Model 340 Workstation's SPU Service Manual

HP 9000 Series 300 Computers
Model 340

HP Part Number 98571-90030



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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.

October 1988...Edition 1

November 1988...Edition 2. (Several part numbers changed and this edition includes the new part numbers.)

Notices

Radio Frequency Interference Statements

FCC Statement

Federal Communications Commission
Radio Frequency Interference Statement
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WARNINGs, CAUTIONs, and Notes

Warnings, cautions and notes are used throughout this document to alert the user to conditions of importance. They are used as follows:

- WARNINGS contain information which, if not observed, could result in injury to personnel or loss of life.
- CAUTIONS contain information which, if not observed, could result in damage to or destruction of equipment.
- Notes contain information that will assist you in accomplishing the job.

Examples:

WARNING

The power supply presents a hazard to personnel. Extreme care must be taken when connecting voltmeter probes to the test points. De-energize the product by turning it off and removing its power cord before connecting or removing test probes.

CAUTION

The printed circuit assemblies in this product are susceptible to damage by electro-static discharge. Extreme care must be taken when handling printed circuit assemblies. Use an Anti-static Workstation while handling printed circuit assemblies.

Note

Hewlett-Packard supports repair of this product only to the assembly level. The fault is diagnosed to the assembly that is causing the problem. That assembly is then replaced with a new or rebuilt one.

Service Information Locator

On the next page is a Service Information Locator. First, find the information to reference in the left-hand column. Next, move to the right to a chapter number. Last, move up to the abbreviated manual title that has the information documented.

Chapter identifiers in the Locator use the following codes:

Chapter Number:	Numbers, such as 2. Inclusive chapters, such as 4-6.
Appendices:	Letters, such as A for Appendix A.
Entire Manual:	All
Varies:	* (Check Table of Contents or Index.)

Manuals identified in this locator are abbreviated by their initials:

Initials	Manual Title	Part Number
SIM	Model 340 Workstation's SPU Service Information Manual	98571-90030
SHB	Model 340 Workstation's SPU Service Handbook	98571-90039
TTM	Series 200/300 Test Tools Manual	09800-90011
SPM	HP 9000 Site Preparation Manual	09000-90041
PIN	Product Installation Note	
TDS	Series 300 Technical Data Sheet/Price List	

Video/Graphics Boards Information

These boards have service information located in other manuals identified in the following table.

Workstation Model	Part Number	Title
340SRX	98720-90030	HP 98720A Graphics Display Station Hardware Support Document
340CH	98550-90000	HP 98550A Graphics Interface Familiarization Guide
	98556-90000	HP 98556A 2D Graphics Interface Familiarization Guide
340C+	98549-90000	HP 98549A Graphics Interface Familiarization Guide
340MH	98548-90000	HP 98548A Familiarization Guide
340M	98562-90030	Model 330/350 Service Information Manual

Model 340 Workstation's SPU Service Information Locator

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Booting Operating Systems	4					
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Environmental requirements	1	2		4, A		*
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HP-HIL device tests			2, 3			
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Product Information 1

Introduction

Model 340 Workstation System Processing Unit's (SPU's) are market entry level versions of the Model 360 and 370 computers. Each provides good performance at low cost to meet the computer-intensive requirements for design automation as well as scientific analysis and general purpose computation. These SPU's are also an enhanced versions of the Model 318 and 319 Workstation SPUs with improved video and graphics capabilities, added interfaces, and a faster clock speed.

The SPU is a limited-configuration product. Depending on the workstation model, one of several video/graphics boards is used. It is upgradeable for memory and has LAN, High-Speed HP-IB or SCSI interface options. Certain user-installable DIO accessory cards can be used if the HP 98013A DIO Slot is installed. No expanders are available for the Model 340 Workstation's SPU.

Each SPU is complete within the case. All memory, interfacing, video and processing functions occur within the case.

Workstation Configurations

Several configurations are available. You should refer to the current *HP 9000 Series 300 Pricing Information and Technical Data Sheets* to find out exactly what is currently offered. Different amounts of memory and interface options are available for installation by qualified service personnel.

Table 1-1 lists the standard Model 340 Workstation configurations.

Table 1-1. Model 340 Workstation Descriptions

Workstation	Product	Name/Description
Model 340SRX	98573C	3D Color Workstation; includes: SPU with LGB Interface, DIO-1 Slot and 4 Mbytes RAM. HP 98720A 3D Display Controller with 8 planes of frame buffer memory. HP 98789A 16-inch High-Res Color Monitor. Opt. 719: Substitute HP 98752A 19-inch High-Res Color Monitor for HP 98789A Monitor.
Model 340CH	98564G	2D Color Workstation; includes: SPU with High-Res Color Graphics (1280 by 1024) and 4 Mbytes RAM. HP 98789A 16-inch High-Res Color Monitor. Opt. 556: Add 2D Integer-Based Graphics Accelerator. Opt. 719: Substitute HP 98752A 19-inch High-Res Color Monitor for HP 98789A Monitor.
Model 340C+	98564C	Color Workstation; includes: SPU with High-Res Color Graphics (1024 by 768) and 4 Mbytes RAM. HP 98785A 16-inch High-Res Color Monitor. Opt. 719: Substitute HP 98751A 19-inch High-Res Color Monitor for HP 98785A Monitor.
Model 340MH	98563G	Monochrome Workstation; includes: SPU with High-Res Monochrome Graphics (1280 by 1024) and 4 Mbytes RAM. HP 98788A 19-inch High-Res Monochrome Monitor.
Model 340M	98563E	Monochrome Workstation; includes: SPU with High-Res Monochrome Graphics (1024 by 768) and 4 Mbytes RAM. HP 98786A 17-inch High-Res Monochrome Monitor.

