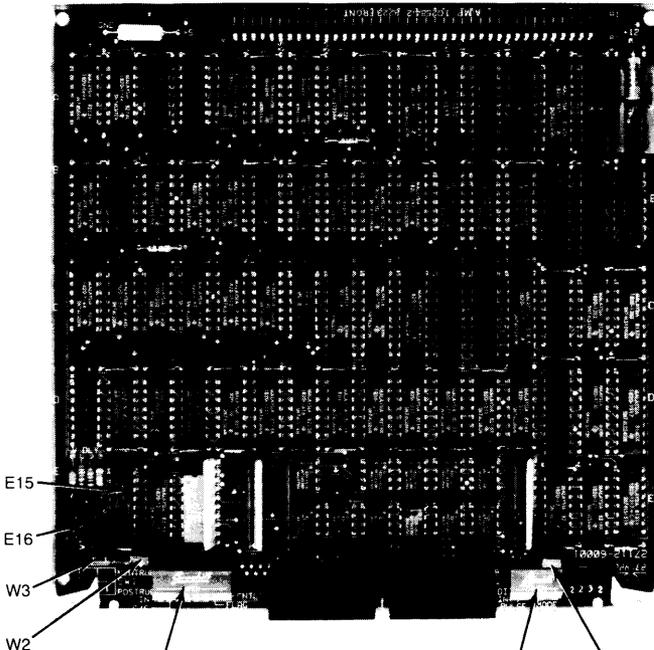
The switch setting functions are:

**SW1**

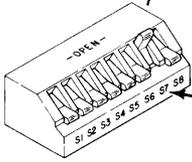
- S1: DIN - Negative True
- S2: CTL and STS - Negative True
- S3: PSET - Negative True
- S4: PDIR - Negative True
- S5: DOUT - Negative True
- S6: PEND - Negative True
- S7: PFLAG - Negative True (97060A)  
- Positive True (9885M/S)
- S8: PCNTL - Negative True

**SW2**

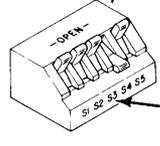
- S1: Bidirectional Bus - Disabled
- S2: Internal Handshake - Disabled
- S3: Full/Pulse Handshake - Disabled (9885M/S)  
- Enabled (97060A)
- S4 and S5: Data Clocked On Ready To Busy Edge Of PFLAG (Leading Edge)



W1, W2, W3  
 Jumper in 5V Position  
 +5  +12  
 Jumper in 12V Position  
 +5  +12



S7:  
 •UP FOR 9885M/S  
 •DOWN FOR 97060A



S3:  
 •UP FOR 9885M/S  
 •DOWN FOR 97060A

**HP 27112A General Purpose I/O (GPIO) Interface Card**

## 7-6 9020 Peripherals

To configure the GPIO card:

1. Install jumpers in W1, W2, and W3, according to whether 5-volt or 12-volt logic levels are to be used.
2. Set the card's switches for proper operation.
3. If necessary, increase the delays on the card as follows:

Two one-shots (E15) on the GPIO card generate the write delay and the internal handshake delay. The write delay one-shot provides approximately 100 nsec for the output data to settle. When extra-long cables are used, or when the peripheral device requires additional settling time for the data, the delay can be increased by adding a capacitor between pins 1 and 4 of the socket at E16.

The formula for selecting the capacitor value is:

$$C = (T - 100) / 1.5$$

where

C = additional capacitance (in pf)

T = total time delay required in nsec

The internal delay one-shot provides a delay of approximately 3 usec between the assertion of PCNTL and the assertion of FLAG. The delay can be increased by adding a capacitor between pins 5 and 8 of the socket at E16.

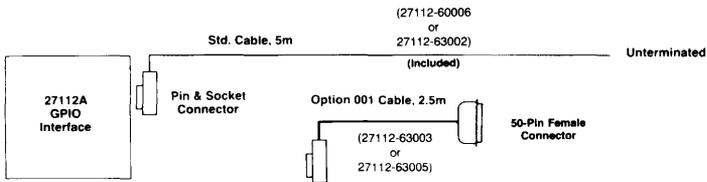
The formula for the value of the capacitor is:

$$C = (T - 3000) / 3$$

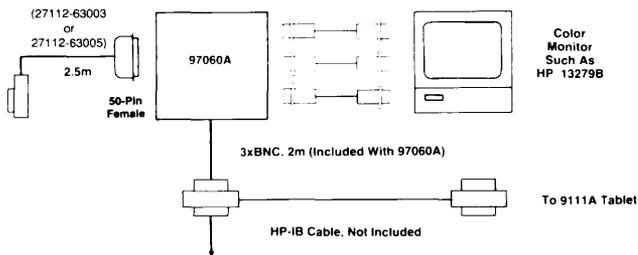
where

C = additional capacitance (in pf)

T = total time delay required (in nsec)



### HP 27112A GPIO Interface Cabling

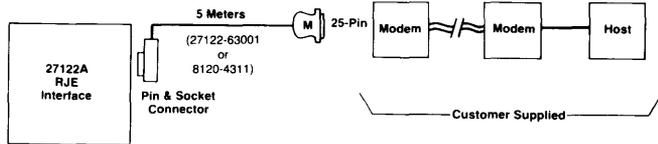


### Interconnecting the HP 97060A Graphics Processor

## HP 27122A Remote Job Entry (RJE)

### Features

- 1,200 to 19,200 baud rates.
- Compatible with EIA RS-232C and CCITT V.24 specifications.
- Supports Bell type 208B, 2096, and 212 data sets or equivalent.
- Supports Siemens MSV2 protocol.
- Works with full or half duplex modems, and supports AUTO ANSWER and ORIGINATE.
- Provides link control functions: line bid, normal and transparent data modes, all responses, and link termination.
- Assures data integrity with CRC error checking.
- EBCDIC character recognition.
- Space compression/truncation.



HP 27122A Remote Job Entry (RJE) Cabling

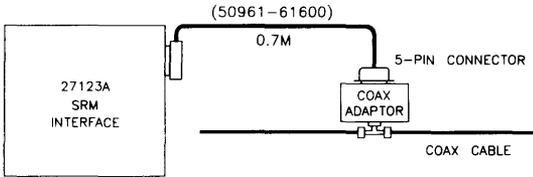
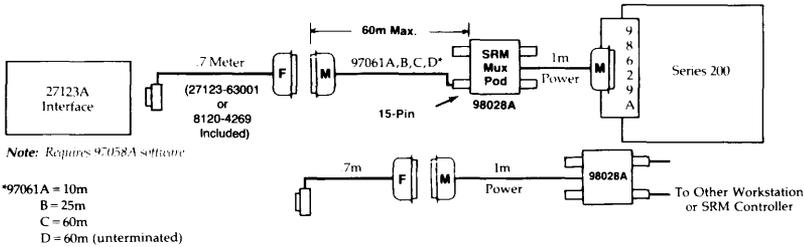
## HP 27123A Shared Resources Manager (SRM)

### Features

- Data transmission rate is 700 Kbits/sec.
- Access to the network through rotary polling on an HP 98028A Multiplexer (part of the SRM product).
- All transmissions are broadcast to all connections on the HP 98028A Multiplexer.
- Packets can contain up to 512 data bytes.
- Reception of packets is acknowledged.
- Remote file access to create/open/purge a file/directory, read/write bytes, set protection, and catalog.

### Configuration

Ensure that the 8 switches are set to the binary equivalent of the assigned decimal node address. S1 is the MSB; S8 is the LSB.



**HP 27123A Shared Resources Manager (SRM) Cabling**

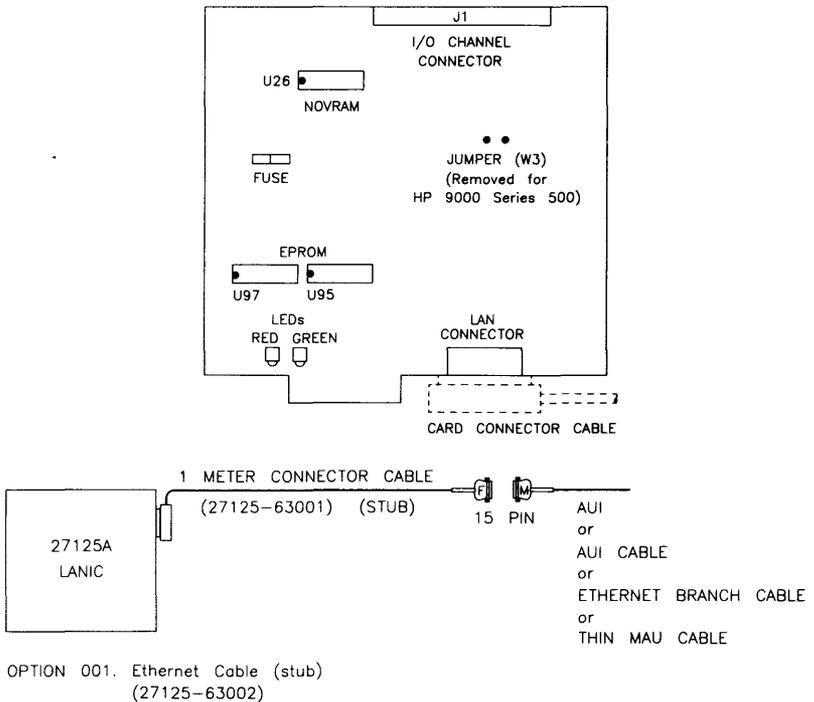
## HP 27125A Local Area Network Interface Controller (LANIC)

### Features

- Implementation of IEEE LAN standards 802.2 type 1 and 802.3.
- Provides LAN connection to HP 9000 Series 500 host computers.
- Operates with baseband networks using Carrier Sense Multiple Access with Collision Detect (CSMA/CD).
- Provides for connection and operation with Ethernet version 1.0.
- 10 Mbps transfer rate.
- 50 metres distance between LANIC and attachment unit.

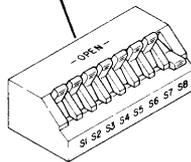
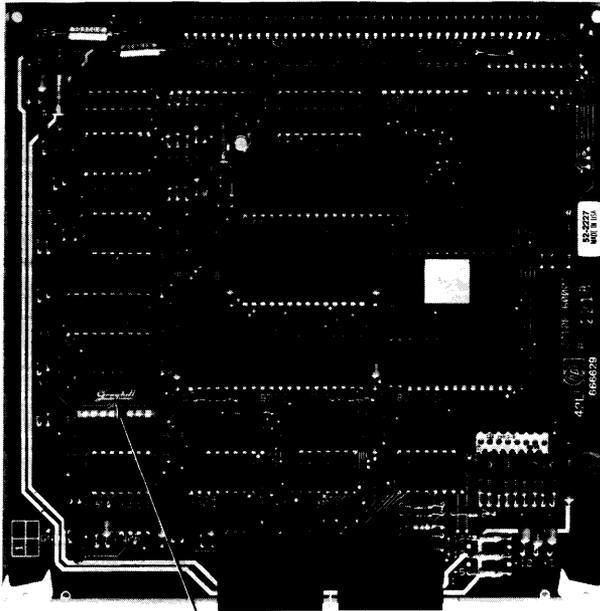
### Configuration

- There are no switches to be set.
- All node hardware must conform to the same standards.
- Remove and throw away jumper W3.
- Record the Link Address—08 00 09 (plus xx yy zz from the NOVRAM).

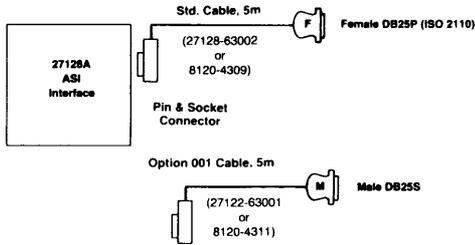


### HP 27125A LANIC Cabling





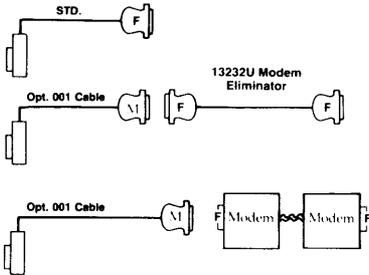
**HP 27128A Asynchronous Serial Interface (ASI) Card**



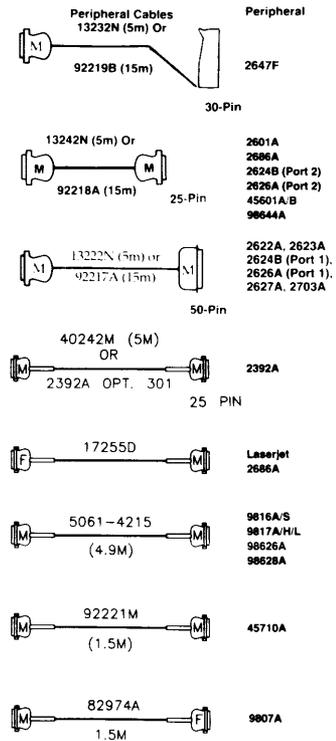
Terminal Cabling

Any of these . . .

ASI Interface Cables



are compatible with any of these.

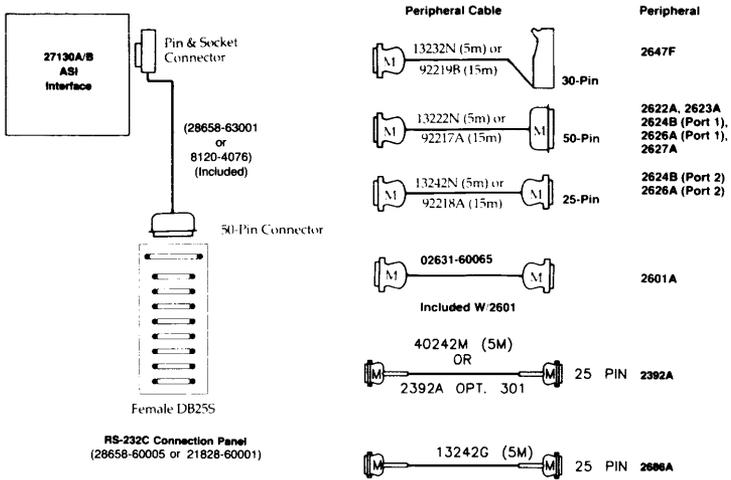


HP 27128A ASI Interface Cabling

## HP 27130A/B Asynchronous 8-Channel Multiplex

### Features

- CCITT V.28 and EIA RS-232C compatible.
- Supports simplex, echoplex, or full-duplex mode (asynchronous transmission only).
- Selection of data transmission attributes can be performed independently on each channel.
- Local intelligence reduces time consumed by the CPU during I/O transactions by offering edit functions, special character recognition, and handshake protocol control.
- Parity, overrun, and framing errors are sensed locally to detect transmission errors.
- X-ON/X-OFF (both directions) and ENQ/ACK (one direction, host sending ENQ) handshaking



### HP 27130A/B Asynchronous 8-Channel Multiplex Cabling

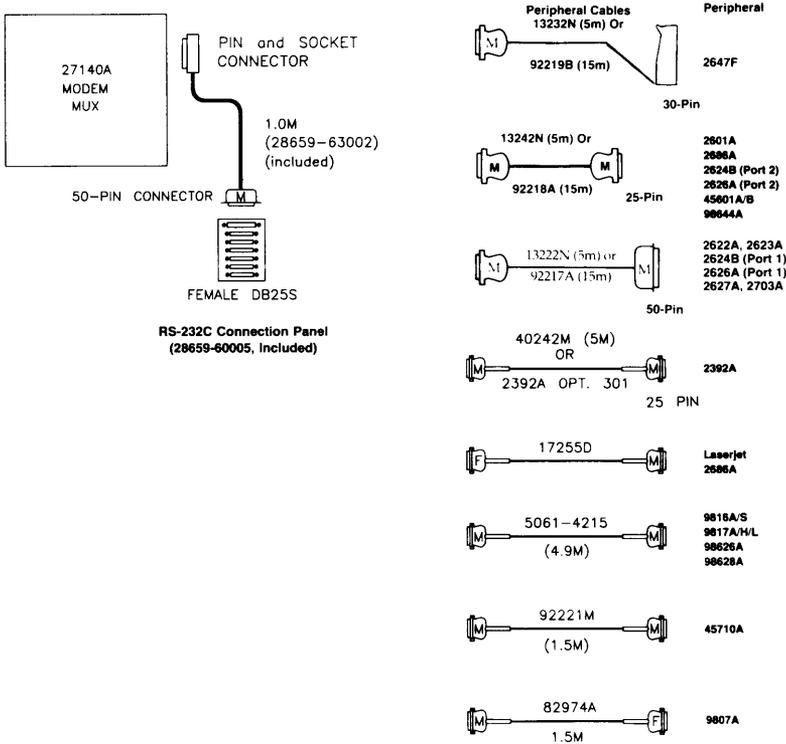
## HP 27140A Modem MUX Interface

### Features

- Supports up to six EIA RS-232C/CCITT-V.22 compatible devices.
- Consists of interface card, cable, and connection panel.
- Provides control lines and handshaking for asynchronous modems and uucp networking.
- Direct DCE style connection.
- DTE style connection with HP 92219Q cable.

### Configuration

There are no switches to set on the HP 27140A card.

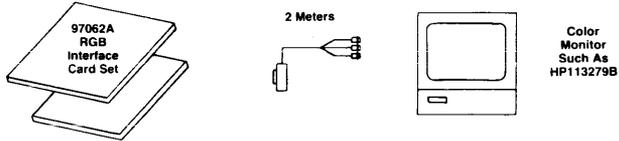


### HP 27140A Modem MUX Cabling

## HP 97062A Color Video

### Features

- Medium-resolution interface to 19-inch color monitor.
- Produces RS-343-compatible signals across three coaxial cables.
- Uses four memory planes to display 16 colors from 4096 available.
- Supports all Graphics/9000 plotter commands including area shading.



HP 97062A Color Video Interface Cabling

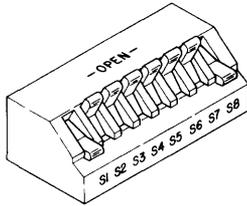
## HP 2885A LAN 9000 Local Area Network

### Features

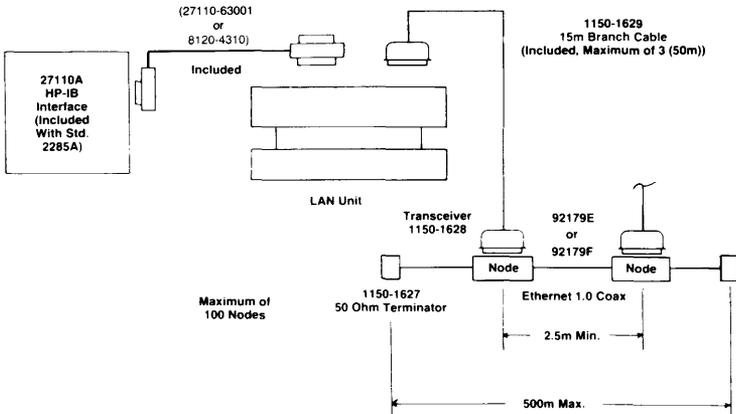
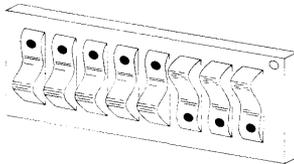
- HP-IB interface to host CPU.
- Coax cable with baseband signaling.
- 10 Mbps data signaling rate.
- Minimum separation between nodes is 2.5 metres.
- Nodes can be up to 40 metres from the coax cable.
- Masterless protocol, Carrier-Sense Multiple Access with Collision Detection (CSMA/CD).
- Up to 500-metre segment coax length and up to 100 nodes per segment.
- Supports broadcast and multicast addressing.
- User-executable diagnostics which can be run simultaneously with other network services.

### Configuration

Before you install the HP-IB card, ensure that the resistor pack is installed in socket U74 (normal speed) and that the switches are set in these positions:



Set the bus address of the LAN unit to 0 by setting the switches on the back of the unit to these positions:



HP 2885A LAN 9000 Local Area Network Cabling

# 9020 Replaceable Parts

Chapter

8

## Exchange Parts

Fig. No.	Index No.	New Part Number	Rebuilt Part Number	Description
5-2	6	09855-67980	09855-69980	Power Supply Assembly
5-2	—	09855-66571	09855-69571	Display Interface Module
5-10	1	09855-66531	09855-69531	Keyboard Electronics Board
5-10	3	09855-67131	09855-69131	Keypad Board
5-3	5	09855-66552	09855-69552	Printer Motor Drive Board
5-6	8	09855-66561	09855-69561	9130K Controller Card
5-9	1	09130-67600	09130-69600	9130K Flexible Disc Drive
5-6	8	09855-66560	09855-69560	Winchester I/O Card
5-6	8	0950-0886	09855-69886	Winchester Disc Controller
5-8	1	09133-67102	09133-69102	Fixed Disc Mechanical Drive
5-8	2	09133-67101	09133-69101	Fixed Disc Electronics Board
5-11	1	09836-66550	09836-69550	98760A Power Supply Board
5-11	2	09836-66540	09836-69540	98760A Sweep Board
5-11	3	09836-66541	09836-69542	98760A Video Board
5-11	4	98760-66573	98760-69573	98760A Alpha/Interface Board
5-11	5	98760-66575	98760-69575	98760A Graphics/Digital Video Board, ASCII
5-11	5	98760-66576	98760-69576	98760A Graphics/Digital Video Board, Katakana
5-5	2	5061-6803	97043-69803	Floating Point CPU
5-5	2	5061-6806	97044-69806	IOP Finstrate (Rev. 3.1)
5-5	2	5461-4232	97040-69232	256K RAM Board
5-5	2	5061-6805	97047-69805	512K RAM Board
5-5	2	5061-7704	97046-69704	1M RAM Board

## Non-Exchange Parts

Fig.	Index	Part Number	Description
5-5	3	5061-4224	Processor Stack Clock Board
5-5	4	5061-4263	Processor Stack Motherboard
5-5	2	5061-6806	IOP Board (Rev. 3.1)
5-5	2	5061-4228	IOP Buffer Assembly
5-5	2	97043-69235	CPU Board (5061-4235)
5-5	2	5061-6803	Floating Point CPU
5-5	2	5061-4232	256K RAM Board
5-5	2	5061-6805	512K RAM Board
5-5	2	5061-7704	1M RAM Board
5-6	8	09855-66562	Bootstrap Loader Card
5-3	4	09855-66551	Printer Logic Board
5-3	7	09845-67163	Printhead
5-3	8	09855-66555	Printhead Interconnect Board
5-4	10	09845-67161	Printhead Chip Module
5-2	28	09855-66500	Motherboard
5-6	1	09855-66501	I/O Backplane
5-2	15	3160-0377	Fan
5-11	7	98760-66500	98760A Display Motherboard

**Product Support Tools**

Part Number	Description
09855-67004	Power Supply Discharge Tool
5040-7433	Keycap Removal Tool
09020-10010	Test Pack
09020-80038	HP 9000 Model 520 Computer Service Manual Package
09815-20602	Paper Spindle Tool

**Extender Board**

Part Number	Description
27116A	HP-CIO Extender

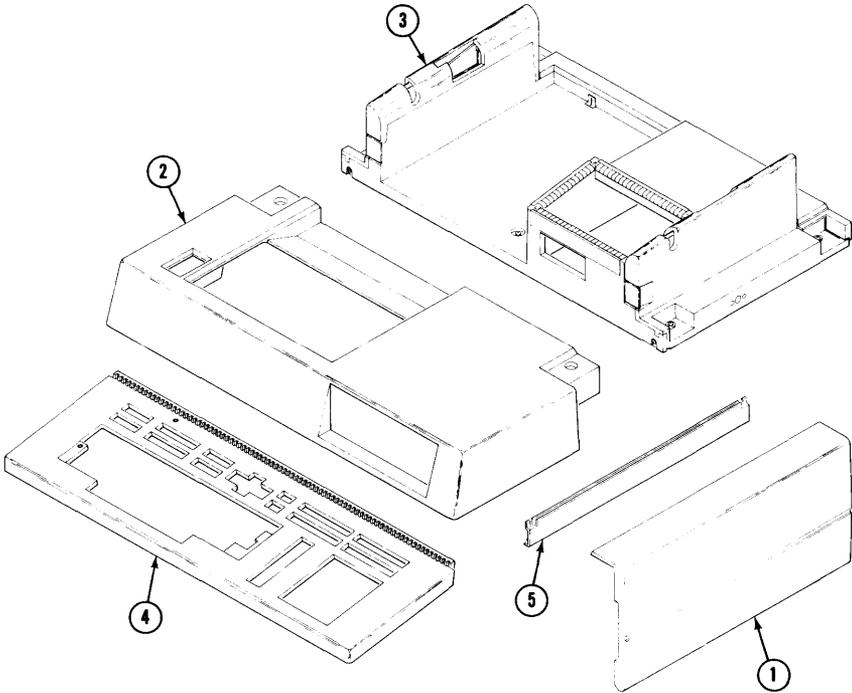
**Product Support Documentation**

Part Number	Description
09020-80038	Service Manual Package, which includes: 09020-90037 Service Manual for the HP 9000 Model 520 09020-90011 Installation and Test for the HP 9000 Model 520 09040-90040 Series 500 Site Preparation Manual 98770-90030 Service Manual for the HP 98770A Display 98780-90030 Service Manual for the HP 98780A Display 5955-6587 Sales and Support Offices 9282-0989 2" 3-Ring Binder 09020-90008 Manual Assembly Instructions 9211-3778 Package Shipping Carton

**HP Printer Replacement Paper**

Part Number	Description
9270-0640	English-dimensioned, black print
9270-0641	English-dimensioned, blue print
9270-0642	Metric-dimensioned, black print
9270-0643	Metric-dimensioned, blue print





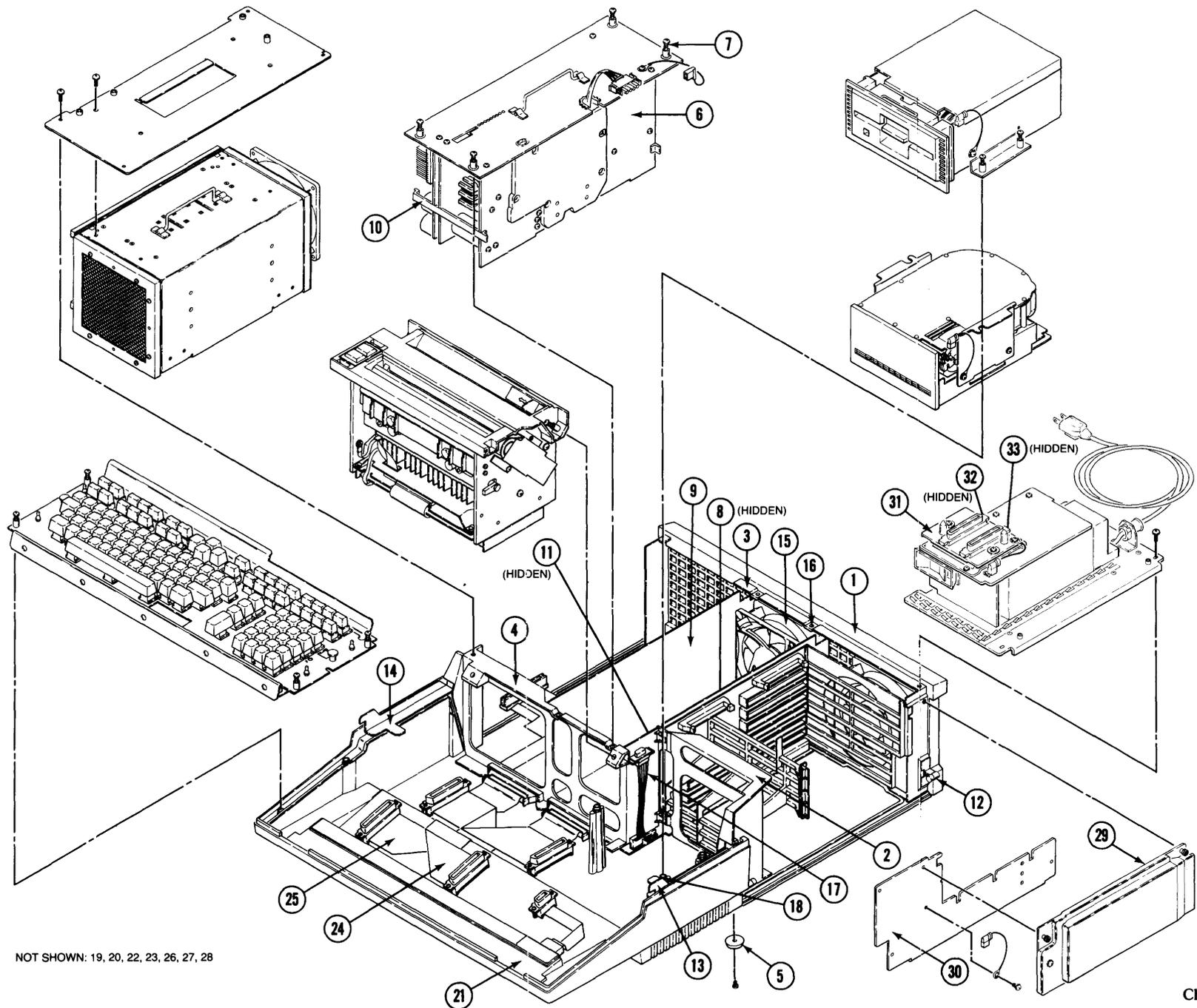
Covers

## Covers Parts List

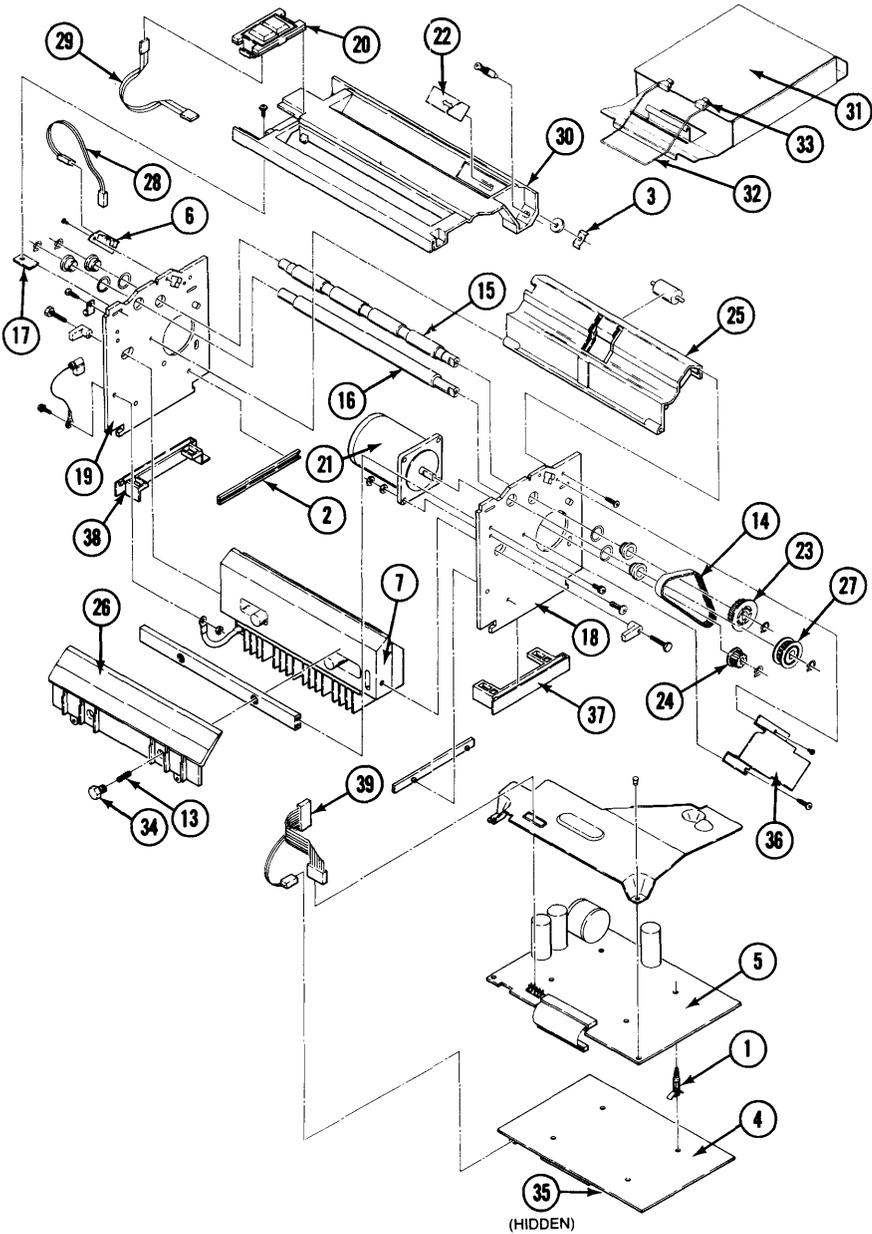
Index Number	HP Part Number	Quantity	Description
1	5041-3449	2	Exterior Door
2	5041-3456	1	Front Cover
	0403-0374	2	● Bumper, Square Self-Adhesive.
3	09855-60371	1	Rear Cover
	2190-0010	6	● Washer, Lock, Ext T.
	3050-0071	6	● Washer, Flat, MTLC.
	0905-0960	6	● O-Ring.
4	5041-3455	1	Keyboard Bezel
	4040-2047	2	● LED Lens.
	0905-0129	2	● O-Ring 0.145-Inch.
	1390-0064	4	● Receptacle, Ball Stud.
	5041-3450	1	● Filler Key, Left.
	5041-3451	1	● Filler Key, Right.
5	7200-1698	2	Door Trim
	<b>Labels</b>		
	5955-8036	1	● FCC Computer-Compliance Label
	7121-3107	1	● Special Function Key Label
	7121-3493	1	● Interlock Warning Label

## Chassis Components Parts List

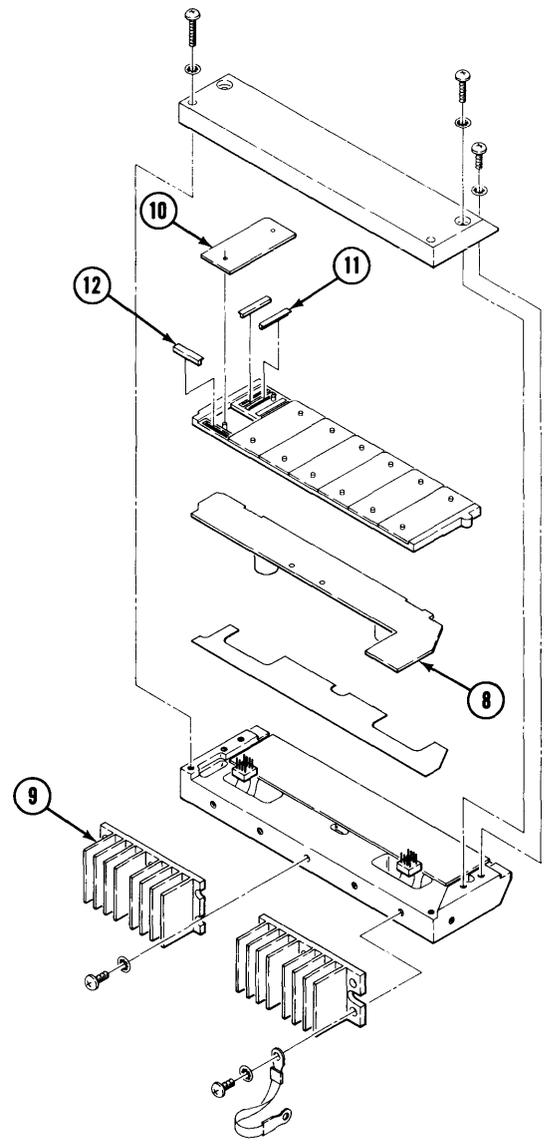
Index Number	HP Part Number	Quantity	Description
<b>Miscellaneous Hardware</b>			
	0515-0389		Screw, Machine, M3.5.
	0515-0653		Screw, Tapping, 3.6 x 1.34.
<b>Components</b>			
1	09855-67904	1	Complete Casting.
2	0050-2096	1	Partial Casting, Right Front (as seen from front).
3	0050-2095	1	Partial Casting, Rear.
4	0050-2094	1	Partial Casting, Left Front (as seen from front).
5	0403-0106	5	Rubber Foot.
6	09855-69980	1	Power Supply Assembly.
7	1390-0595	4	Captive Screw.
8	4040-2050	1	Power Supply Guide (bottom of power supply bucket).
9	1600-1235	1	Power Supply Bucket.
10	4040-2040	2	Power Supply Side Clamp.
11	0330-0359	1	Long Mounting Foam Support (inside power supply bucket).
12	1600-1216	4	Door Hinge.
13	1600-1217	1	Left Strap.
14	1600-1218	1	Right Strap.
15	3160-0377	3	9.5 VDC Fan.
16	0590-1453	8	Fan Clip.
17	8120-3551	1	Flexible Disc Drive Power Cable.
18	8120-3599	1	Ground Cable.
19	1600-1210	1	Alternate Cursor Control Bracket.
20	1600-1230	1	No Printer Cover.
21	5041-3457	1	Base.
22	8120-3553	1	Fan Cable.
23	8120-3558	1	Alternate Cursor Cable Assembly.
24	8120-3559	1	Keyboard Power Cable.
25	8120-3562	1	Keyboard/IOP Bus Cable.
26	1531-0226	1	Roller/Bushing Assembly (under back of base).
27	1480-0051	2	Roller Axle.
28	09855-66500	1	Motherboard.
29	09855-60200	1	I/O Door Assembly.
30	1600-1226	1	Mass Memory Cover.
<b>98770A and 98780A Displays</b>			
	0050-2091	1	Casting
	09855-69571	1	Display Interface Module (DIM).
	1600-1237	1	Lid.
	1531-0231	2	Pivot.
31	09855-67903	1	Display Connector Plate.
32	8120-3556	1	Display Data Cable (Long Cable).
33	8120-3563	1	Display Power Cable (Short Cable).