DIO-I Accessory Cards Supported

When the HP 98013A DIO Slot Upgrade is installed, only the DIO-I accessory cards listed below are supported:

- HP 36593A HP-UX Gateway/SNA Interface.
- HP 50955A 3278 Emulator.
- HP 50962A SRM Interface.
- HP 98255A EPROM Board.
- HP 98259A Bubble Memory Card.
- HP 98286A DOS Coprocessor.
- HP 98622A 16-Bit GPIO.
- HP 98623A BCD Interface.
- HP 98624A HP-IB Interface.
- HP 98625B High-Speed HP-IB Interface.
- HP 98626A 50-Pin RS-232C Interface.
- HP 98628A Datacomm Interface.
- HP 98630A Breadboard Interface Card.
- HP 98633A 6944A Multi-Programmer Interface.
- HP 98640A 7-Channel A/D Interface.
- HP 98641A RJE 2780/3780 Interface.
- HP 98642A 4-Port RS-232 MUX Interface.
- HP 98643A LAN Interface.
- HP 98644A RS-232C Interface.
- HP 98646A VMEbus Interface.
- HP 98647A PC-IB Interface.
- HP 98658A SCSI Interface.
- HP 98691A Programmable Datacomm Interface.
- HP 98725A Local Graphics Bus Interface.

SPU Physical Identification

Depending on the interface options and video boards used, each version can usually be identified by the rear panel configuration. Figure 1-1 shows each Model 340 Workstation rear panel.

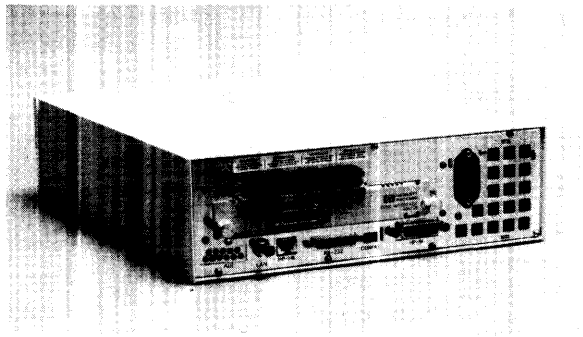


Figure 1-1a. Model 340SRX

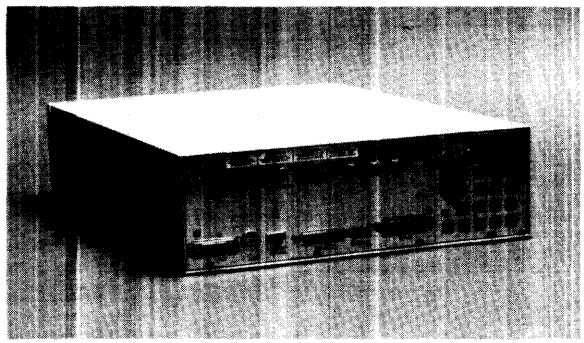


Figure 1-1b. Model 340CH and 340C+

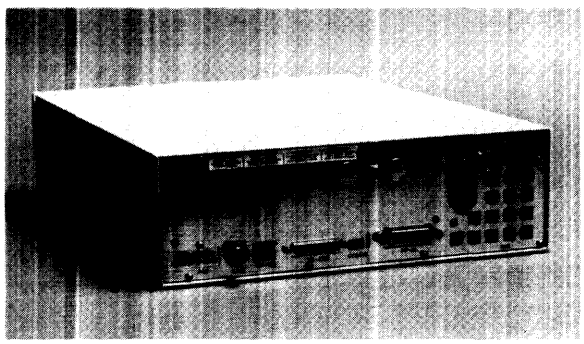


Figure 1-1c. Model 340MH

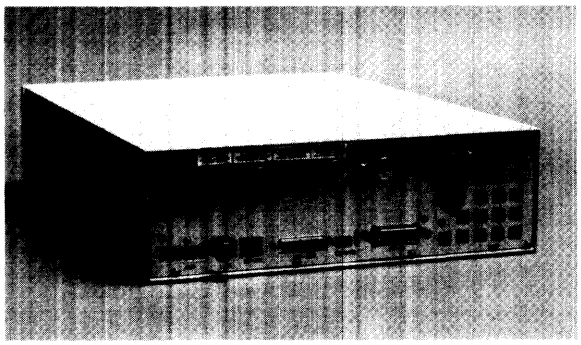


Figure 1-1d. Model 340M

SPU Hardware

Power Supply

A modular power supply is provided for the voltages required. Its voltage select switch is user-accessible.

Processor Board

Here's a list of what the processor board has:

- MC68030 CPU at 16.67 MHz.
- MC68882 Floating-Point Coprocessor.
- Parity-Checking RAM Controller.
- HP-IB (IEEE-488) Interface with two-channel DMA controller.
- RS-232C Serial Interface with DB25 connector.
- HP-HIL Interface.

Bus Architecture

A 32-bit system bus connects the video/graphics, SCSI if installed and RAM to the processor board. If an HP 98013A DIO-I Slot is installed, ribbon cables connect its DIO backplane to the SPU backplane. LAN interface is provided through the LAN connector to the processor board.

Memory

Up to four HP 98268A 4 MByte RAM boards may be plugged into the processor board. Depending on the specific workstation model, different amounts of RAM is installed.

Video/Graphics Boards

High-resolution color or monochrome video/graphics is output to the workstation's monitor through one of several video/graphics boards. A list of video/graphics boards supported is shown below with the workstation model each is supplied with:

- Model 340SRX: 3D Color Graphics Interface.
- Model 340CH: Color (1280 by 1024).

  Option 556 adds the 2D Integer-Based Color Graphics Accelerator.
- Model 340C+: Color (1024 by 768).
- Model 340MH: Monochrome (1280 by 1024).
- Model 340M: Monochrome (1024 by 768).

Interfaces

Optional interfaces are available that provide additional capability in addition to those on the processor board:

- Option 006 - One DIO-I slot. Also available separately as an HP 98013A DIO-I Slot Upgrade. It's standard with the Model 340SRX and supplied with Options 010 and 011.
- Option 010 - High-Speed HP-IB Interface. Standard with the Model 340SRX.
- Option 011 - Small Computer Systems Interface (SCSI).
- Opt. 015 - AUI LAN (requires external media attachment unit).
- Opt. 017 - ThinLAN with built-in ThinMAU and BNC "T" connector.

Note that Options 010 and 011 cannot be installed together because each occupies the same slot in the SPU.

Keyboard

Standard keyboard is the Integrated Terminal Format (ITF) HP 46021A Keyboard. It connects to the HP-HIL connector through the rear panel.

Operating Systems

HP-UX

Series 300 HP-UX, Revision 6.2 or later, is supported in Model 340 Workstations.

BASIC 5.2

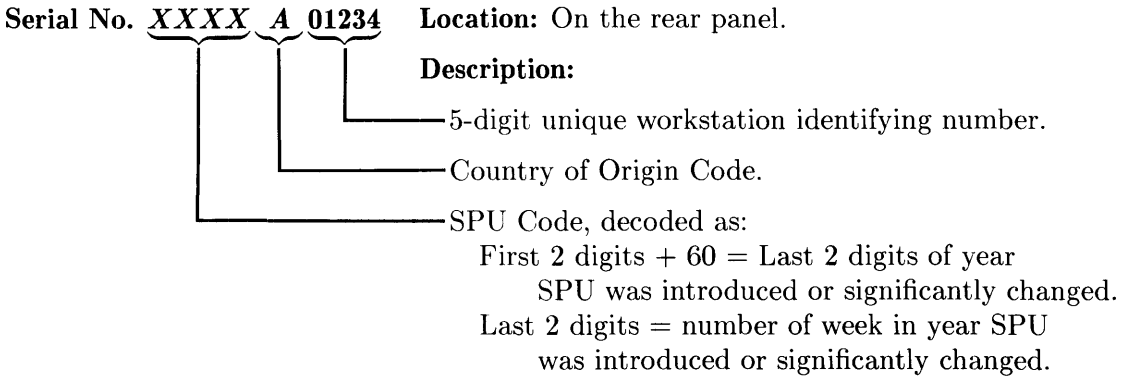
Supported as a service tool only, the HP 98613D Series 300 BASIC 5.2 operating system may be used to test the workstation. BASIC does not have drivers for the LGB interface used in Model 340SRX workstations.

Product Identification

Several terms in this manual are used to describe and identify the various parts of the SPU. This section explains the terms used to improve your understanding of service information.

Serial Numbers

The Model 340 Workstation SPU's serial number is on the rear panel. Other equipment in the workstation will also have its own serial number. An example serial number is explained below:



Hardware Terminology

Hardware means the physical elements of this workstation. Different parts and locations of hardware items are explained below.

Product Terms/Conventions

The following terms are used to describe products and their main parts and areas:

- **SPU** - System Processing Unit, a box containing the power supply, processor board and other assemblies such as RAM add-on or interface boards.
- **Internal (circuit)** - A circuit, such as an interface, that is part of the processor board. Internal does not mean "inside the SPU's case".
- **External (circuit)** - A circuit that is located on an assembly other than the processor board. External does not mean 'outside the SPU's case'.
- **Peripheral** - A device external to the SPU, such as a keyboard, monitor, disc drive, plotter, printer, etc.
- **System** - An SPU with one or more peripherals connected together to run an application for a desired end result.

Printed Circuit Assemblies

Printed circuit boards in the SPU and are made of several component parts. In this manual, **boards** identify the printed circuit assemblies installed inside the SPU. Boards are not usually removed or installed by users.

Printed circuit cards are those used in the DIO-I slot. They are usually installed by users.

Software Terminology

As used in this manual, software refers to information stored in, or on a device. Typically, this information can be changed and can be transferred to another location in the workstation. Types of software are:

- **Firmware** - The data or instructions in Read-Only-Memory (ROM) chips.
- **Operating Systems** - Computer languages, such as BASIC, Pascal, and HP-UX. They have various commands, statements, and keywords that when executed by the CPU in a particular sequence, cause SPU to manipulate data to some desired end result.
- **Application Program** - A series of operating system program lines in a specific sequence to cause specific actions, such as accounting, electro-mechanical design, data sampling and output, etc. This information is sometimes referred to as software as it is information that is stored in or on a medium and can be transferred.

Hardware Support Documentation

The purpose of this SPU's Hardware Documentation is to support the installation and maintenance of these products. Hardware Support Documentation consists of these manuals for the HP 9000 Series 300 Model 340 Workstation's SPU:

- Service Manual.
- Service Handbook.
- Service Notes.
- Series 200/300 Test Tools Manual.
- HP 9000 Series 200/300/500 Site Preparation Manual.
- Series 300 Computer System Configuration Reference.