NOT SHOWN: 19, 20, 22, 23, 26, 27, 28



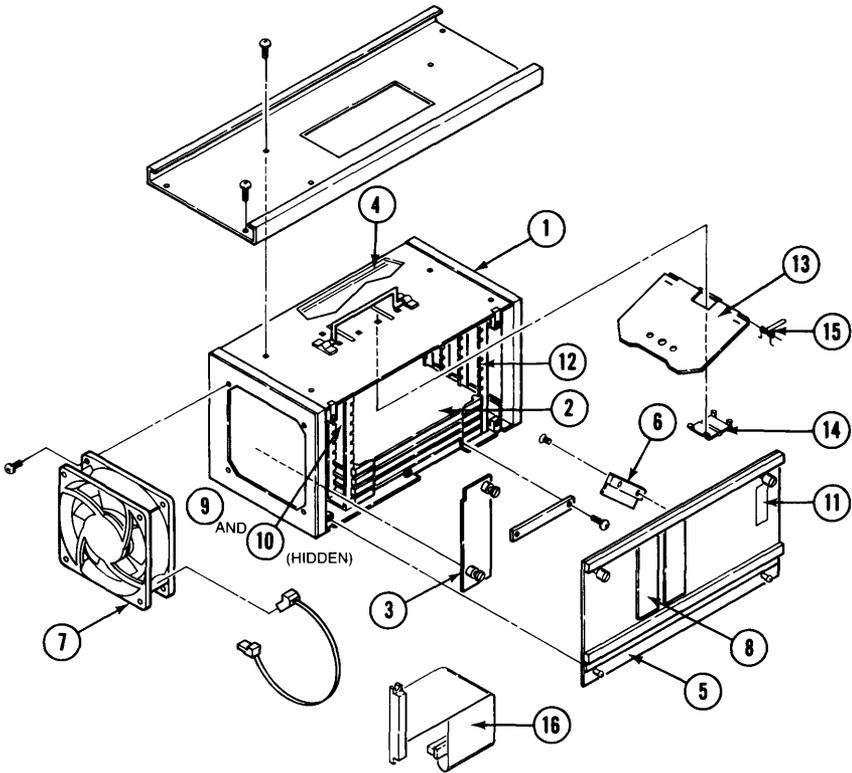
Printer



Printhead

## Printer Parts List

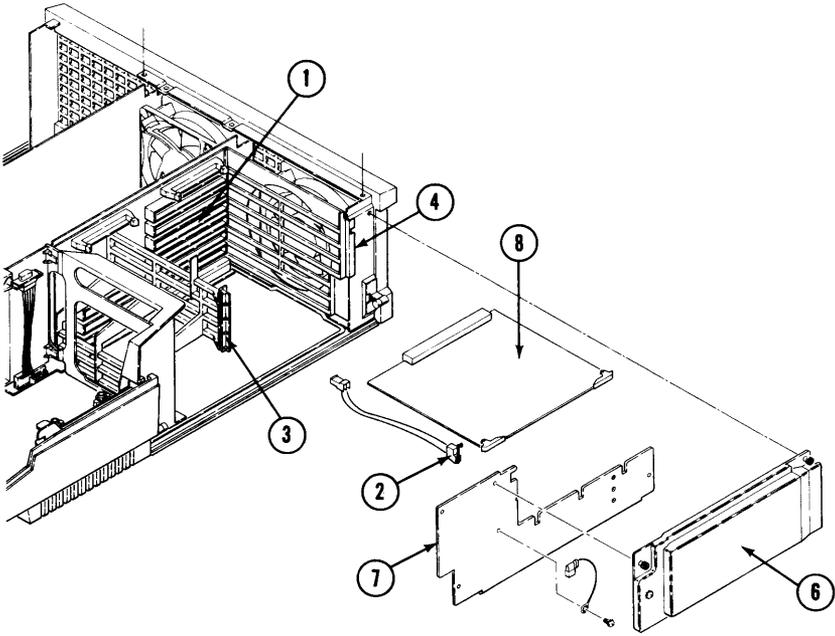
Index Number	HP Part Number	Quantity	Description
	09855-67950		Printer
1	0380-1502	4	PC Board Fastener
2	0403-0268	2	4.50 inch PC Board Guide
3	0510-1196	1	Slider Clip
4	09855-66551	1	Logic Board
5	09855-69552	1	Motor Drive Board
6	09855-66554	1	Paper Sense Board
7	09845-67163	1	Printhead
8	09855-66555	1	Printhead Interconnect Board
9	1205-0377	2	Printhead Heat Sink
10	09845-67161	7	Printhead Chip Module
11	1251-4819	28	Elastomate Connector, Long
12	1251-4820	7	Elastomate Connector, Short
13	1460-0636	2	Compression Spring
14	1500-0530	1	Drive Belt
15	1530-2025	1	Roller
16	1530-2026	1	Platen
17	1600-1201	4	Bezel Clamp
18	1600-1333	1	Right Side Plate
19	1600-1334	1	Left Side Plate
20	3101-2564	1	Switches Assembly
21	3140-0668	1	Stepper Motor and Connector
22	4040-2057	1	Paper Guide Slider
23	5040-8143	1	Roller Pulley
24	5040-8144	1	Motor Pulley
25	5041-1497	1	Lower Paper Guide
26	5041-1498	1	Tear Bar
27	5060-7463	1	Platen Assembly Pulley
28	8120-3560	1	Paper Sense Cable
29	8120-3564	1	Paper Advance Cable
30	7101-0689	1	Bezel
31	09855-67951	1	Paper Tray Assembly
32	1460-1948	1	Wire Paper Guide
33	4040-2038	2	Wire Guide Hinge
34	0380-1161	2	Hex Standoff
35	1818-1870	1	ROM
36	1600-1264	1	Belt Guard
37	4040-2079	1	Plastic Locator Guide, Right
38	4040-2080	1	Plastic Locator Guide, Left
39	8120-3994	1	Printhead Cable



Processor Stack

## Processor Stack Parts List

Index Number	HP Part Number	Quantity	Description
1	97011-64403	1	Processor Cage (Without Cards or Clock)
2	<b>Stack Replacement Boards</b>		
	97043-69235	1	● CPU Board (5061-4235)
	97043-69803	1	● Floating Point CPU (exchange)
	5061-6803	1	● Floating Point CPU (new)
	97044-69806	1	● IOP Board (Rev. 3.1) (exchange)
	5061-6806	1	● IOP Board (Rev. 3.1) (new)
	5061-4228	1	● IOP Buffer Assembly
	5061-4232	1	● 256K RAM Board
	5061-6805	1	● 512K RAM Board
	97047-69805	1	● 512K RAM Board (exchange)
	97046-69704	1	● 1M RAM Board (exchange)
	5061-7904	1	● 1M RAM Board (new)
	09855-66525	1	● Load Board
3	5061-4224	1	Clock Board
4	5061-4263	1	Stack Motherboard
	5041-3463	2	● Motherboard Support
5	1600-1353	1	Stack Door
	5180-5201	1	Label, Door Seal
6	1400-1179	1	IOP Cable Clamp
7	3160-0377	1	Fan
8	1600-1353	1	IOP Connector Plate, Aluminum
	5041-3468	1	IOP Connector Plate, Black
9	3101-2565	1	Processor Interlock Switch
10	8120-3600	1	Processor Interlock Cable
11	4040-2101	1	LED Window
12	5041-3464	2	Card Guide
13	4040-2114	1	Air Controller
14	4040-2115	1	Air Controller Pivot
15	1460-1981	1	Air Controller Spring
16	8120-3806	1	IOP #2 Cable
	8120-3807	1	IOP #3 Cable



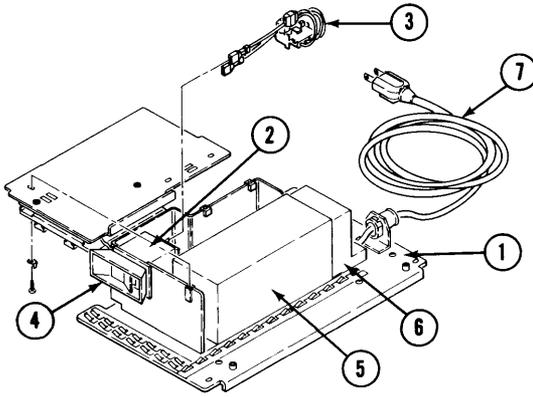
I/O Cage

## I/O Cage Parts List

Index Number	HP Part Number	Quantity	Description
1	09855-66501	1	I/O Backplane.
2	8120-4017	1	I/O Interlock Cable and Switch.
3	0403-0434	1	I/O Front Card Guide.
4	0403-0435	1	I/O Rear Card Guide.
5	7121-3061	1	I/O Card Guide Label (Select Codes).
6	09855-60200	1	I/O Door Assembly.
7	1600-1226	1	Mass Memory Cover.
8*	<b>I/O Cards and Parts</b>		
	09855-69560	1	Fixed Disc Drive I/O Card.
	8120-3801	1	● 2 Pin Controller Interconnect Power Cable.
	8120-3789	1	● 20 Pin Controller Interconnect Cable.
	8120-3788	1	● 34 Pin Controller Interconnect Cable.
	8120-3803	1	● 50 Pin Controller Interconnect Cable.
	0380-1562	4	● Fixed Disc Controller Standoffs.
	09855-69886	1	Fixed Disc Drive Controller.
	1818-1989	1	● Fixed Disc Drive Program ROM.
	09855-66562	1	Bootstrap Loader Card.
**	09020-80000	1	● Loader/ID ROM (for Fixed Disc Drive or Bootstrap Loader Card).
**	09020-80001	1	● Loader/ID ROM (for Fixed Disc Drive or Bootstrap Loader Card).
	09855-69561	1	9130K Flexible Disc Drive Controller.
	1818-1897	1	● Flexible Disc Controller ROM.

\* For Interface Card information, see the 520 Installation Manual, 09020-90011, Appendix A.

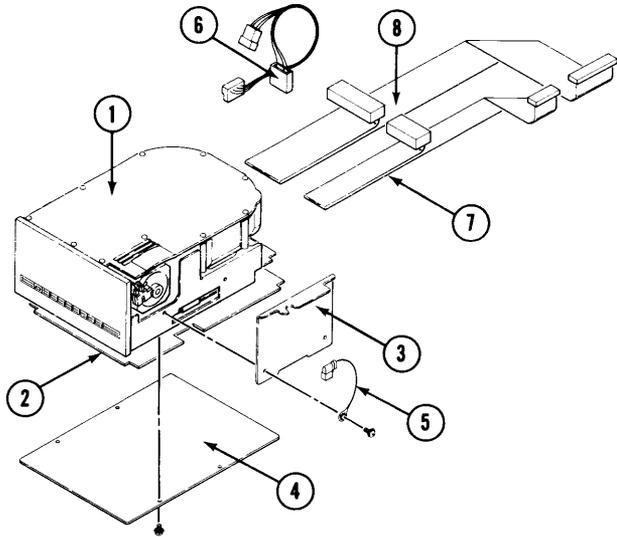
\*\* When ordering the Loader/ID ROM, the serial number of the computer must be given to the individual taking the order. The serial number is programmed into the replacement ID ROM. Boot Loader ROM 09020-80001 is required for systems using 1 Megabyte RAM boards and UNIX 4.0 or BASIC 2.0. The Boot Loader ROM can be used with other RAM configurations if UNIX 4.0 or BASIC 2.0 is used. Boot Loader ROM 09020-80000 can be used with UNIX 4.0 or BASIC 2.0 (or any previous software) as long as the stack does not contain a 1 Megabyte board. The above part numbers are replacement part numbers. The ROMs will be labelled 1818-3467 (Rev. A) or 1818-3461 (Rev. B).



AC Module

AC Module Parts List

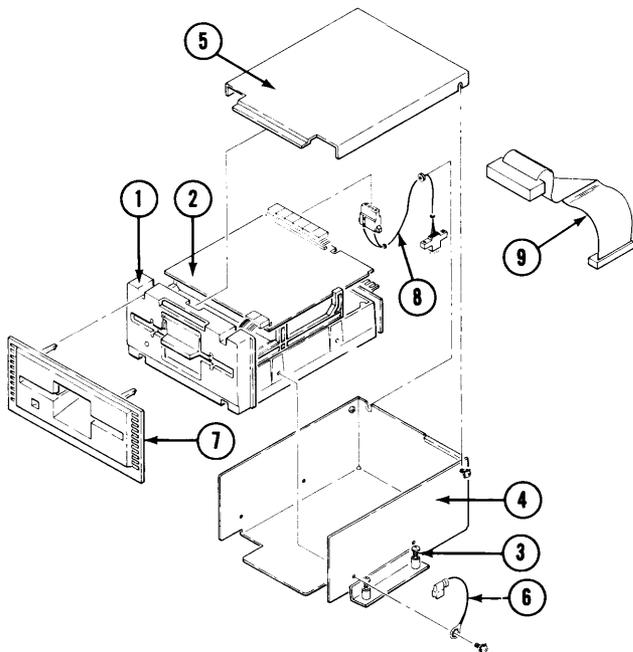
Index Number	HP Part Number	Quantity	Description
1	09855-67901	1	110V Ac Module.
	09855-67902	1	220V Ac Module.
2	09855-67101	1	110V Ac Power Switch.
	09855-67102	1	220V Ac Power Switch.
3	8120-3554	1	110V Ac Module Cable.
	8120-3580	1	220V Ac Module Cable.
4	4040-2054	1	Switch Bezel.
5	9135-0163	1	Line Filter.
6	4040-2048	1	Ac Wiring Shield.
	7120-6157	1	Ac Danger Label.
	7121-3060	1	90-125V Line Voltage Label.
	7121-3062	1	220V Line Voltage Label.
	7121-2708	1	High Voltage Label.
7	<b>Ac Power Cords</b>		
	09855-61600	1	United States. 110V.
	09855-61601	1	Australia.
	09855-61602	1	Europe.
	09855-61603	1	CSA and United States. 220V.
	09855-61604	1	Switzerland.
	09855-61605	1	Great Britain.
	09855-61606	1	Denmark.



Winchester Fixed Disc Drive

Winchester Fixed Disc Drive Parts List

Index Number	HP Part Number	Quantity	Description
1	09133-69102	1	Fixed Disc Mechanical Drive.
2	09133-69101	1	Electronics Board.
3	1600-1306	2	Mounting Bracket.
4	1600-1311	1	Bottom Cover.
5	8120-3598	1	Ground Cable.
6	8120-3800	1	Drive Power Cable.
7	8120-3786	1	20 Pin Drive Cable.
8	8120-3802	1	34 Pin Drive Cable.

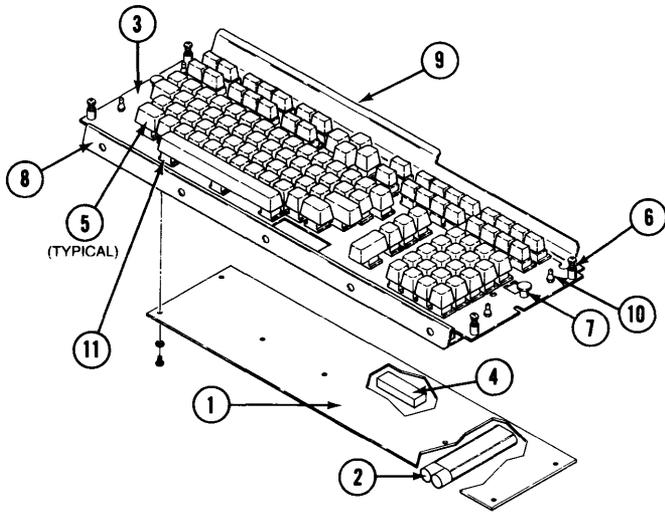


**Flexible Disc Drive**

**Flexible Disc Drive Parts List**

Index Number	HP Part Number	Quantity	Description
1	09130-69600	1	9130K Flexible Disc Mechanical Drive.
2	09130-66501	1	Electronics Board.
*	09131-69600	1	9131G Flexible Disc Drive (with board).
3	1390-0596	3	Captive Screw.
4	1600-1212	1	Bucket Assembly.
5	1600-1228	1	Bucket Cover.
6	8120-3598	1	Ground Cable.
7	4040-2056	1	Appearance Bezel.
8	8120-3552	1	Power Cable.
9	8120-3555	1	Logic Cable.

\* 9020 serial number prefix 2422 uses this disc drive. The electronics board cannot be ordered separately.



Keyboard

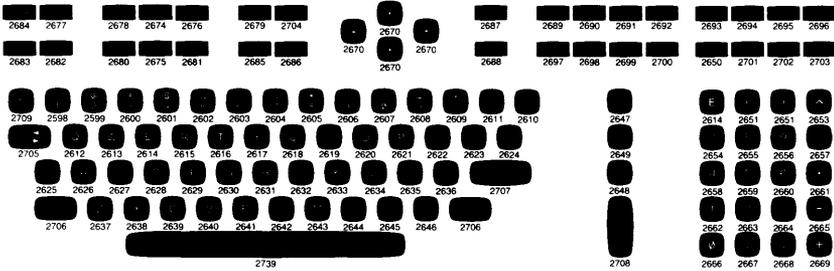
## Keyboard Parts List

Index Number	HP Part Number	Quantity	Description
	09855-67930	1	Keyboard (complete)
1	09855-69531	1	Keyboard Electronics Board.
2	1420-0302	1	4.8V RTC/NVM Battery Assembly.
3	09855-69131	1	Keyswitch Board.
4	1820-2707	1	Processor/ROM (8048 - Bottom of board).
5	3101-2595	-	Keyswitch, Micro.
	3101-2596	-	Keyswitch, Cortron.
6	1390-0448	4	Snap-in Fastener.
7	1440-0160	2	Pull Handle.
8	1600-1234	1	Structural Strip, Front.
9	1600-1236	1	Structural Strip, Rear.
10	1390-0448	4	Ball Stud.
11	3131-0494	2	Plastic Clip - Spacebar

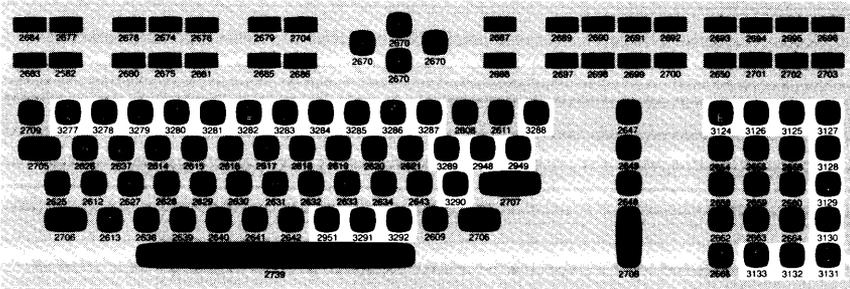
## Keycap Part Numbers

The last four digits of the keycap part number are provided for each keycap. The first four digits are always **0371**. For example, the "J" keycap is identified on the ASCII keyboard as 2632. To order the "J" keycap, order part number 0371-2632.

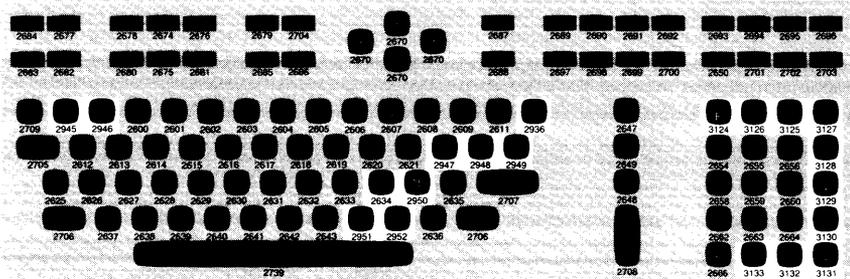
All keycap configurations except ASCII have some keycaps highlighted. The highlighted keycaps differ from the keycaps on the ASCII keyboard. The ASCII keyboard is the exchange assembly in case of keyboard failure. Before returning a failed non-ASCII keyboard, remove all non-ASCII keycaps from the failed board and place them on the replacement keyboard.