The following manuals also relate to hardware:

- Various Installation Notes.
- Series 300 Installation Reference.
- Series 200/300 Peripheral Installation Guide.

A complete listing of titles and part numbers is in Chapter 7 of this manual and the SPU's Service Handbook, Chapter 10.

Service Manual

This manual (the one you're reading now) contains tutorial information on the SPU's features, functional descriptions of each assembly, and how to replace these assemblies.

Its purpose is to serve as a learning tool in training environments wherein the service person learns how the SPU works and its parts are replaced. Most of the information in the Service Information Manual is not found in the Service Handbook.

Organization of the Service Manual is found in the Table of Contents.

Service Handbook

This manual is intended to be used on site during service situations. It contains information useful to configuring, troubleshooting, and replacing parts. It is organized as follows:

Chapter No. and Title	Contents
Chapter 1: Product Information	Has a brief description of the product, along with configuration and similar information. Product technical data is also listed.
Chapter 2: Environmental, Installation, and PM	Gives power requirements, and power cord data, and installation information. If preventive maintenance is required, it is shown in this chapter.
Chapter 3: Configuration	Lists product configurations and explains what each one is.
Chapter 4: Troubleshooting	Lists tools required, including Test Tools, and explains several troubleshooting procedures. Flow charts are frequently used.
Chapter 5: Tests	Lists tests to run to check out the SPU, some peripherals, and interfaces.
Chapter 6: Adjustments	There's no adjustments for the SPU.
Chapter 7: Systems	Refers to the Series 300 Pricing Information and Technical Data sheet for current bundled system configuration.
Chapter 8: Replacement Parts	Lists part numbers for all field-replaceable parts and explains how they may be obtained.
Chapter 9: Diagrams	Block diagrams of the products are shown here.
Chapter 10: Reference	Other documentation related to these products are listed here with their part numbers.
Chapter 11: Service Notes	When you receive Service Notes for this product, they should be inserted here.

Test Tools Manual

Series 200/300 Test Tools Manual supports a software package for diagnosing Model 340 Workstations. The Test Tools manual and its associated discs or tape permit troubleshooting workstations in failure analysis. Part numbers for the complete Test Tools packages are:

- 09800-12300 for 3.5-inch disk drives.
- 09800-12700 for 5.25-inch disk drives.
- 98561-10835 for 0.25-inch tape drives.

Contents of the four parts of the Test Tools Manual are:

Part No. and Title	Contents
Part I: Introduction and Built-In Tests	Introduces the Test Tools package and overviews the SPU self-tests and explains what the different tests do.
Part II: Computer Tests	Covers loading and running of Series 300 Computer Tests. Each test is explained as to what it does. Error messages are listed and explained.
Part III: System Functional Tests	Tells how various SPU-peripheral tests are loaded and run. Tests are explained, error messages shown and defined. Examples of some tests are given. Includes tests for HP-HIL devices.
Part IV: CS/80 Exercisers	Explains how tests for CS/80 disc drives are loaded, ran, and results are interpreted. Error messages are shown as well as several examples of running the tests.

Service Notes

When a situation occurs that effects servicing of the SPU that is not covered in existing documentation, a Service Note is written to explain it. Service Notes are distributed through a Subscription Service to HP Customer Engineers and to customers on the Cooperative Support Program for these products. Being half-page in size, they are intended to be placed in Chapter 11 of the Model 340 Workstation SPU's Service Handbook.

Installation Notes

Each separately available accessory or upgrade has an Installation Note packaged with it. These Notes have instructions for configuring and installing the hardware. In addition, an Installation Picture Guide is provided with each bundled system showing how to install and turn on the workstation.

Series 300 Configuration Reference Manual

All supported configurations of Series 300 Computer Systems are explained in this manual.

Section No. and Title	Contents
Section 1: Configuration Overview	Has configuration worksheets to assist in planning the application.
Section 2: Operating Systems and Application Software	Covers supported languages and media options.
Section 3: System Packaging	Lists the configurations, features and options available.
Section 4: Interface and Peripheral Selection	Explains Interfacing, networking, mass storage, monitors, printers, and other output peripherals.
Section 5: Support Services	Overviews Customer Training, installation and support services, and consulting.
Appendix A: Detailed Product Reference	Gives detail information about the SPU and peripherals.

Site Preparation Manual

Explains site preparation and how to prepare the site for hardware installation. Covers physical, environmental and electrical requirements. Its organization is shown below.

Chapter No. and Title	Contents
Chapter 1: Introduction	Explains the purpose and contents of the Site Preparation Manual.
Chapter 2: Responsibilities	Identifies customer and HP responsibilities for preparing the HP 9000 System site. Includes a time frame for setting up the workstation, and identifies people who can provide assistance.
Chapter 3: Preparing the Electrical Environment	Includes power technical data, dealing with electrical interference, connecting cables, and data communication configurations.
Chapter 4: Preparing the Physical Environment	Explains heat and humidity considerations, airborne contaminants, and shipping weights and dimensions for movement and storage.
Chapter 5: Providing Other Necessities	Covers media storage, equipment and record protection, supplies, and nearby telephones for assistance which are an integral part of preparing for and sustaining the operation of a workstation.
Chapter 6: Equipment Arrangement and Space Planning	Provides information and guidelines for planning the location of the workstation equipment at your site.
Chapter 7: When Your Computer Arrives	Discusses the final preparation for system arrival, coordinated deliveries, arrival dates, how to check for damage in shipment, unpacking the cartons, and scheduling the installation of HP 9000 Systems.
Appendix A	Lists product technical data for electrical requirements, heat generation, temperature and humidity requirements, and shipping dimensions.
Appendix B	Contains forms to use for preparing the site, such as Pre-Installation Worksheet, Shipment Scheduling Form, and a Site Completion Checklist.

Installation Reference

The workstation has step-by-step procedures for installing each part. An Installation Card is a pictorial set of instructions to show installers how to unpack, connect, and power up the SPU, disc drive, and monitor. More detailed information is contained in the Installation Reference. To install the operating system and/or application program, the documents supplied with these software products should be referred to.

Organization of the Installation Reference is:

Chapter No. and Title	Contents
Chapter 1: Introduction	Covers how the guide is organized and explains some SPU fundamentals.
Chapter 2: Installing Your Computer	Includes procedures on positioning the SPU, checking voltage settings, connecting power cords, and turning on the SPU.
Chapter 3: Installing Accessories	This chapter covers accessory configuration and installation.
Chapter 4: Installing Your Keyboard and Monitor	This chapter covers keyboard and monitor installation.
Chapter 5: Installing HP-IB Peripherals	Standard HP-IB peripheral configuration and connection procedures.
Chapter 6: Installing Non-HP-IB Peripherals	Peripheral configuration and connection procedures other than HP-IB.
Chapter 7: Reading the Self-Test	Covers procedures performed by self-test and how to interpret the results of the self-tests. Error messages are explained and help is provided should the user get into trouble at this point.
Reference	This chapter has information regarding internal configuration switches, running extended tests, Boot ROM error messages and tutorial information on data communications and interfacing.
Glossary	Provides explanations of computerese terms and phrases.

Technical Information

Note

Technical information listed below should not be interpreted as specifications. Official specifications are listed in the *HP 9000 Series 300 Hardware Technical Data and Pricing Sheet.*

Electrical

Line voltage/frequency	115 V ac @ 48-66 Hz 230 V ac @ 48-66 Hz
Line transient spike immunity (1 nsec rise, 800 nsec duration)	1 KV dc
Power Consumption	155 Watts maximum
Current Requirements	2.6 A @ 115 V ac 1.5 A @ 230 V ac
Maximum Heat Dissipation	570 BTU/hr 167 Kcal/hr

Environmental

Operating temperature	0 - 55° C (32 - 104° F)
Operating humidity	5 - 80% relative
Operating altitude	4 572 metres (15 000 feet)

Electromagnetic Interference

Standards met	FCC Class A VCCI Class 1 VDE Class B, VDE 1046/84

Regulatory Requirements

Standards met	UL 478, 5th Edition CSA 220-M1986 IEC 380, 2nd Edition; 435, 2nd Edition

Physical

Dimensions	
Height	104 mm (4.1 inches)
Width	325 mm (12.8 inches)
Length	444 mm (17.5 inches)
Weight	4.55 kg (10 pounds) maximum

Processor Board

CPU	
Type	Motorola MC68030
Clock Frequency	16.67 Mhz
Internal Architecture	32-bit data and address registers
Address range	4 Gbytes virtual mapped to 4 Gbytes physical
Data bus	32-bit synchronous
Floating point Coprocessor	
Type	Motorola MC68882
Clock Frequency	16.67 Mhz
MMU	
Type	Motorola MC68852
Clock Frequency	16.67 Mhz
LAN Interface	
Media	LAN coax cable (RG 58U)
Protocols	IEEE 802.3, Ethernet
Data Rate	10 Mbits /sec
Parallel Interface	
Type	HP-IB (IEEE 488)
Data Rate	350 Kbyte/sec
Number of connected devices	15 per interface devices supported
Serial Interface	
Type	RS-232C standard
Capacitor-backed Real-Time Clock	
Resolution	10 milliseconds
Accuracy	±5 seconds/day
Clock life	24 hours

DMA

Input Clock	10 MHz
Channels	2
Channel Priority	Programmable, high or low, each channel
Channel Arbitration	Round-robin
Bus Arbitration	DIO daisy chain
Transfer Types	8-bit (byte) 16-bit (word) 32-bit (long word)
Max Transfers	4G transfers per arming
Bus Bandwidth Use Limits	Programmable: 100%, 50%, 25%, 12.5%
Min Cycle Time	300 ns
Max Theoretical Transfer Rate	13.3 Mbytes/sec
Typical Burst Transfer Rate	2.8 Mbytes/sec
Interrupt levels	Programmable: 7, 6, 5, 4, 3
Address range	FFFFFFFF - 00000000

Memory

Amount	4, 8, or 16 Mbytes
Type	Byte parity error-checking
Average cycle time	300 nsec

I/O Bus

Width	32 bits address; 16 bits data
Bus bandwidth	6 Mb/sec

Video

Video Interface	High-Resolution Color

Shipping Information

The shipping container for each SPU includes the Localization Kit, which includes power cords, keyboard cable, HP-HIL cable, Safety and Regulatory Information, and Installation Picture Card.