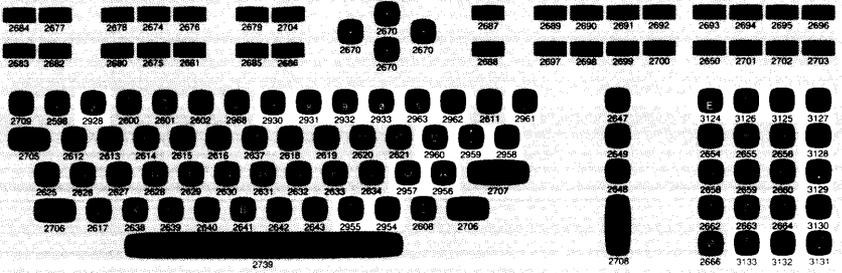
ASCII Keyboard



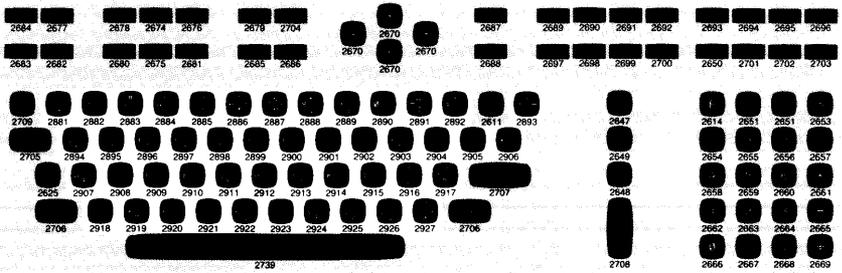
French Keyboard



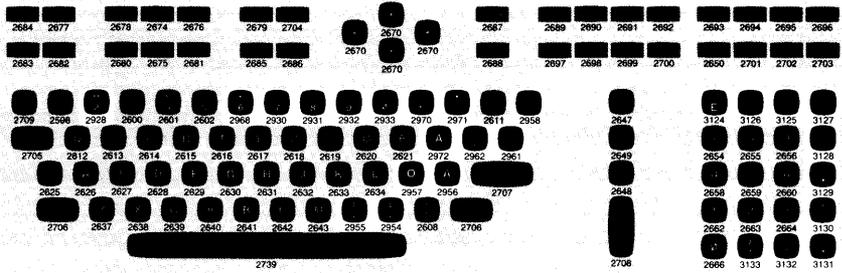
Spanish Keyboard



German Keyboard



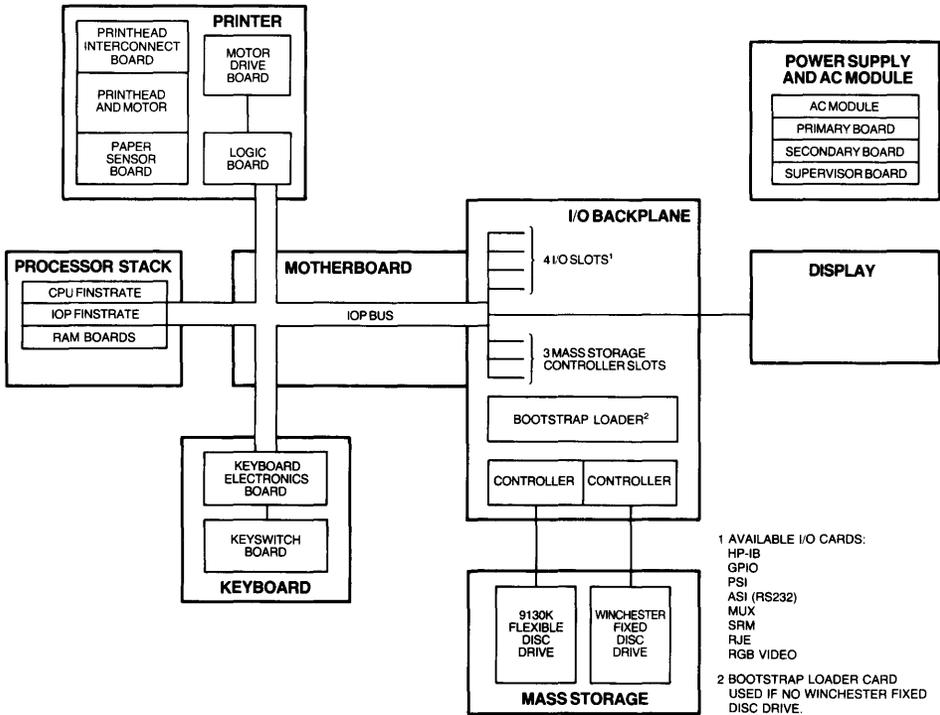
Katakana Keyboard



Swedish/Finnish Keyboard



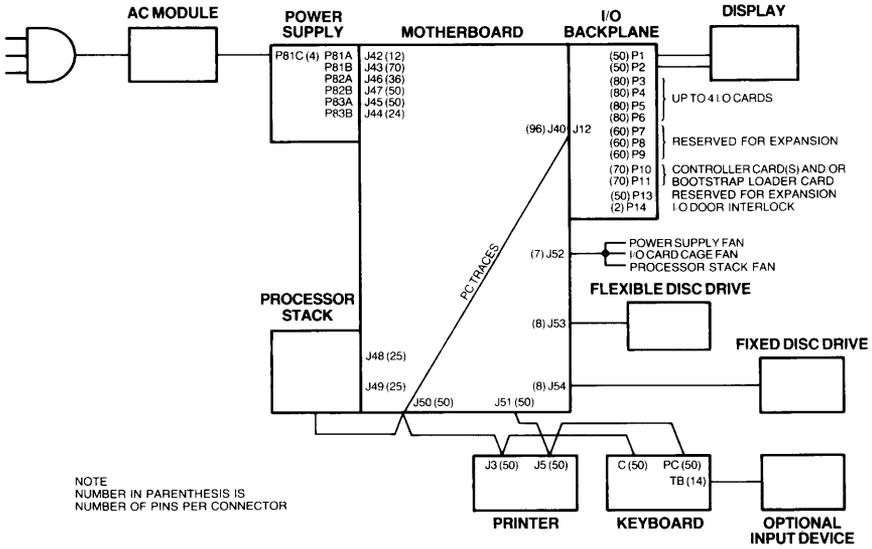
Computer Block Diagram



# 9020 Diagrams

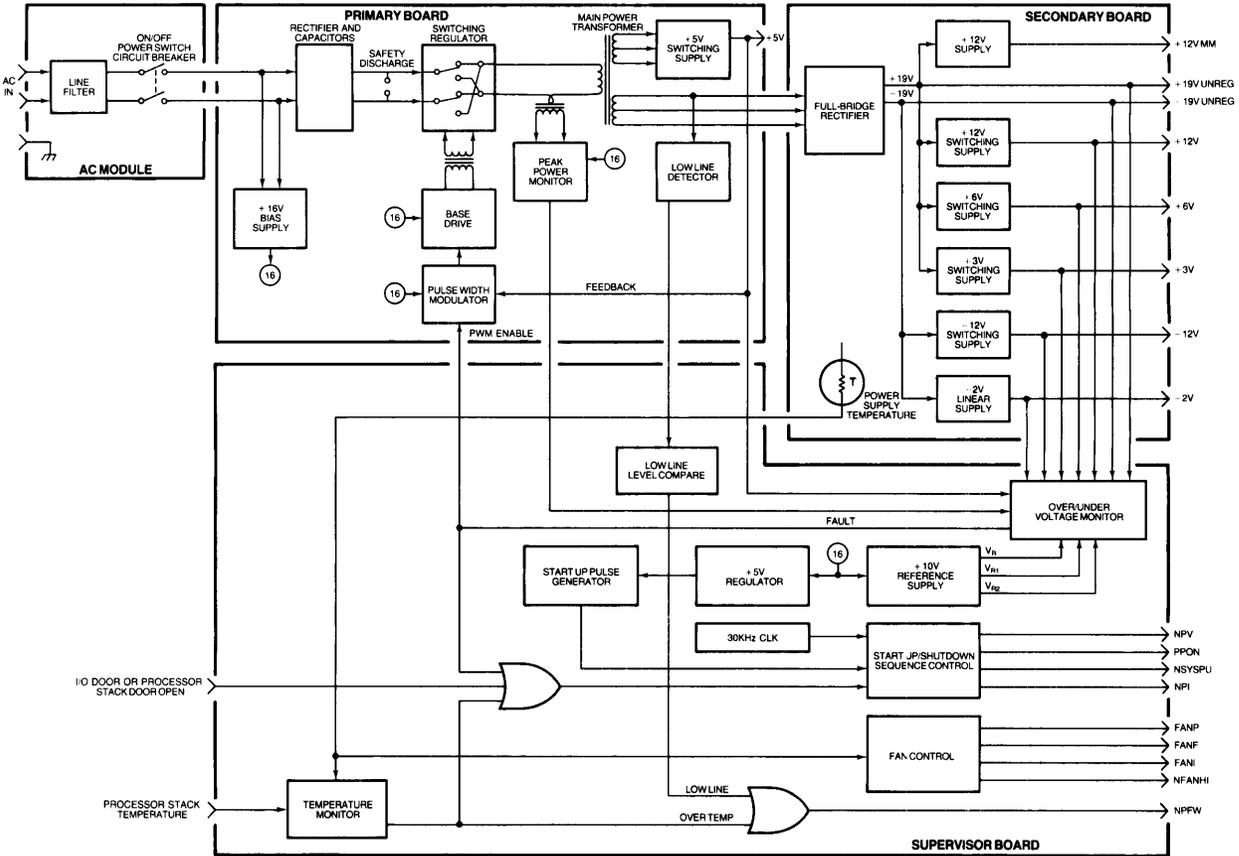
## Chapter 9

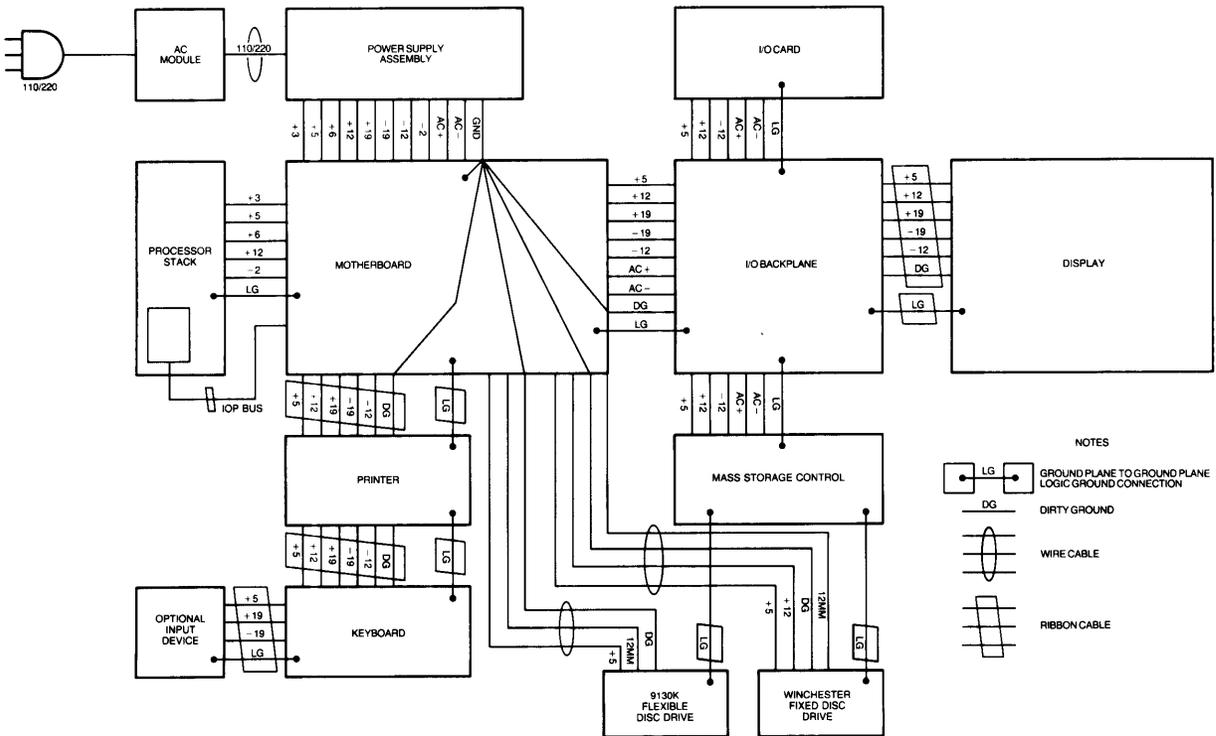
9-2 9020 Diagrams



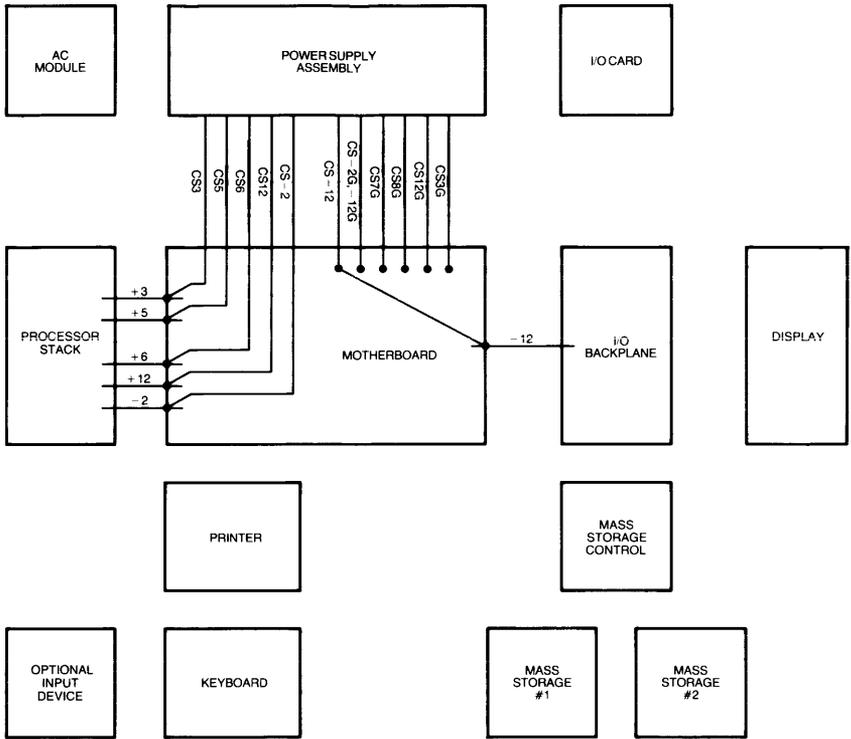
Computer Interconnection Diagram

Power Supply Assembly Block Diagram



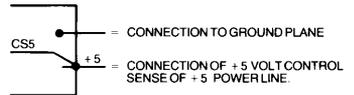


Power Distribution Diagram



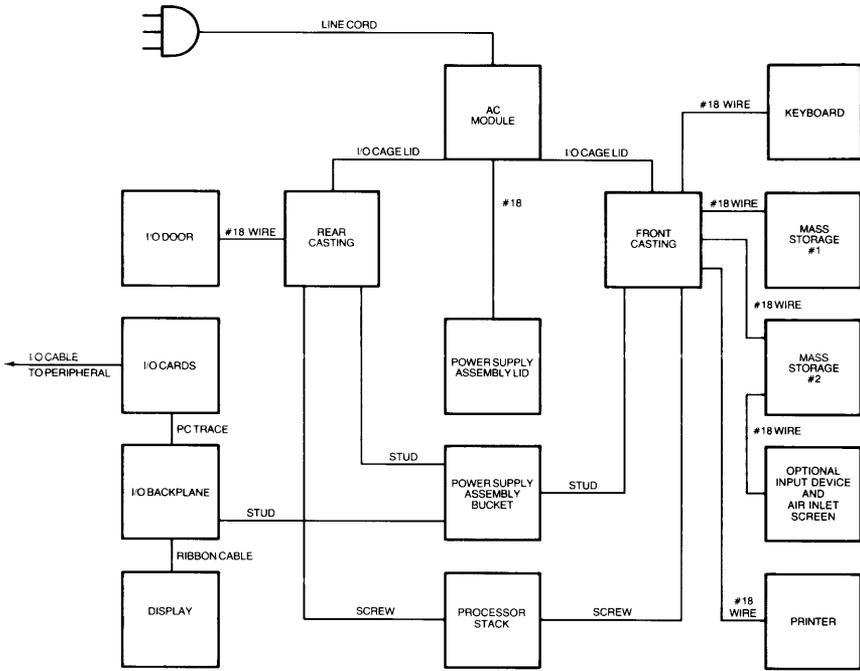
NOTES

CS5 = +5 VOLT CONTROL SENSE  
 CS-12G = -12 VOLT GROUND CONTROL SENSE



Voltage Sensing Diagram

9-6 9020 Diagrams

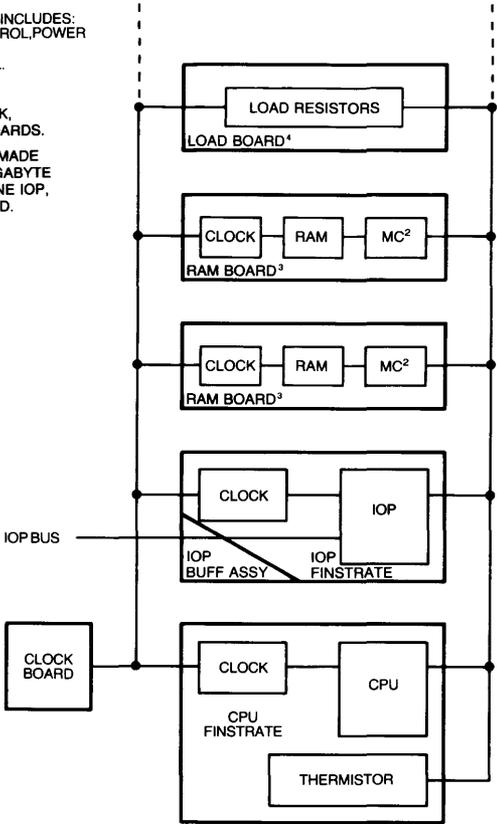


Safety Grounding Diagram

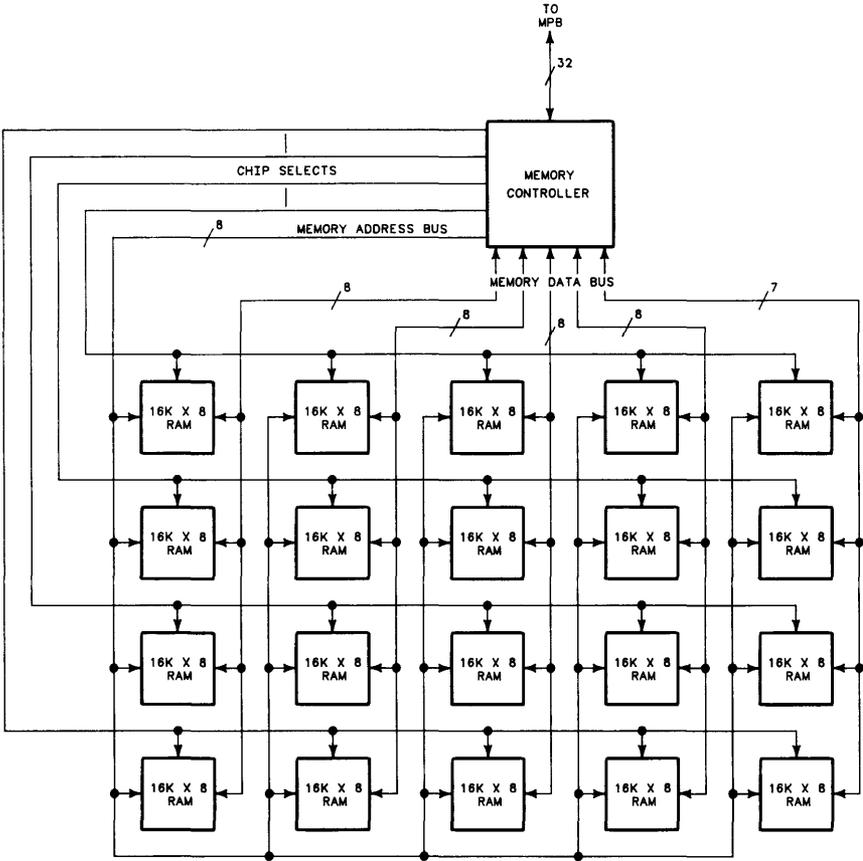
SYSTEM CLOCK

MEMORY PROCESSOR BUS (MPB)<sup>1</sup>

- NOTES
- 1 MEMORY PROCESSOR BUS INCLUDES: ADDRESS, DATA, BUS CONTROL, POWER AND GROUND, SELF-TEST MISCELLANEOUS CONTROL.
  - 2 MEMORY CONTROLLER
  - 3 RAM BOARDS CAN BE 256K, 512K, OR PAIRS OF 1M BOARDS.
  - 4 REQUIRED WHEN RAM IS MADE UP OF SIX OR LESS 1 MEGABYTE BOARDS; OR ONE CPU, ONE IOP, AND ONE 512K RAM BOARD.