Shipping Weight	9.1 kg (20 pounds)
Container Dimensions	Width - 533 mm (21 inches) Length - 584 mm (23 inches) Depth - 292 mm (11.5 inches Cube - 0.085 m^3 (3.21 $feet^3$)

HP-HIL Accessories

Listed below are HP-HIL accessories compatible with the Model 340 Workstations. For a complete list, consult the *HP 9000 Series 300 Hardware Technical Data and Price List.*

Table 1-2. HP-HIL Devices

Product Number	Product Name/Description
HP 35723A	Touchscreen Bezel
HP 46021A	ITF Keyboard
HP 46060A	HP Mouse
HP 46080A	Extension Module
HP 46081A	3 Metre Ext.
HP 46082A/B	15/30 Metre Extension[1]
HP 46083A	Rotary Control Knob
HP 46084A	ID Module
HP 46085A	Control Dials
HP 46086A	Button Box
HP 46087A	"A"-Size Digitizer
HP 46088A	"B"-Size Digitizer
HP 46089A	4-Button Cursor for Digitizer
HP 46094A	Quadrature Port Device
HP 46095A	Three-Button Mouse
HP 92916A	Barcode Reader

Hewlett-Packard Support

Support services and policies mentioned in this section are subject to change. Please consult your local Hewlett-Packard Sales and Service Office for the current support policies.

Repair Philosophy

Field Repair Philosophy for this SPU is assembly, or board level. This means that when a failure occurs, the problem is diagnosed to the assembly having the failed part. That assembly is then replaced. Replacement assemblies are available through local HP Sales and Service Offices.

Some assemblies may be exchanged for rebuilt ones. Other assemblies are only available as new ones. Refer to Chapter 6, or the Service Handbook, Chapter 8, for information on replacement parts.

Schematics

In support of the repair philosophy, this manual contains information to the assembly level. Schematics are not available for these products.

Supported Configurations

Only workstations with Hewlett-Packard approved parts, accessories, peripherals, operating systems and application programs are supported by Hewlett-Packard. Any workstation with other than HP approved hardware or software connected or installed must have the non-HP approved hardware and software removed by the customer before On-Site repair is accomplished.

HP Repair Services

There are many hardware support options available, from utilizing customer's maintenance groups to buying full support from the local HP Sales Office. Please contact your local Hewlett-Packard Sales and Service Office for complete information.

Hewlett-Packard provides on-site repair services for Model 340 Workstation SPU's.

More information is available in the *HP 9000 Series 300 Pricing Information Sheet* Contact your local HP Sales and Service for complete information on these services. Each is briefly described below.

Repair by Customers

In addition, customers may obtain service training courses and spare parts to do their own repair. Contact your nearest HP Sales and Service Office for information concerning service training, special tools and test equipment, and spare parts.

Operating Systems Support

HP-UX Installation Services

A set of modular services that provide expert installation of hardware, operating system, and selected HP DesignCenter applications is available. They allow users to make productive use of their system in the shortest possible time. Services include:

- Interconnection of system hardware.
- Formatting discs.
- Loading and configuration of the HP-UX Operating System.
- Loading applications.
- Verification of system operation.
- Review of the system for its System Administrator.

Refer to the *HP 9000 Series 300 HP-UX Installation Services Technical Data (5954-9695)* for details and complete information.

Primary Support

There are numerous operating system support options:

- Account Management Support (AMS) provides a local SE, on-site assistance, one Response Center caller and one alternate for telephone assistance, and a Software Materials Subscription.
- Response Center Support (RCS) provides one Response Center caller and one alternate for telephone assistance, and Software Materials Subscription.
- Software Materials Subscription (SMS) provides software and manual updates, Software Status Bulletins, and HP communicator magazine. Updates to ROM-based systems are not provided.

Support For An Additional System

The following options support an additional system:

- Additional System Coverage extends AMS or RCS coverage on the operating system to one additional system under the same system manager. All support is delivered through the central system.
- Extended Materials Support extends SMS by providing the right to make one copy of all central system materials for use on one additional system.
- Additional Response Center Caller provides one additional caller and one alternate for access to the HP Response Center
- Manual Update Service (MUS) provides one copy of updates to software reference manuals.
- Software Notification Service (SNS) provides issues of the HP Communicator and Software Status Bulletin.

Assembly Replacement 2

Introduction

Tools Required

CAUTION

In this SPU, special screws requiring Torx® T-10 or #1 Pozidriv screwdrivers are used. Do not use other screwdrivers as they will damage the screw head recess.

All field replaceable parts can be accessed with these tools:

- T-10 Torx® screwdriver, 4-inch (100 mm) blade.
- Pozidriv® #1 screwdriver, 4-inch (100 mm) blade.
- One each of these nutdrivers.
    - 3/16-inch (8720-0001).
- 5.5mm (8720-1220).
    - 9/32-inch.
- 5/8-inch open-end wrench.
- 9/16-inch open-end wrench.

CAUTION

A static-free Workstation (9300-0794) should be used as a work surface. Anti-static bags should be used to store assemblies in.

A unique feature of this SPU is that once the internal assembly is out of the case, no fasteners are used to hold the printed circuit assemblies in place. Only the rear panel has screws and locknuts to hold assemblies, interface connectors and the case in place.

Safety Precautions

As with any electrical/electronic product, certain safety precautions must be practiced. These safety precautions, when followed protect both you and the equipment from injury and possible permanent damage.

Electrical

WARNING

Always turn off the SPU and remove the power cord before removing the case to remove or replace an assembly. If maintenance requires power to be applied while the case is removed, proceed only with extreme caution using safe, live-unit maintenance procedures. Do not touch energized components in the SPU.

Heed and follow all "WARNING-HAZARDOUS VOLTAGE" labels. Failure to follow these safety precautions may result in serious injury, or worse.

Electro-Static Discharge

Integrated circuit components can be damaged by electro-static discharge. It doesn't make any difference whether the IC's are installed on a printed circuit board or laying on a table. Static charges can build up in people to a potential of several thousand volts by simply walking across a room.

These circuits in the SPU and peripherals can be protected by using a static free workstation and wearing clothes that do not hold static charges before handling any of the SPU's PC boards.

When you need to remove or install a part, turn off power to the SPU first. With the static free workstation in place, touch sheet metal with your fingers before touching the printed circuit assembly. If the assembly is not going to be re-installed, place the assembly in an anti-static bag.

Following these precautions will extend the life of the computer products you maintain.

Mechanical

CAUTION

Adequate support of the processor or SPU backplane boards is required at their connectors when removing or installing boards to prevent flexing and possible failure of the traces inside these boards.

Apply pressure on the component side of the processor/backplane boards when removing other boards from them. Apply pressure on the back side of the processor/backplane boards when installing other boards in them.

If insertion resistance seems high, check the male connectors for bent pins.

Helpful Hints

Removal Sequences

Figure 2-1 is an Assembly Access Flow Chart showing the sequence for removing parts. To use this chart, identify the part to be replaced at the bottom of the chart. Then start at the top of the chart and work through the steps toward the part to replace. Use this chart as a guide to install assemblies by starting at the bottom and working toward the top.

Table 2-1 also lists each assembly and what needs to be removed before that assembly can be removed.

Referencing the SPU's Service Handbook, Chapter 8, Replaceable Parts, as you remove each assembly/part for the first time will help associate the part numbers with their respective assemblies.

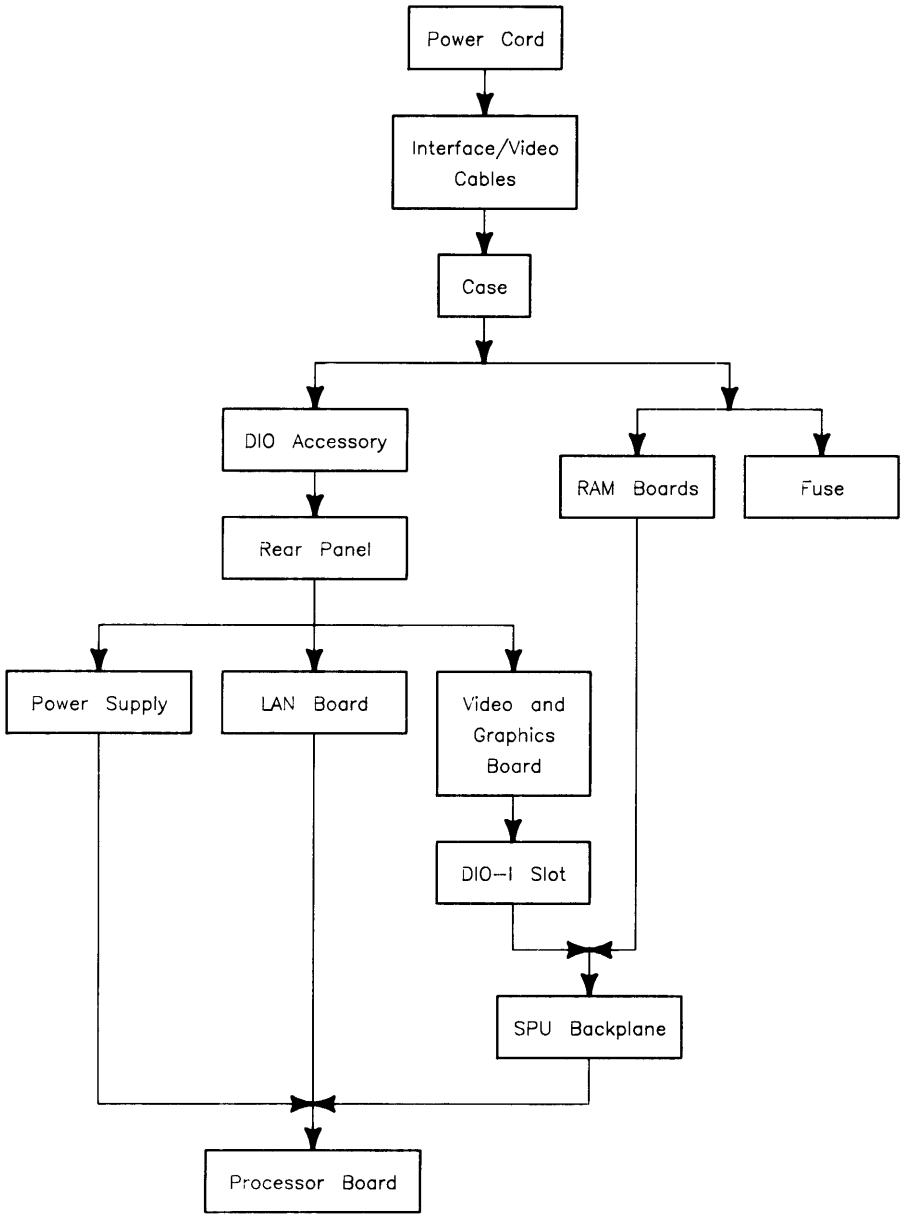


Figure 2-1. Assembly Access Flow Chart

Table 2-1. Disassembly Sequence

To Remove This Assembly:	Remove This Assembly First	Remove This Assembly Second	Remove This Assembly Third	Remove This Assembly Fourth	Remove This Assembly Last
Power Supply	DIO Card (1)	Case			Rear Panel
Video/Graphics Board	DIO Card (1)	Case			Rear Panel
Graphics Accelerator Board	DIO Card (1)	Case	Rear Panel		Video Board
LAN Board	DIO Card (1)	Case			Rear Panel
RAM Board					Case
Processor Board	DIO-I Card and Case	Rear Panel	RAM, LAN Boards	Video, Backplane Boards	Power Supply
DIO-I Slot	DIO Card	Case	Rear Panel		Video Board
SPU Backplane	Case	Rear Panel	RAM Boards	Video Board	DIO-I Ribbon Cables (1)

Note (1): If installed.