Processor Stack Block Diagram

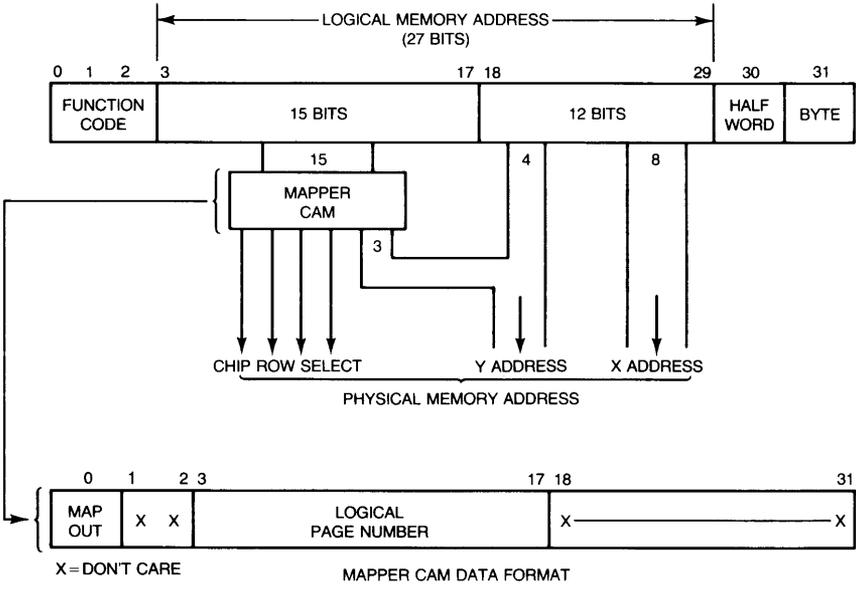


256K RAM Finstrate Block Diagram

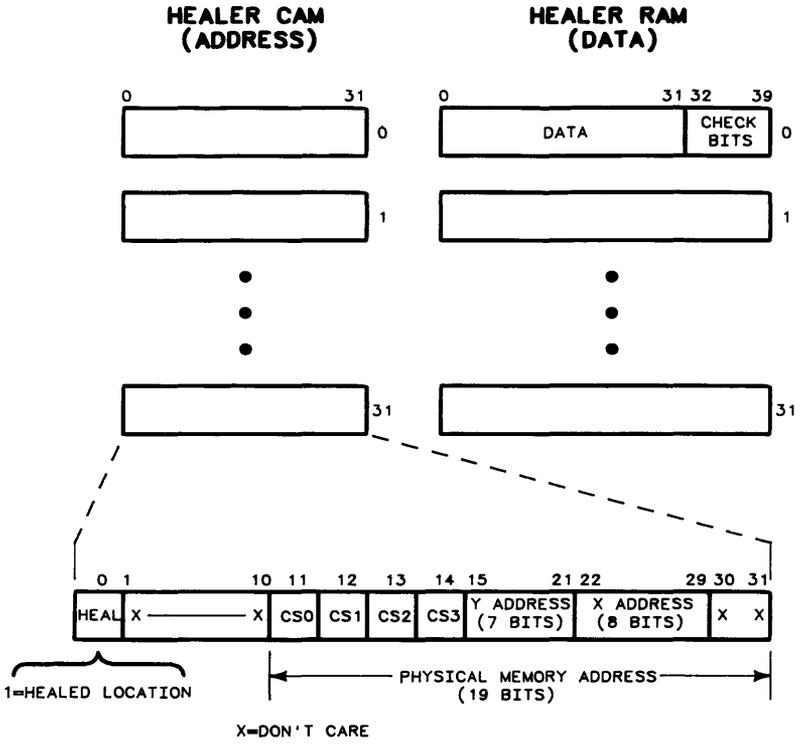
MAPPER CAM REGISTER ADDRESS	CS SELECTED ROW	Y ADDRESS SELECTED BLOCK NUMBER	X AND Y ADDRESS SELECTS WORD WITHIN THE BLOCK				
			4K WORDS	4K BYTES	4K BYTES	4K BYTES	4K BYTES
0	3	0	4K WORDS	4K BYTES	4K BYTES	4K BYTES	4K BYTES
1	3	1	4K WORDS	4K BYTES	4K BYTES	4K BYTES	4K BYTES
2	3	2	4K WORDS	4K BYTES	4K BYTES	4K BYTES	4K BYTES
3	3	3	4K WORDS	4K BYTES	4K BYTES	4K BYTES	4K BYTES
4			NOT USED				
5							
6							
7							
8	2	0	4K WORDS	16K BYTE RAM	16K BYTE RAM	16K BYTE RAM	16K BYTE RAM
9		1	4K WORDS				
10		2	4K WORDS				
11		3	4K WORDS				
12			NOT USED				
13							
14							
15							
16	1	0	4K WORDS	16K BYTE RAM	16K BYTE RAM	16K BYTE RAM	16K BYTE RAM
17		1	4K WORDS				
18		2	4K WORDS				
19		3	4K WORDS				
20			NOT USED				
21							
22							
23							
24	0	0	4K WORDS	16K BYTE RAM	16K BYTE RAM	16K BYTE RAM	16K BYTE RAM
25		1	4K WORDS				
26		2	4K WORDS				
27		3	4K WORDS				
28			NOT USED				
29							
30							
31							

256K Memory Mapping Organization

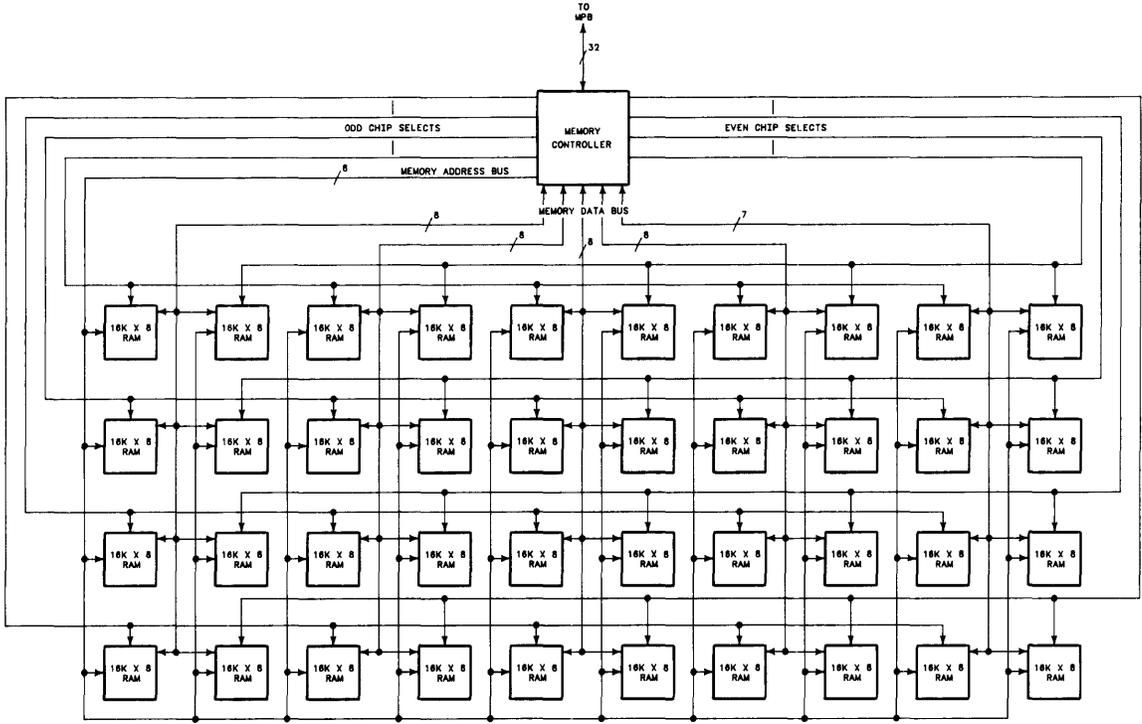
9-10 9020 Diagrams



256K Memory Mapping Operation



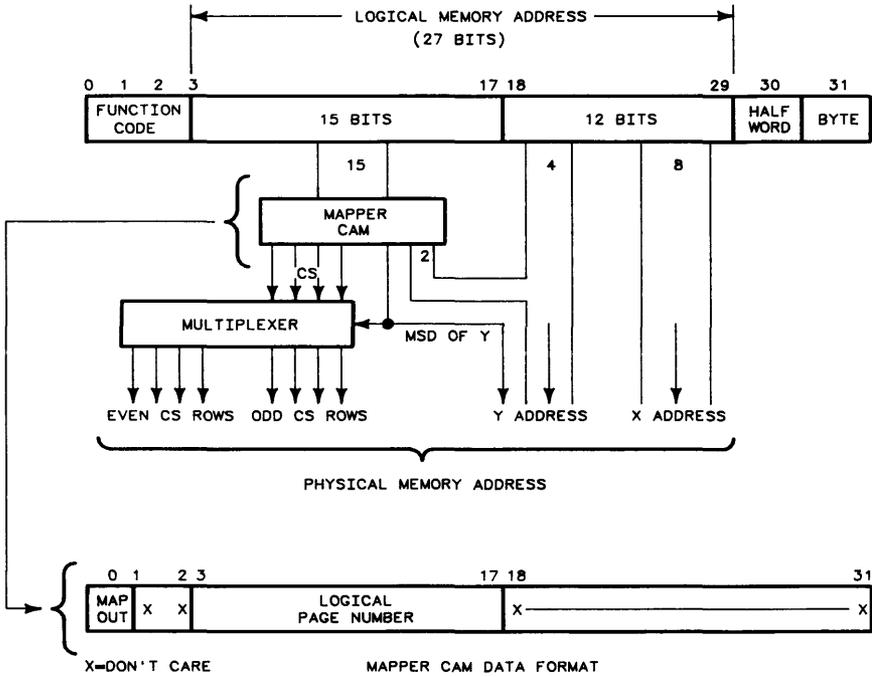
256K Memory Healing



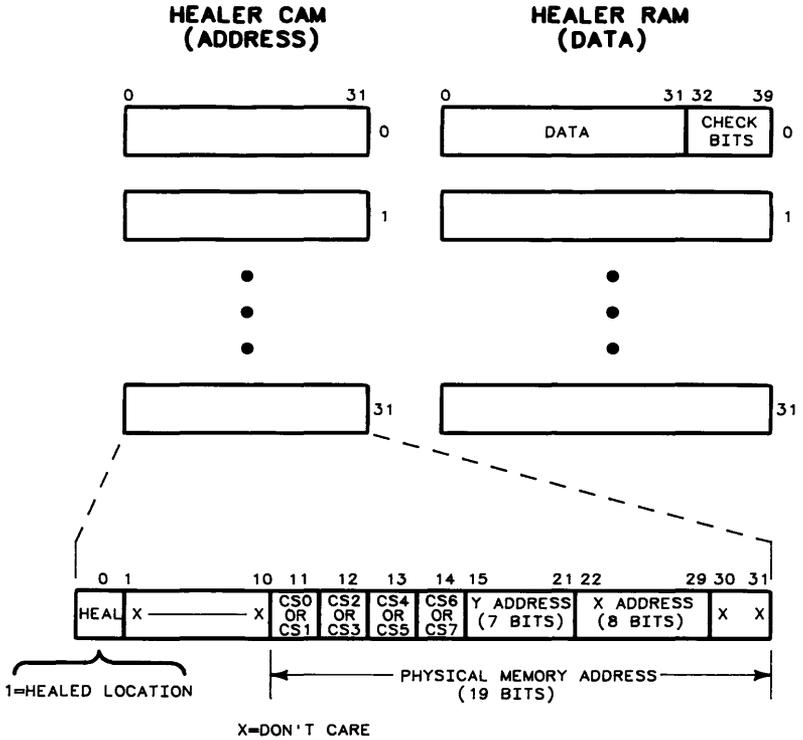
512K RAM Board Block Diagram

MAPPER CAM REGISTER ADDRESS	CS SELECTED ROW	Y ADDRESS SELECTED BLOCK NUMBER	X AND Y ADDRESS SELECTS WORD WITHIN THE BLOCK				
			4K WORDS	4K BYTES	4K BYTES	4K BYTES	4K BYTES
0	7	0	4K WORDS	4K BYTES	4K BYTES	4K BYTES	4K BYTES
1	7	1	4K WORDS	4K BYTES	4K BYTES	4K BYTES	4K BYTES
2	7	2	4K WORDS	4K BYTES	4K BYTES	4K BYTES	4K BYTES
3	7	3	4K WORDS	4K BYTES	4K BYTES	4K BYTES	4K BYTES
4	6	0	4K WORDS	16K BYTE RAM	16K BYTE RAM	16K BYTE RAM	16K BYTE RAM
5		1	4K WORDS				
6		2	4K WORDS				
7		3	4K WORDS				
8	5	0	4K WORDS	16K BYTE RAM	16K BYTE RAM	16K BYTE RAM	16K BYTE RAM
9		1	4K WORDS				
10		2	4K WORDS				
11		3	4K WORDS				
12	4	0	4K WORDS	16K BYTE RAM	16K BYTE RAM	16K BYTE RAM	16K BYTE RAM
13		1	4K WORDS				
14		2	4K WORDS				
15		3	4K WORDS				
16	3	0	4K WORDS	16K BYTE RAM	16K BYTE RAM	16K BYTE RAM	16K BYTE RAM
17		1	4K WORDS				
18		2	4K WORDS				
19		3	4K WORDS				
20	2	0	4K WORDS	16K BYTE RAM	16K BYTE RAM	16K BYTE RAM	16K BYTE RAM
21		1	4K WORDS				
22		2	4K WORDS				
23		3	4K WORDS				
24	1	0	4K WORDS	16K BYTE RAM	16K BYTE RAM	16K BYTE RAM	16K BYTE RAM
25		1	4K WORDS				
26		2	4K WORDS				
27		3	4K WORDS				
28	0	0	4K WORDS	16K BYTE RAM	16K BYTE RAM	16K BYTE RAM	16K BYTE RAM
29		1	4K WORDS				
30		2	4K WORDS				
31		3	4K WORDS				

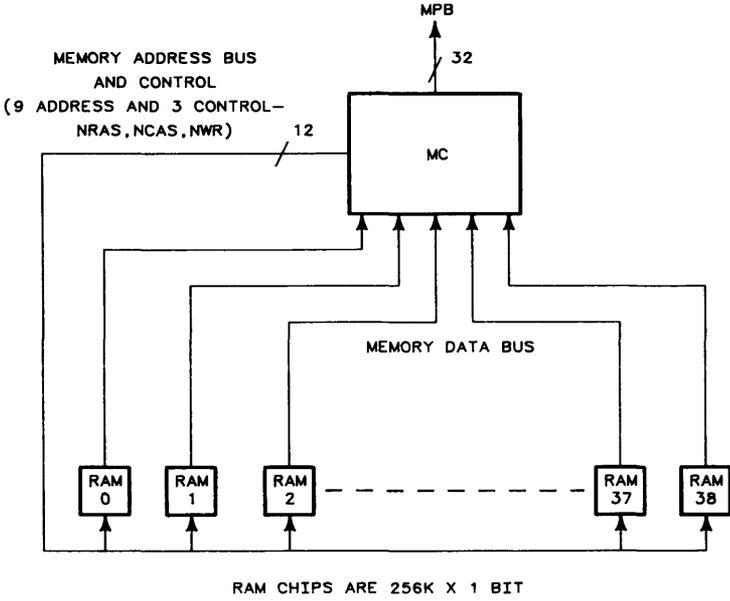
512K Memory Mapping Organization



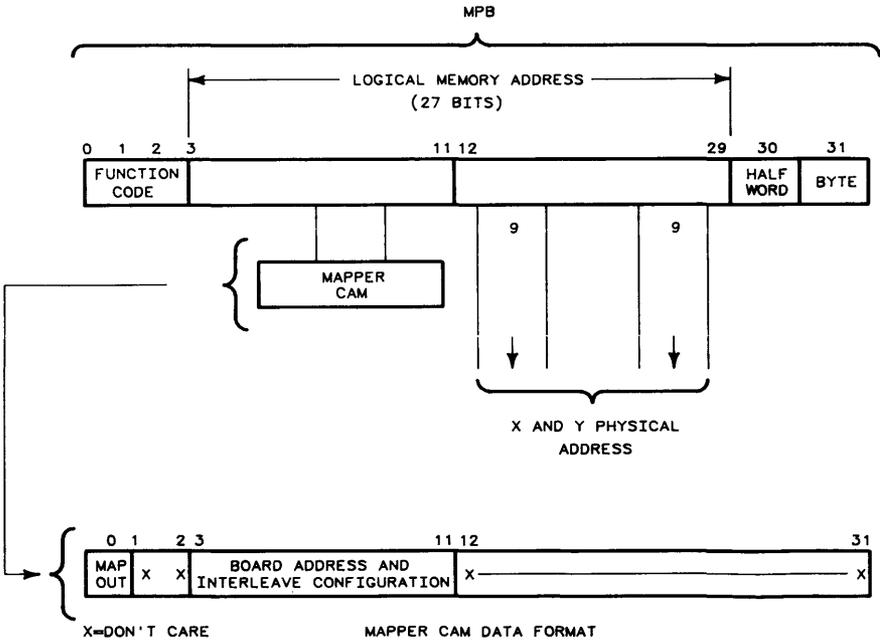
512K Memory Mapping Operation



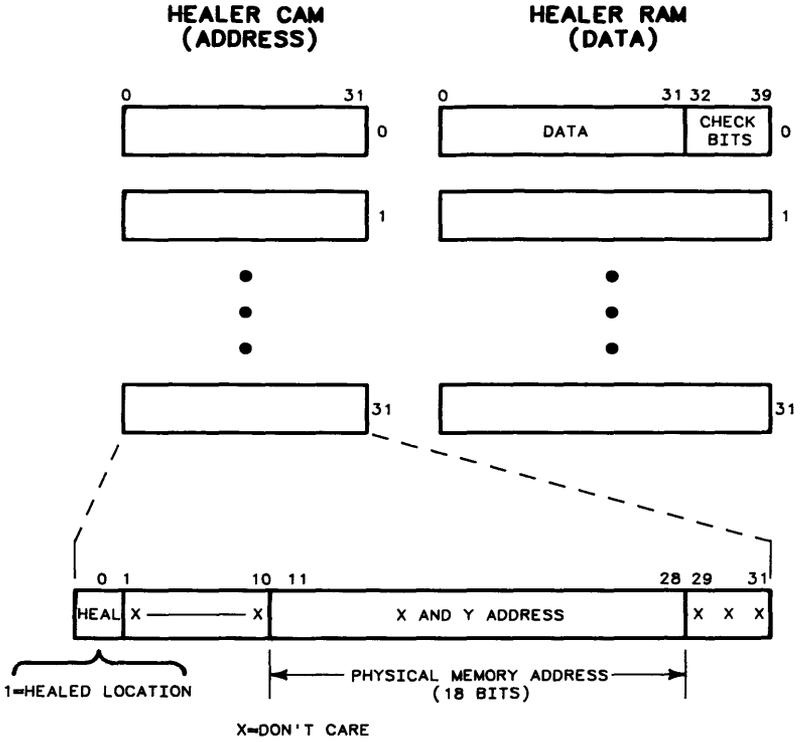
**512K Memory Healing**



1 Megabyte Memory Organization

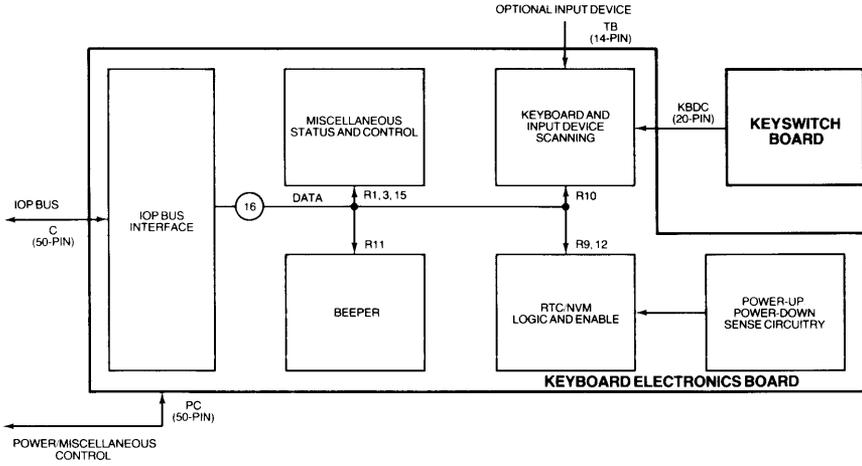


1 Megabyte Memory Mapping Operation

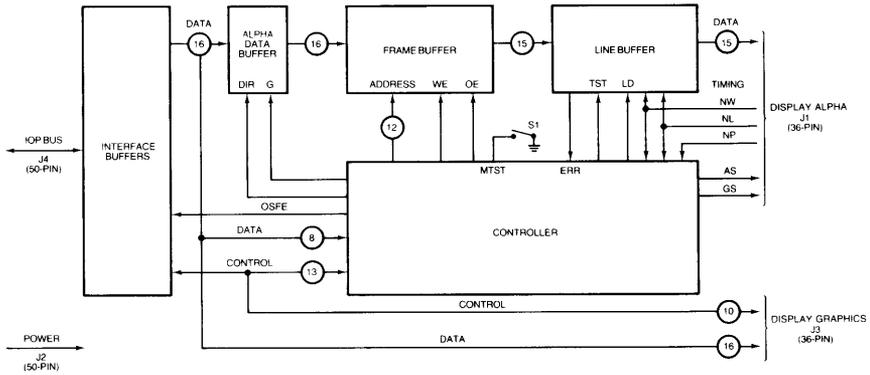


**1 Megabyte Memory Healing**

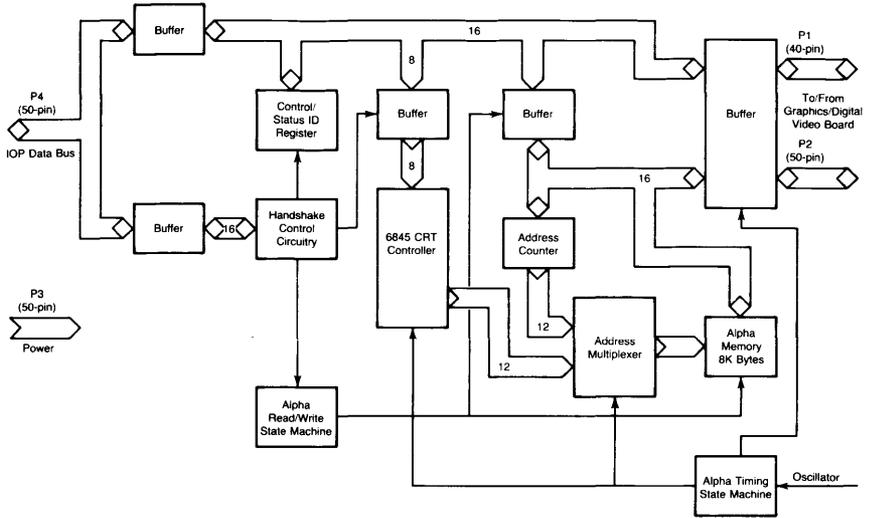
9-18 9020 Diagrams



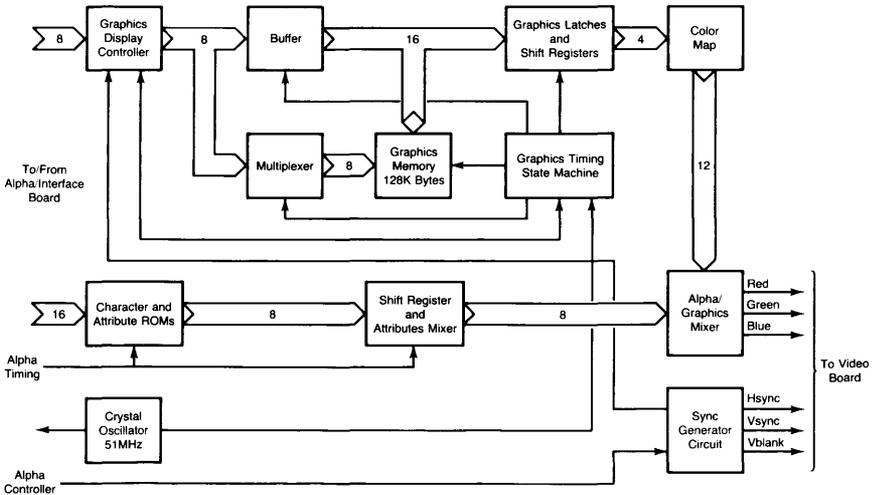
Keyboard Block Diagram



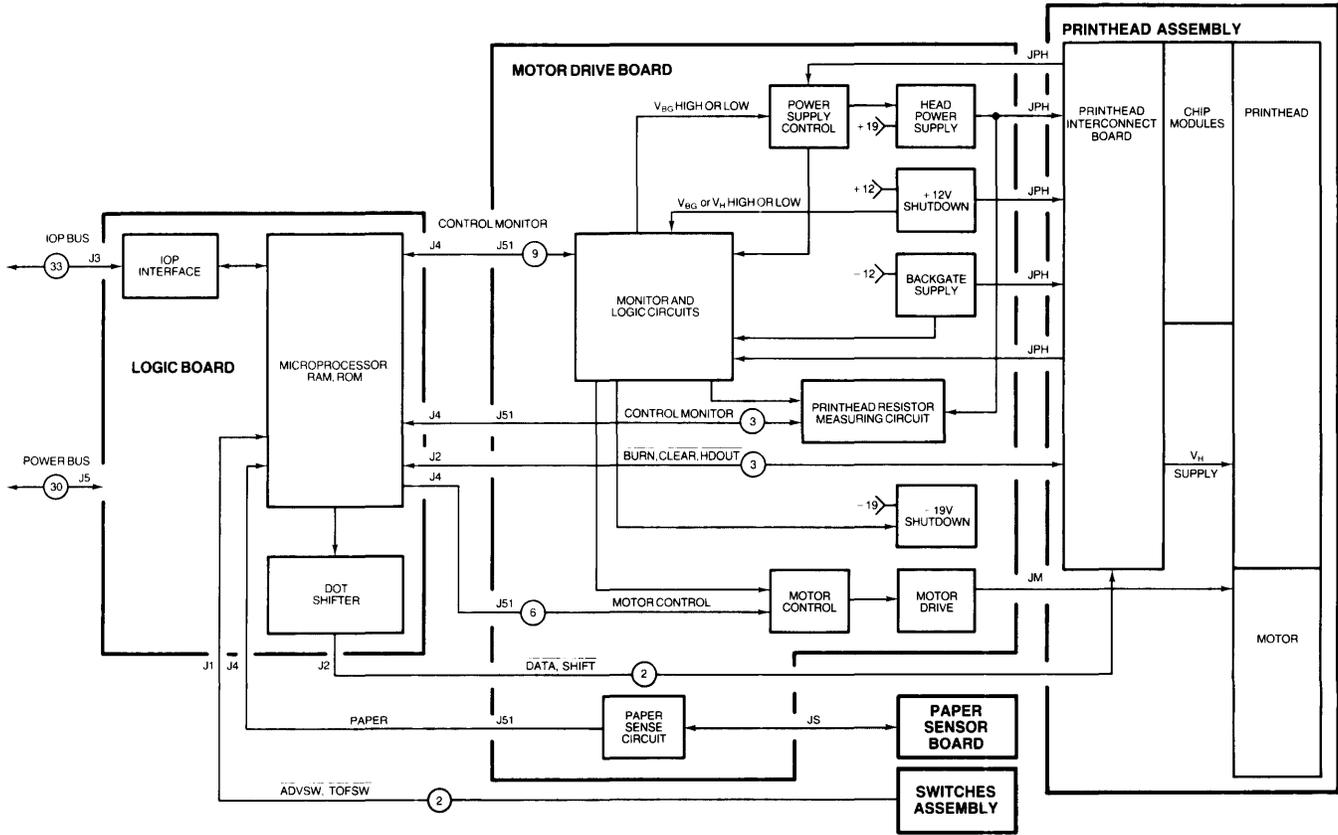
Display Interface Module (DIM) (9020B/C Only)



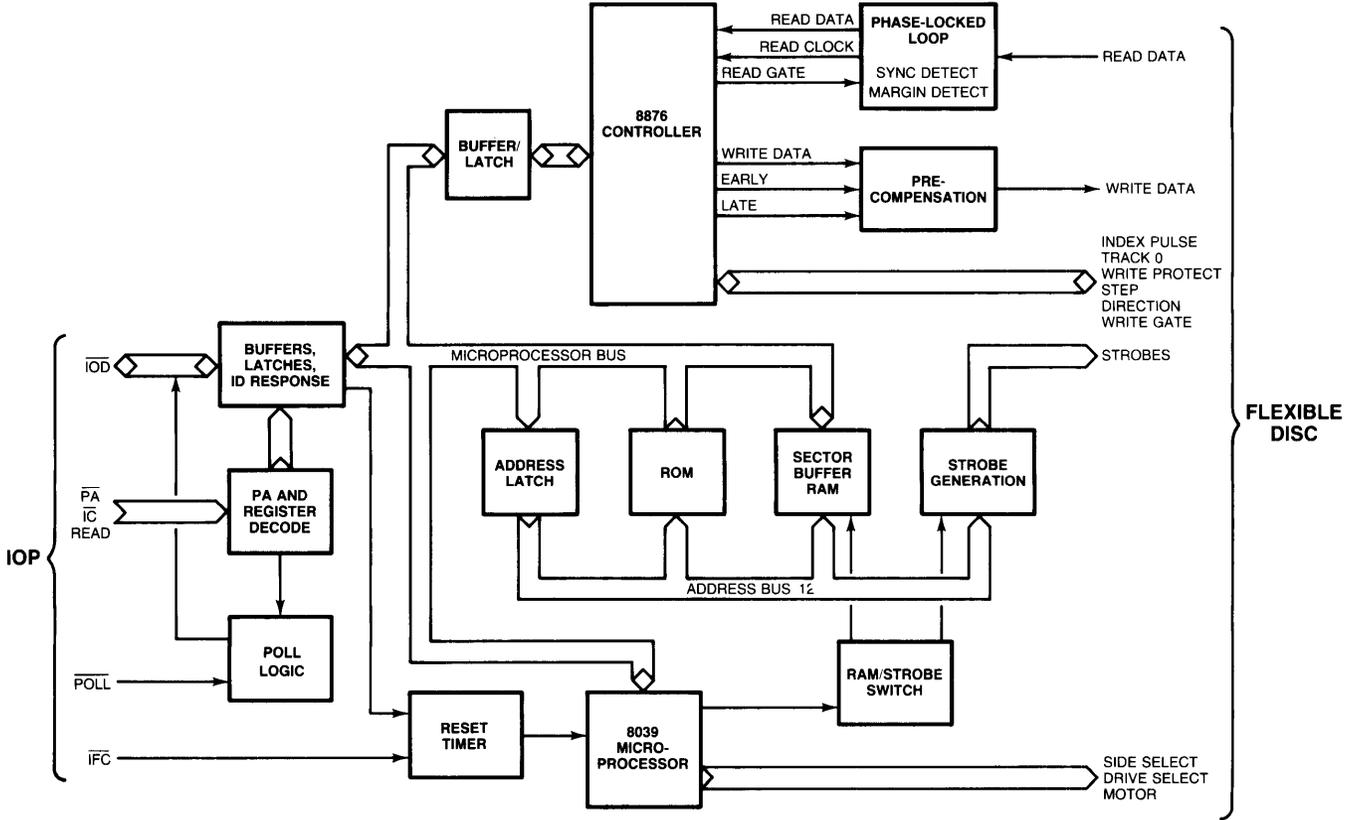
Alpha/Interface Board Block Diagram (9020A Only)



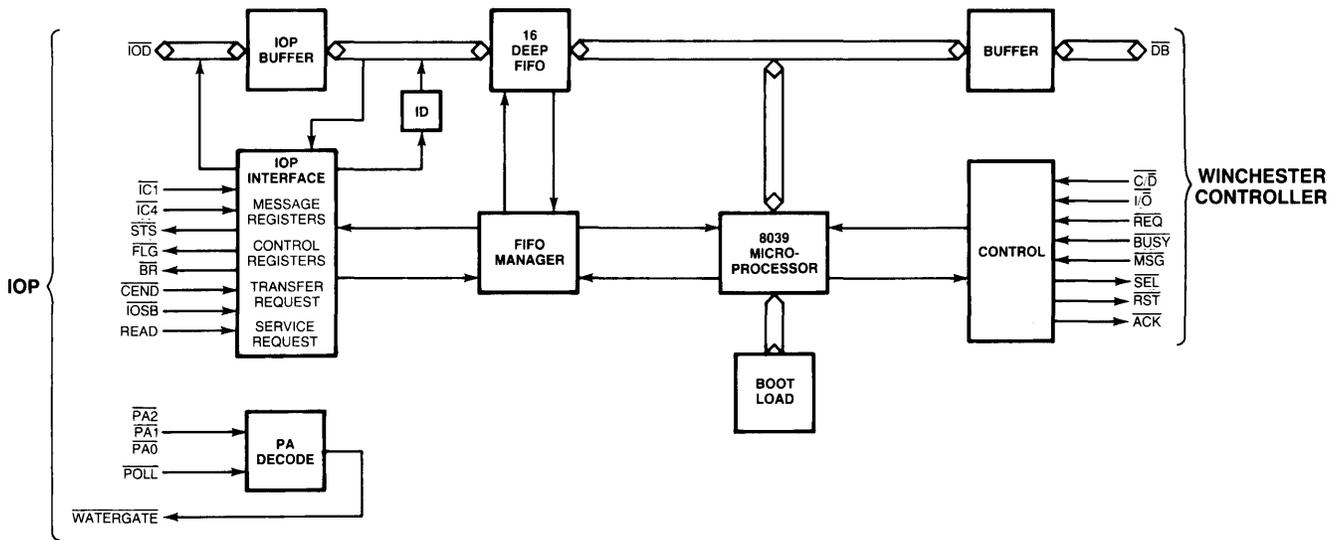
Graphics/Digital Video Board Block Diagram (9020A Only)

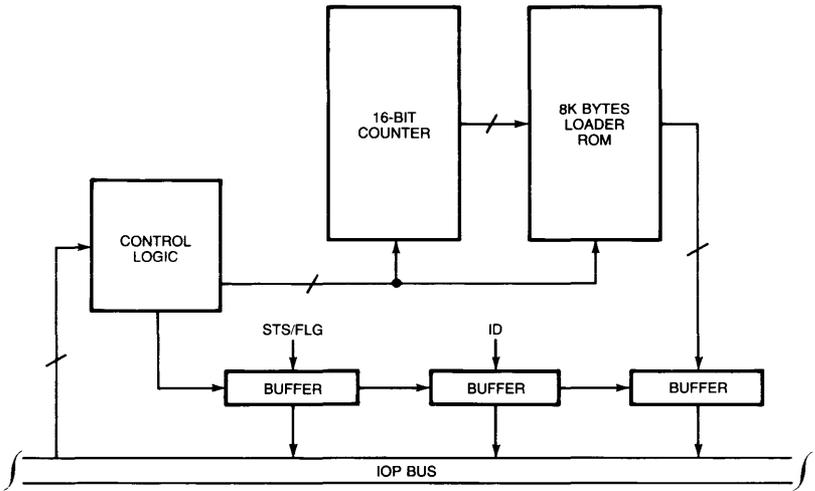


Flexible Disc Drive Controller Card Block Diagram



Winchester Fixed Disc Drive I/O Card Block Diagram

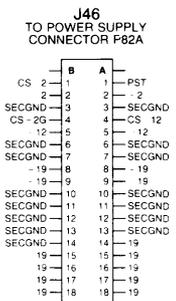
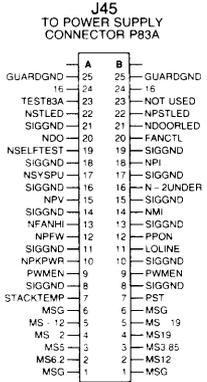
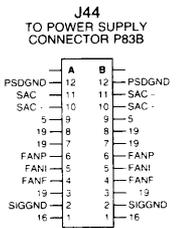
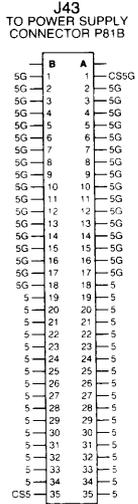
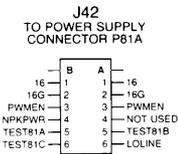
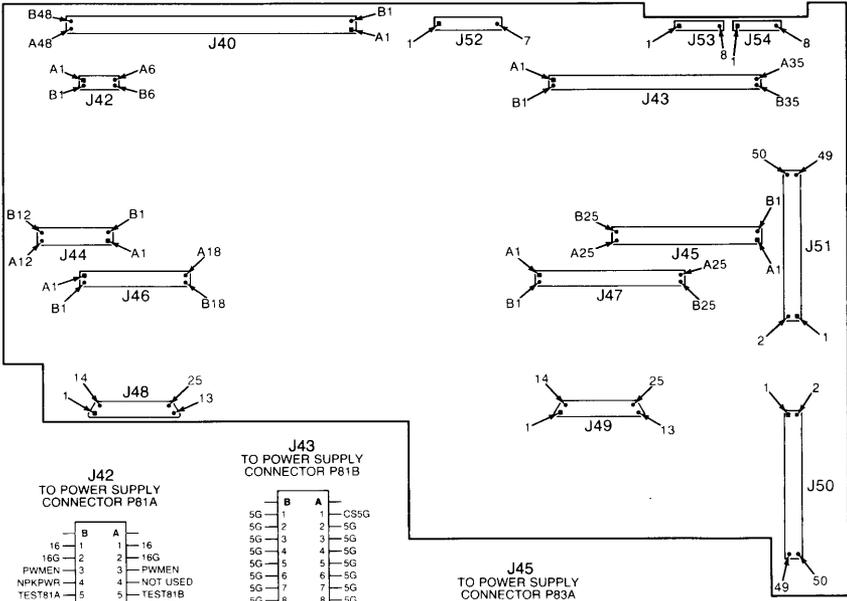


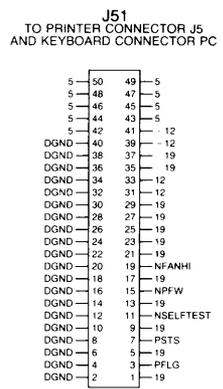
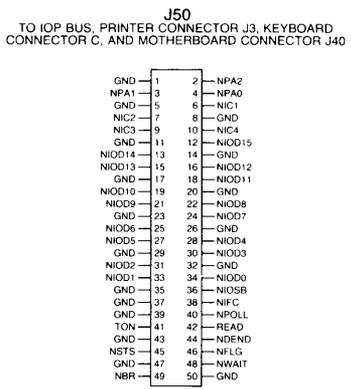
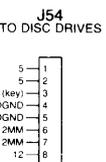
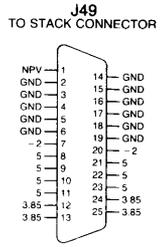
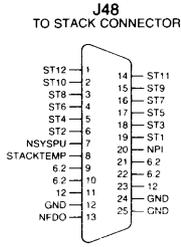
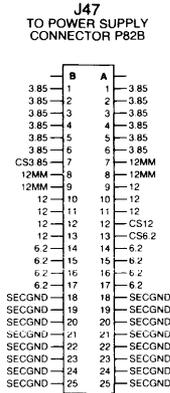
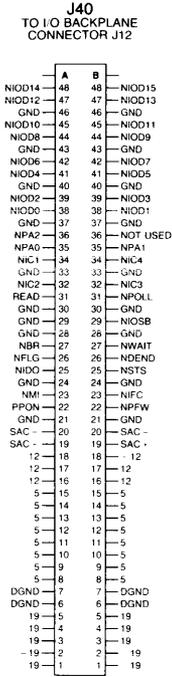


Bootstrap Loader Card Block Diagram

Motherboard Connectors

Designator	Connecting Assembly
J40	I/O Backplane
J42	Power Supply
J43	Power Supply
J44	Power Supply
J45	Power Supply
J46	Power Supply
J47	Power Supply
J48	Processor Stack
J49	Processor Stack
J50	IOP #1, Printer, Keyboard, J40
J51	Printer, Keyboard
J52	Three Fans
J53	Mass Storage Device
J54	Mass Storage Device





Motherboard Connectors Locator Drawing (Sheet 2 of 2)

## Motherboard Signal Definitions

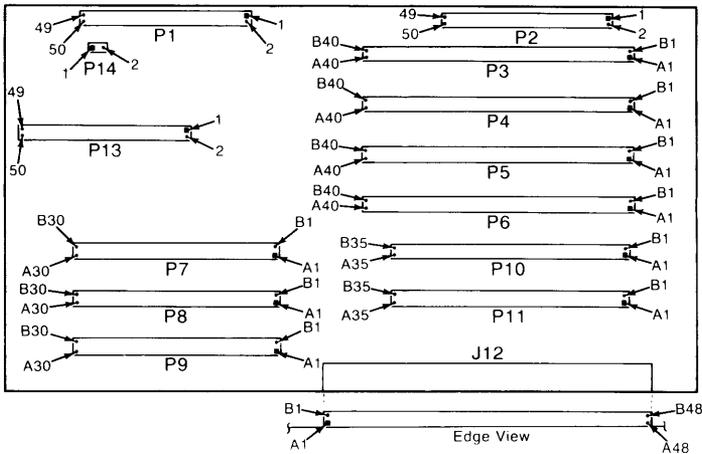
Signal	Definition
(KEY)	Keyed hole in connector plug.
- 12	- 12 volt supply.
- 19	- 19 volt supply.
- 2	- 2 volt supply for processor stack back gate.
12	12 volt supply.
12MM	12 volt supply to mass storage devices only.
16	16 volt bias supply voltage.
16G	Ground for bias supply.
19	19 volt supply.
3.85	3.85 volt supply.
5	5 volt supply.
5G	5 volt supply ground.
6.2	6.2 volt supply.
CS - 12	Control sense for - 12 volt supply.
CS - 2	Control sense for - 2 volt supply.
CS - 2G	Control sense for - 2 volt supply ground.
CS12	Control sense for 12 volt supply.
CS3.85	Control sense for 3.85 volt supply.
CS5	Control sense for 5 volt supply.
CS5G	Control sense for 5 volt supply ground.
CS6.2	Control sense for 6.2 volt supply.
DGND	Dirty ground return.
FANCTL	Fan control. Connected to PST.
FANF	Power to processor stack fan (negative voltage).
FANGND	Fan ground return.
FANI	Power to I/O card cage fan (negative voltage).
FANP	Power to power supply fan (negative voltage).
GND	Ground plane of motherboard.
GUARDGND	Shields power supply supervisor board from primary and secondary boards.
LOLINE	Low line indication.
MS - 12	Monitor sense for - 12 volt under/over voltage.
MS - 19	Monitor sense for - 19 volt under/over voltage.
MS - 2	Monitor sense for - 2 volt under/over voltage.
MS12	Monitor sense for 12 volt under/over voltage.
MS19	Monitor sense for 19 volt under/over voltage.
MS3.85	Monitor sense for 3.85 volt under/over voltage.
MS5	Monitor sense for 5 volt under/over voltage.
MS6.2	Monitor sense for 6.2 volt under/over voltage.
MSG	Monitor sense ground.
N - 2UNDER	- 2 volt undervoltage (negative true).
NBR	I/O bus burst mode DMA request (negative true).
NDEND	I/O bus device end (negative true).
NDO	Door open (negative true). Wired OR of NFDO and NIDO.
NDOORLED	Door open (negative true).
NFANHI	Power supply fan at highest speed (negative true).
NFDO	Processor stack door open (negative true). OR'd with NIDO.
NFLG	I/O bus ready for data (negative true).
NIC1	I/O bus interface control bit 1 (negative true).
NIC2	I/O bus interface control bit 2 (negative true).
NIC3	I/O bus interface control bit 3 (negative true).
NIC4	I/O bus interface control bit 4 (negative true).
NIDO	I/O cage door open (negative true). OR'd with NFDO.
NIFC	I/O bus interface clear (negative true).
NIOD0	I/O bus input/output data bit 0 (negative true).
NIOD1	I/O bus input/output data bit 1 (negative true).
NIOD2	I/O bus input/output data bit 2 (negative true).
NIOD3	I/O bus input/output data bit 3 (negative true).
NIOD4	I/O bus input/output data bit 4 (negative true).

## Motherboard Signal Definitions (Continued)

Signal	Definition
NIOD5	I/O bus input/output data bit 5 (negative true).
NIOD6	I/O bus input/output data bit 6 (negative true).
NIOD7	I/O bus input/output data bit 7 (negative true).
NIOD8	I/O bus input/output data bit 8 (negative true).
NIOD9	I/O bus input/output data bit 9 (negative true).
NIOD10	I/O bus input/output data bit 10 (negative true).
NIOD11	I/O bus input/output data bit 11 (negative true).
NIOD12	I/O bus input/output data bit 12 (negative true).
NIOD13	I/O bus input/output data bit 13 (negative true).
NIOD14	I/O bus input/output data bit 14 (negative true).
NIOD15	I/O bus input/output data bit 15 (negative true).
NIOSB	I/O bus data transfer strobe (negative true).
NMI	Non-maskable interrupt.
NPA0	I/O bus peripheral address bit 0 (negative true).
NPA1	I/O bus peripheral address bit 1 (negative true).
NPA2	I/O bus peripheral address bit 2 (negative true).
NPFW	Power fail warning (negative true).
NPI	Not pop in (negative true). Resets the stack.
NPKPWR	Shut down command indicator due to peak power (negative true).
NPOLL	I/O bus interface poll (negative true).
NPSTLED	Power supply overtemperature (negative true).
NPV	Not power valid; all outputs in spec (negative true).
NSELFTEST	Leading edge causes power supply to send stack into self-test via NSYSPU and NPI (negative true). Originates on keyboard.
NSTLED	Stack overtemperature (negative true).
NSTS	I/O bus status (negative true). Driven by keyboard.
NSYSPU	Not system pop unsynchronized (negative true). Used with NPI to cause stack to perform a self-test.
NWAIT	I/O bus lengthen IOSB (negative true).
PFLG	Printer's flag line; driven by keyboard.
PPON	Primary power on; all outputs in spec.
PSDGND	Power supply ground for 25 KHz and fan circuitry.
PST	Power supply temperature indicator; connected to FANCTL.
PSTS	Printer's status line.
PWMEN	Pulse width modulator enable.
READ	I/O bus data direction (positive true; high indicates data to IOP).
SAC +	25 KHz ac sine wave from power supply.
SAC -	25 KHz ac sine wave from power supply.
SECGND	Ground on power supply secondary board.
SIGGND	Ground for logic on supervisor board.
SPARE	Spare line; no connection.
ST1	Processor stack self-test from slot 1.
ST2	Processor stack self-test from slot 2.
ST3	Processor stack self-test from slot 3.
ST4	Processor stack self-test from slot 4.
ST5	Processor stack self-test from slot 5.
ST6	Processor stack self-test from slot 6.
ST7	Processor stack self-test from slot 7.
ST8	Processor stack self-test from slot 8.
ST9	Processor stack self-test from slot 9.
ST10	Processor stack self-test from slot 10.
ST11	Processor stack self-test from slot 11.
ST12	Processor stack self-test from slot 12.
STACKTEMP	Processor stack temperature indicator.
TEST81A	Test point.
TEST81B	Test point.
TEST81C	Test point.
TEST83A	Test point.
TON	5 volts from IOP.

I/O Backplane Connectors

Designator	Connecting Assembly
P1	Display Interface Module (Power)
P2	Display Interface Module (IOP)
P3	I/O Card
P4	I/O Card
P5	I/O Card
P6	I/O Card
P7	Reserved
P8	Reserved
P9	Reserved
P10	Mass Storage Controller Card
P11	Mass Storage Controller Card
J12	Motherboard
P13	Reserved
P14	I/O Cage Door Switch



P1  
TO DISPLAY INTERFACE  
MODULE CONNECTOR J2: POWER

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

P2  
TO DISPLAY INTERFACE  
MODULE CONNECTOR J4: IOP BUS

GND	50	49	NBR
NWAIT	48	47	GND
NFLG	46	45	NSTS
NRAMD	44	43	GND
READ	42	41	GND
NPOLL	40	39	GND
NIFC	38	37	GND
NIOBSB	36	35	GND
NIOD0	34	33	NIOD1
GND	32	31	NIOD2
NIOD3	30	29	GND
NIOD4	28	27	NIOD5
GND	26	25	NIOD6
NIOD7	24	23	GND
NIOD8	22	21	NIOD9
GND	20	19	NIOD10
NIOD11	18	17	GND
NIOD12	16	15	NIOD13
GND	14	13	NIOD14
NIOD15	12	11	GND
NIC4	10	9	NIC3
GND	8	7	NIC2
NIC1	6	5	GND
NPA0	4	3	NPA1
NPA2	2	1	GND

**P3**  
TO I/O CARD SLOTS

	A	B	
	5	40	5
	5	39	5
	12	38	12
	-12	37	-12
AC +	36	36	AC +
AC -	35	35	AC -
GND	34	34	GND
PPON	33	33	PPON
NPFW	32	32	NNMI
NOT USED	31	31	NOT USED
NSW2	30	30	NOT USED
NSW1	29	29	NSW1
NDPA	28	28	NSTS
GND	27	27	GND
NMYPA	26	26	NIFC
NDBYT	25	25	NDEND
NBR	24	24	NARO
GND	23	23	GND
CLK	22	22	NIOSB
GND	21	21	GND
SYNC	20	20	NPOLL
NIC2	19	19	NIC3
NIC1	18	18	NIC4
READ	17	17	NUAD
GND	16	16	GND
NPA0	15	15	NPA1
NPA2	14	14	NPA3
GND	13	13	GND
NIOD4	12	12	NIOD1
NIOD2	11	11	NIOD3
GND	10	10	GND
NIOD4	9	9	NIOD5
NIOD6	8	8	NIOD7
GND	7	7	GND
NIOD8	6	6	NIOD9
NIOD10	5	5	NIOD11
GND	4	4	GND
NIOD12	3	3	NIOD13
NIOD14	2	2	NIOD15
SGND	1	1	SGND

**P4**  
TO I/O CARD SLOTS

	A	B	
	5	40	5
	5	39	5
	12	38	12
	-12	37	-12
AC +	36	36	AC +
AC -	35	35	AC -
GND	34	34	GND
PPON	33	33	PPON
NPFW	32	32	NNMI
NOT USED	31	31	NOT USED
NSW1	30	30	NOT USED
NSW1	29	29	NSW1
NDPA	28	28	NSTS
GND	27	27	GND
NMYPA	26	26	NIFC
NDBYT	25	25	NDEND
NBR	24	24	NARO
GND	23	23	GND
CLK	22	22	NIOSB
GND	21	21	GND
SYNC	20	20	NPOLL
NIC2	19	19	NIC3
NIC1	18	18	NIC4
READ	17	17	NUAD
GND	16	16	GND
NPA0	15	15	NPA1
NPA2	14	14	NPA3
GND	13	13	GND
NIOD0	12	12	NIOD1
NIOD2	11	11	NIOD3
GND	10	10	GND
NIOD4	9	9	NIOD5
NIOD6	8	8	NIOD7
GND	7	7	GND
NIOD8	6	6	NIOD9
NIOD10	5	5	NIOD11
GND	4	4	GND
NIOD12	3	3	NIOD13
NIOD14	2	2	NIOD15
SGND	1	1	SGND

**P5**  
TO I/O CARD SLOTS

	A	B	
	5	40	5
	5	39	5
	12	38	12
	-12	37	-12
AC +	36	36	AC +
AC -	35	35	AC -
GND	34	34	GND
PPON	33	33	PPON
NPFW	32	32	NNMI
NOT USED	31	31	NOT USED
NSW0	30	30	NOT USED
NSW0	29	29	NSW1
NDPA	28	28	NSTS
GND	27	27	GND
NMYPA	26	26	NIFC
NDBYT	25	25	NDEND
NBR	24	24	NARO
GND	23	23	GND
CLK	22	22	NIOSB
GND	21	21	GND
SYNC	20	20	NPOLL
NIC2	19	19	NIC3
NIC1	18	18	NIC4
READ	17	17	NUAD
GND	16	16	GND
NPA0	15	15	NPA1
NPA2	14	14	NPA3
GND	13	13	GND
NIOD0	12	12	NIOD1
NIOD2	11	11	NIOD3
GND	10	10	GND
NIOD4	9	9	NIOD5
NIOD6	8	8	NIOD7
GND	7	7	GND
NIOD8	6	6	NIOD9
NIOD10	5	5	NIOD11
GND	4	4	GND
NIOD12	3	3	NIOD13
NIOD14	2	2	NIOD15
SGND	1	1	SGND

**P6**  
TO I/O CARD SLOTS

	A	B	
	5	40	5
	5	39	5
	12	38	12
	-12	37	-12
AC +	36	36	AC +
AC -	35	35	AC -
GND	34	34	GND
PPON	33	33	PPON
NPFW	32	32	NNMI
NOT USED	31	31	NOT USED
NSW2	30	30	NOT USED
NSW2	29	29	NSW2
NDPA	28	28	NSTS
GND	27	27	GND
NMYPA	26	26	NIFC
NDBYT	25	25	NDEND
NBR	24	24	NARO
GND	23	23	GND
CLK	22	22	NIOSB
GND	21	21	GND
SYNC	20	20	NPOLL
NIC2	19	19	NIC3
NIC1	18	18	NIC4
READ	17	17	NUAD
GND	16	16	GND
NPA0	15	15	NPA1
NPA2	14	14	NPA3
GND	13	13	GND
NIOD0	12	12	NIOD1
NIOD2	11	11	NIOD3
GND	10	10	GND
NIOD4	9	9	NIOD5
NIOD6	8	8	NIOD7
GND	7	7	GND
NIOD8	6	6	NIOD9
NIOD10	5	5	NIOD11
GND	4	4	GND
NIOD12	3	3	NIOD13
NIOD14	2	2	NIOD15
SGND	1	1	SGND

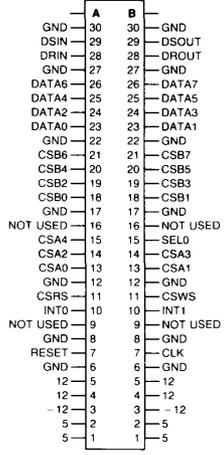
**P7**  
RESERVED

	A	B	
GND	30	30	GND
DSIN	29	29	DSOUT
DRIN	28	28	DROUT
GND	27	27	GND
DATA6	26	26	DATA7
DATA4	25	25	DATA5
DATA2	24	24	DATA3
DATA0	23	23	DATA1
GND	22	22	GND
CSB6	21	21	CSB7
CSB4	20	20	CSB5
CSB2	19	19	CSB3
CSB0	18	18	CSB1
GND	17	17	GND
NOT USED	16	16	NOT USED
CSA4	15	15	SELO
CSA2	14	14	CSA3
CSA0	13	13	CSA1
GND	12	12	GND
CSRS	11	11	CSWS
INT0	10	10	INT1
NOT USED	9	9	NOT USED
GND	8	8	GND
RESET	7	7	CLK
GND	6	6	GND
12	5	5	12
12	4	4	12
12	3	3	12
5	2	2	5
5	1	1	5

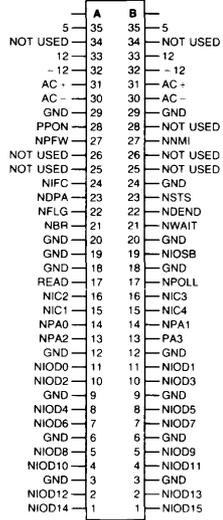
**P8**  
RESERVED

	A	B	
GND	30	30	GND
DSIN	29	29	DSOUT
DRIN	28	28	DROUT
GND	27	27	GND
DATA6	26	26	DATA7
DATA4	25	25	DATA5
DATA2	24	24	DATA3
DATA0	23	23	DATA1
GND	22	22	GND
CSB6	21	21	CSB7
CSB4	20	20	CSB5
CSB2	19	19	CSB3
CSB0	18	18	CSB1
GND	17	17	GND
NOT USED	16	16	NOT USED
CSA4	15	15	SELO
CSA2	14	14	CSA3
CSA0	13	13	CSA1
GND	12	12	GND
SFRS	11	11	CSWS
INT0	10	10	INT1
NOT USED	9	9	NOT USED
GND	8	8	GND
RESET	7	7	CLK
GND	6	6	GND
12	5	5	12
12	4	4	12
12	3	3	12
5	2	2	5
5	1	1	5

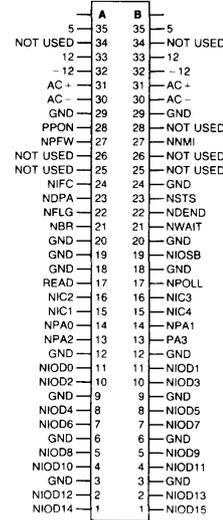
**P9**  
RESERVED



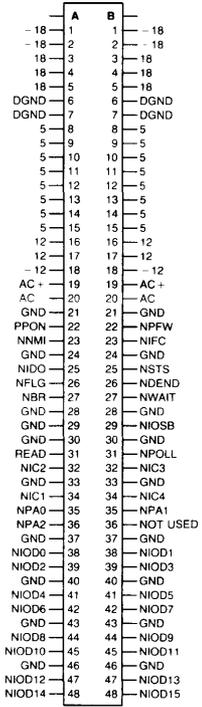
**P10**  
TO MASS STORAGE  
CONTROLLER CARD SLOTS



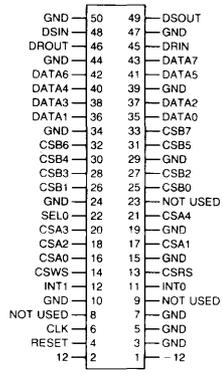
**P11**  
TO MASS STORAGE  
CONTROLLER CARD SLOTS



**J12**  
TO MOTHERBOARD  
CONNECTOR J40



**P13**  
RESERVED



## I/O Backplane Signal Definitions

Signal	Definition
-12	- 12 volt supply.
-18	- 18 volt supply.
12	12 volt supply.
18	18 volt supply.
5	5 volt supply.
AC -	25 KHz ac sine wave from power supply.
AC +	25 KHz ac sine wave from power supply.
CLK	Clock.
CCLK	Common clock.
CSA0	Reserved.
CSA1	Reserved.
CSA2	Reserved.
CSA3	Reserved.
CSA4	Reserved.
CSB0	Reserved.
CSB1	Reserved.
CSB2	Reserved.
CSB3	Reserved.
CSB4	Reserved.
CSB5	Reserved.
CSB6	Reserved.
CSB7	Reserved.
CSRS	Reserved.
CSWS	Reserved.
DATA0	Reserved.
DATA1	Reserved.
DATA2	Reserved.
DATA3	Reserved.
DATA4	Reserved.
DATA5	Reserved.
DATA6	Reserved.
DATA7	Reserved.
DGND	Dirty ground return.
DRIN	Reserved.
DROUT	Reserved.
DSIN	Reserved.
DSOUT	Reserved.
GND	Ground plane of I/O backplane.
INT0	Reserved.
INT1	Reserved.
NARQ	HP-IO card requests attention (negative true).
NBR	I/O bus burst mode DMA request (negative true).
NDBYT	I/O bus ready for data (negative true).
NDEND	I/O bus device end (negative true).
NDPA	Internal select code available (negative true).
NFLG	I/O bus ready for data (negative true).
NIC1	I/O bus interface control bit 1 (negative true).
NIC2	I/O bus interface control bit 2 (negative true).
NIC3	I/O bus interface control bit 3 (negative true).
NIC4	I/O bus interface control bit 4 (negative true).
NIDO	I/O cage door open (negative true).
NIFC	I/O bus interface clear (negative true).
NIOD0	I/O bus input/output data bit 0 (negative true).
NIOD1	I/O bus input/output data bit 1 (negative true).
NIOD2	I/O bus input/output data bit 2 (negative true).
NIOD3	I/O bus input/output data bit 3 (negative true).
NIOD4	I/O bus input/output data bit 4 (negative true).
NIOD5	I/O bus input/output data bit 5 (negative true).

## I/O Backplane Signal Definitions (Continued)

Signal	Definition
NIOD6	I/O bus input/output data bit 6 (negative true).
NIOD7	I/O bus input/output data bit 7 (negative true).
NIOD8	I/O bus input/output data bit 8 (negative true).
NIOD9	I/O bus input/output data bit 9 (negative true).
NIOD10	I/O bus input/output data bit 10 (negative true).
NIOD11	I/O bus input/output data bit 11 (negative true).
NIOD12	I/O bus input/output data bit 12 (negative true).
NIOD13	I/O bus input/output data bit 13 (negative true).
NIOD14	I/O bus input/output data bit 14 (negative true).
NIOD15	I/O bus input/output data bit 15 (negative true).
NIOSB	I/O bus data transfer strobe (negative true).
NMYPA	HP-IO card recognized its address has been asserted (negative true).
NNMI	Non-maskable interrupt (negative true).
NPA0	I/O bus peripheral address bit 0 (negative true).
NPA1	I/O bus peripheral address bit 1 (negative true).
NPA2	I/O bus peripheral address bit 2 (negative true).
NPA3	I/O bus peripheral address bit 3 (negative true).
NPFW	Power fail warning (negative true).
NPOLL	I/O bus interface poll (negative true).
NSTS	I/O bus status (negative true).
NSW0	Select code switch 0 (negative true).
NSW1	Select code switch 1 (negative true).
NSW2	Select code switch 2 (negative true).
NUAD	Reserved.
NWAIT	I/O bus lengthen IOSB (negative true).
PA3	I/O bus peripheral address bit 3.
PPON	Primary power on: all outputs in spec.
READ	I/O bus data direction (positive true; high indicates data to IOP).
RESET	Reserved.
SEL0	Reserved.
SGND	Safety ground.
SYNC	Synchronize.

# 9020 References

**Chapter**
**10**

## BASIC Language Error Messages

1	Missing OPTION or configuration error	46	No binary to STORE BIN or no program to STORE or SAVE
2	Memory overflow	47	COM declarations are inconsistent or incorrect
3	Line not found or not in current program context	48	Direct recursion not allowed in a single line function
4	Improper return	50	File number <1 or >10
5	Improper context terminator	51	File not currently assigned
6	Improper FOR/NEXT matching	52	Improper mass storage unit specifier, bad subaddress specified, or bad driver name
7	Undefined function or subroutine	53	Improper file name
8	Improper parameter matching	54	Duplicate file name
9	Improper number of parameters	55	Directory overflow
10	String value required	56	File name is undefined
11	Numeric value required	57	SDF support missing
12	Attempt to redeclare variable	58	Improper file type
13	Array dimensions not specified	59	Physical or logical End Of File/BUFFER found
14	Multiple OPTION BASE statements or OPTION BASE after declaration	60	Physical or logical End of Record found in random mode
15	Invalid string or array bounds	61	Defined record size is too small for data item
16	Dimensions are improper or inconsistent	62	File is protected, wrong PROTECT code specified or PROTECT not allowed
17	Subscript out of range	63	Invalid record size
18	Substring out of range or improper string length	64	Medium overflow – out of user storage space, possibly due to fragmentation
19	Improper value	65	Incorrect data type
20	INTEGER overflow	66	INITIALIZE failed – excessive bad tracks, or can't spare dynamically
21	SHORT overflow	67	Mass storage parameter is incorrect
22	REAL overflow	68	Invalid line number or line did not parse during GET
23	DOUBLE overflow	69	Format switch on drive is off
24	SIN, COS, TAN argument too large for accurate evaluation	73	Incorrect device type in mass storage unit specifier
25	Magnitude of ASN or ACS argument is >1	77	File open on PURGE
26	Zero to non-positive power	78	Invalid volume label
27	Negative base to non-integral power	79	File open on target device
28	LOG or LGT of non-positive number	80	Door open, medium not in drive, medium changed, or printer out of paper
29	Illegal floating point number	81	Device/Interface hardware failure
30	Negative argument to SQR	82	Device/Interface not present
31	Division by zero, X MOD Y, or X MODULO Y with Y = 0	83	Write protected
32	String does not represent a valid number	84	Record not found; medium possibly uninitialized
33	Improper argument for NUM or RPT\$	85	Mass storage medium is not initialized
34	Referenced line is not IMAGE	86	Incorrect mass storage medium
36	Out of DATA items	88	Read data error
37	EDIT string longer than 160 characters	89	Checkread error
39	Multi-line function not allowed here	90	Mass storage system error
40	Improper COPYLINES, MOVELINES, DEL or REN		
41	First line number > second		
42	Attempt to replace, modify or delete a busy line or subprogram		
43	Matrix not square		
44	Illegal operand in matrix transpose or matrix multiply		

### BASIC Language Error Messages (Continued)

91	Negative length field in BDAT unformatted string	222	Data base directory not created
92	TYP not defined for this file type or device	225	Root file not compatible with current version of IMAGE
100	Item in USING list is a string but the corresponding IMAGE is numeric	226	Corrupt root file – must purge and redefine it
101	Item in USING list is numeric but the corresponding IMAGE is string	227	Corrupt data base – some sets require erasure
102	Numeric field specifier is too large	229	Data base in use
103	Item in USING list has no corresponding IMAGE	230	Improper set list or duplicate sets in the set list
108	Image is too long and/or complex	231	Improper record count specified
117	Too many nested structured statements	232	Root file cannot be purged until all data sets have been purged
128	Line exceeds maximum line length in GET	233	Root file not found
133	DELSUB of missing or busy subprogram	234	Referenced line not a 'PACKFMT' statement
136	REAL underflow	236	String buffer too short for required information
137	SHORT underflow		
141	Variable already ALLOCATED or not allocatable	244	Device was busy and could not handle request
142	Variable not ALLOCATED	247	Tape runaway – no data found on medium
143	Attempt to reference a missing OPTIONAL parameter	248	Beginning/End of tape
145	Too many COM blocks, or COM blocks are interleaved	306	Interface card failed self test
150	Improper device specifier or select code	315	Missing clock from multiplexor pod
152	Parity error	316	Link is down, clear to send false too long
153	Insufficient data to satisfy ENTER	326	Register address error
155	Invalid interface register number or value	327	Register value error
157	No ENTER terminator found within 256 characters of satisfying input	330	Lexical table size exceeds array size
158	Improper IMAGE specifier	331	Improper pointer array
159	Numeric data not received for numeric item	332	Non-existent dimension specified
163	Driver or interface not present	333	Pointer array contains out-of-range subscript value
164	Illegal BYTE/WORD option	334	Pointer array length does not equal the number of records in the reorder dimension
165	IMAGE specifier has count > size of variable	335	Pointer array is not one-dimensional
166	Improper TRANSFER length	337	Substring specifier extends beyond dimensioned maximum length
167	Interface status error	338	Subscript out-of-range in key specifier
168	Device timeout occurred and ON TIMEOUT branch could not be taken	340	Mode table too long or case table indicator is improper
170	I/O operation not allowed, or HP-IB improperly addressed	341	Improper mode indicator
171	I/O error – illegal addressing sequence	342	Lexical table is not one dimensional or is not of type INTEGER
172	I/O device or peripheral error	343	Lexical mode section pointer is out of range
173	I/O operation requires active or system control of the HP-IB	344	1 for 2 replacement list is either empty or too long
174	Concurrent I/O operation not allowed on object – nested I/O	345	Data type of expression in CASE does not match type of expression in SELECT
175	Unreported overlapped I/O error(s) pending	347	Improper matching of structured programming construct
177	Undefined I/O path name	353	Remote node does not respond, data link failure
208	Volume not mounted	401	Improper argument passed to system function or statement
209	SDF directory format required	402	MOVELINES could not completely delete source lines after copying them
210	Bad status array	403	Line failed to copy; program modification may be incomplete
211	Improper data base specified	404	Specified SCREEN does not exist
212	Data set not found	405	Attempt to delete a SCREEN with system function(s) attached
213	Data base directory not found	406	File specifier or BUFFER parameter not allowed as a single line function parameter
214	Data base not created		
215	Operation left at least one data set corrupt		
216	Maximum number of data bases already open		
217	Data base definition incomplete		
220	Improper or illegal use of maintenance word		
221	Data set not created		

**BASIC Language Error Messages (Continued)**

407	SAVE failed; program contains unlistable line(s)	477	Only one driver may be attached to this device
408	Out of line numbers during LOAD or LOADSUB	478	Media failure
409	Attempt to load a non-BASIC intermediate code context	479	Operation incomplete due to user programmed holdoff
410	STORE or STORESUB failed; all contexts reference missing options	480	Data operation aborted by an interface or device clear operation
411	Record length must be 256 for RE-SAVE and RE-STORE KEY files	481	File already locked, or unlocked in exclusive mode
413	Variables must be explicitly declared in FORCE DECLARE ON mode	482	Cannot move a directory via a RENAME
415	Line too complex	483	Shared Resource Management controller is down
416	Cannot COMPILE a TRACE or GET statement	484	Password not found
417	SCREEN number is outside the allowed range of 1 to 99	485	HP IB secondary command seen
418	Illegal screen size in CREATE SCREEN	486	Write blocked due to unread inbound data
419	Illegal screen position in CREATE or MOVE SCREEN	487	Request incompatible with previous requests or current state
420	Cannot ASSIGN ROLL KEYS TO SCREEN with no scrolling buffer	500	Partition already exists
421	Bad key number in stored SFK definition	501	Partition not present
422	Attempt to ASSIGN KEYBOARD to a public SCREEN	502	Cannot delete the foreground partition
423	HP-IB EOI assertion requires data	503	Partition must be foreground to ATTACH
424	Insufficient I/O bandwidth to honor request	504	Partition(s) must be in the STOP state
425	Too many chained SFK definitions	505	EVENT not present
426	I/O resource in use by another partition or subsystem	506	EVENT already exists
450	Specified volume not found	507	EVENT LEVEL negative – cannot delete
451	Volume labels do not match	508	Unsupported partition type in CREATE PARTITION
452	Duplicate volume labels	509	Attempt to COMPILE an empty program
453	File in use	510	BUFFER parameters not allowed in a default CALL
454	Directory formats do not match	511	Result array for INV is not SHORT or REAL
455	Possible corrupt directory	512	ON EVENT active – cannot delete
456	Directory format does not support this operation	515	PROG file or PROG file directory too small
457	Passwords not supported for this directory format	600	Attribute cannot be modified once established
458	Unsupported directory format	602	BUFFER variable has insufficient longevity
459	Specified file is not a directory	603	Variable not declared BUFFER
460	Directory not empty	604	Illegal source and destination combination for TRANSFER
461	Duplicate passwords not allowed	605	TRANSFER must be to a BDAT file
462	Invalid password	606	TRANSFER termination delimiters not supported
465	RENAME cannot specify different volumes	607	Inconsistent attributes
466	Duplicate volume entries	608	Zero count specified
467	Medium has been improperly inserted	609	IVAL result too large
468	Disc capacity exceeds 32 bit record address range	610	Maximum buffer size of .5 Mbytes exceeded
469	HP-IB TCT byte must be at end of ATN sequence	612	BUFFER pointer(s) in use – CONTROL/RESET not allowed
470	Device does not support CHECKREAD	650	Illegal remote operation
471	Device does not support TRANSFER	700	Graphics driver specifier not recognized
472	Interface cannot be HP-IB active controller	701	Incompatible GRAPHICS INPUT and PLOTTER drivers
473	Synchronous data rate could not be met to complete this operation	702	Internal CRT has no graphics hardware, or malfunctioning hardware, or no graphics driver
474	Device failed its self test or diagnostic	704	Upper bound <= lower bound
475	HP-IB interface too slow for this device	705	Specified area is outside GDU limits
476	Termination mode not supported by this driver	706	Incompatible hardware and driver
		707	Graphics device limits out of range
		708	Graphics device not initialized
		709	Graphics device not selected

**BASIC Language Error Messages (Continued)**

<b>710</b>	Service request interrupt on HP-IB from unknown origin	<b>737</b>	FONT stroke data invalid
<b>711</b>	Maximum number of graphics devices already initialized	<b>740</b>	Parameters specify the zero length vector
<b>712</b>	Memory overflow while attempting to report an overlapped I/O error	<b>741</b>	Perspective image for the point is undefined – zero distance from center of projection along the view normal
<b>713</b>	Request not supported by the device or driver	<b>742</b>	Front plane is not between the center of projection and the back plane
<b>714</b>	An attribute value (PEN or LINE TYPE) is out of range for a graphics device	<b>743</b>	Parameters specify a point that is on the wrong side of the view plane as determined by the view normal
<b>730</b>	Array not in COM for array PLOTTER	<b>744</b>	Viewing matrix is not invertible
<b>731</b>	The specified TRACK operation has not been initiated	<b>745</b>	Two vectors specifying the viewing transformation are parallel
<b>733</b>	GESCAPE opcode not recognized	<b>746</b>	GDU z value too large – no point has a perspective image with that value
<b>734</b>	FONT identifier out of range or not found	<b>749</b>	Graphics system error
<b>735</b>	FONT identifier already in use		
<b>736</b>	FONT specification data invalid		

**IMAGE Status Error Messages**

<b>0</b>	Successful execution – no error	<b>11</b>	End of file encountered
<b>-1</b>	Miscellaneous host system error, see status element 10 for error number	<b>12</b>	Negative record number specified
<b>-10</b>	Maximum number of data bases already open	<b>13</b>	Record number greater than capacity specified
<b>-11</b>	Bad data base reference or preceding blanks missing	<b>14</b>	Beginning of chain encountered
<b>-12</b>	Not all necessary data sets are locked	<b>15</b>	End of chain encountered
<b>-14</b>	DBPUT, DBDELETE, and DBUPDATE not allowed with DBOPEN mode 8	<b>16</b>	The data set is full
<b>-21</b>	Improper or nonexistent data set, data item, password, or volume specified	<b>17</b>	No current record, no chain head, or the selected record is empty
<b>-22</b>	Detail data set required	<b>18</b>	Broken chain encountered
<b>-23</b>	Write access to data set required	<b>20</b>	At least one requested data set is already locked
<b>-24</b>	DBPUT, DBDELETE, or DBUPDATE not allowed on an Automatic master data set	<b>41</b>	DBUPDATE will not alter a key or sort item
<b>-31</b>	Improper mode specified	<b>43</b>	Key value already exists in Master set
<b>-32</b>	DBOPEN mode conflicts with another user	<b>44</b>	Can't delete a Master entry with non-empty Detail chains
<b>-52</b>	Item specified is not a key item in the specified set or bad List parameter	<b>50</b>	String buffer is too small for requested data
<b>-91</b>	Root file not compatible with current version of IMAGE	<b>51</b>	Variable size or type does not match the item size or type
<b>-92</b>	Data base not created	<b>52</b>	Number of variables specified does not match the item list
<b>-93</b>	Corrupt root file, must purge and redefine it	<b>53</b>	Argument parameter type or size incompatible with key item type or size
<b>-94</b>	Corrupt data base, some sets require erasure	<b>94</b>	Corrupt data base opened in read-only mode
<b>-135</b>	Wait lock not allowed while a lock is already in effect	<b>1xx</b>	There is no chain head for path xx
<b>10</b>	Beginning of file encountered	<b>3xx</b>	The Automatic Master for path xx is full

# 9020 Service Notes

Chapter

**11**