Reference Diagram

Table 2-2 lists a reference number with each SPU field replaceable part. Reference numbers are the same as those in the exploded view in Figure 2-2. These should help you determine parts orientation and identification for their removal and installation.

Table 2-2. SPU Parts

Ref. No.	Electrical Part Description
1	Power Supply
2	Processor board
3	RAM board
4	LAN board
5	SPU backplane
6	Video/graphics board
7	DIO-I backplane
8	DIO-I short cable
9	DIO-I long cable

Ref. No.	Mechanical Part Description
10	Case
11	Front cover
12	Molded foot
13	SPU board guide
14a	Panel screw
14b	DIO screw
14c	DIO screw
15	Rear panel
16	Shoulder washer
17	ThinLAN capacitor/washer
18	Flat washer
19	HP-IB jackscrew
20	HP-IB lockwasher
21	RS-232 jackscrew
22	RS-232 lockwsher
23	RGB/LAN lockwasher
24	RGB/ThinLAN hex nut
25	DIO-I Left bracket
26	DIO-I Right bracket
27	DIO-I Card guide
28	Power supply plate

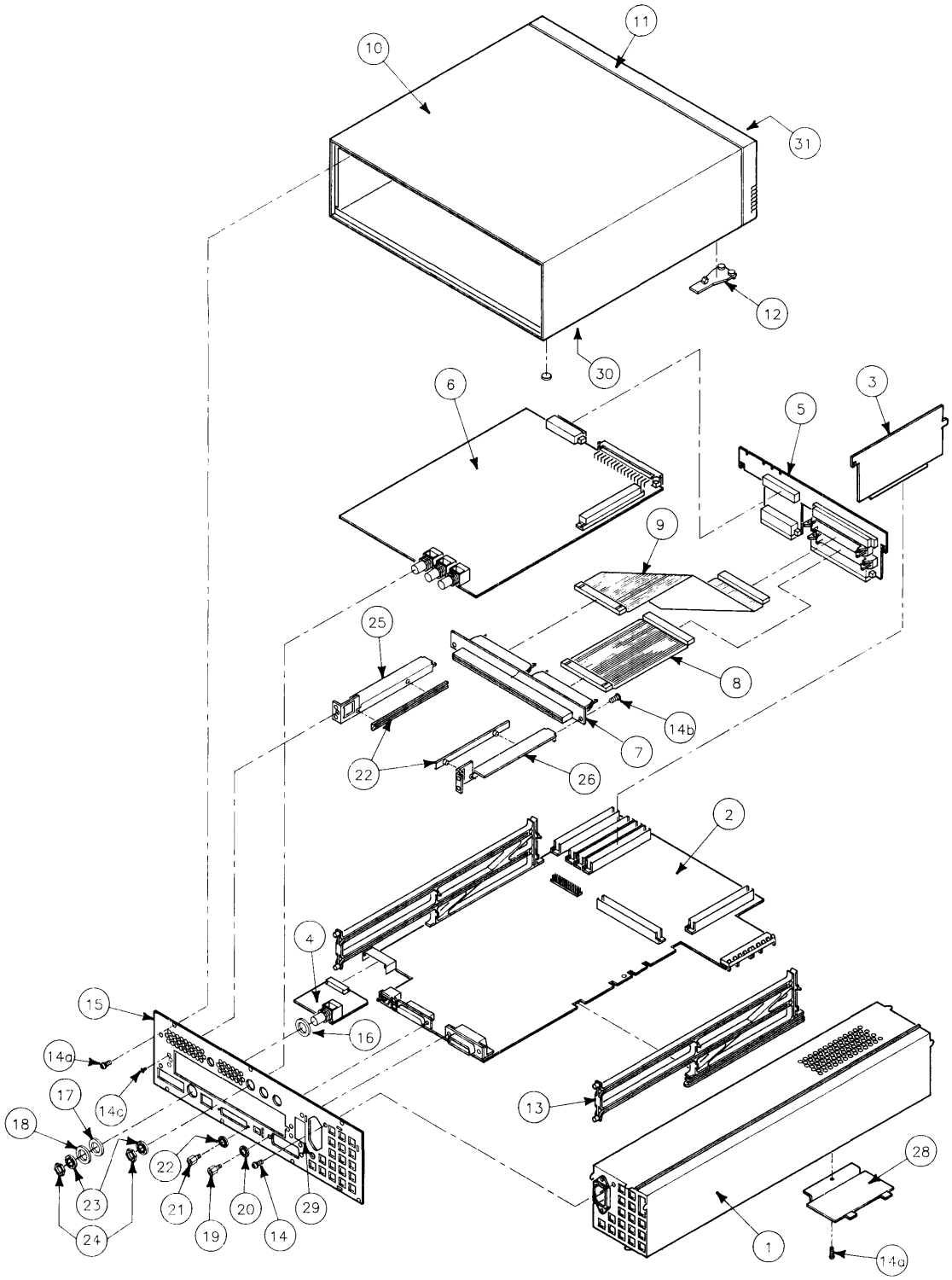


Figure 2-2. SPU Exploded Diagram

Procedures

Overview

In this section, procedures are listed for removing and installing each assembly. For each assembly, a list of Preliminary Requirements is provided indicating what should be done in what order before removing the assembly.

Instructions are based on the hardware orientation shown in Figure 2-3.

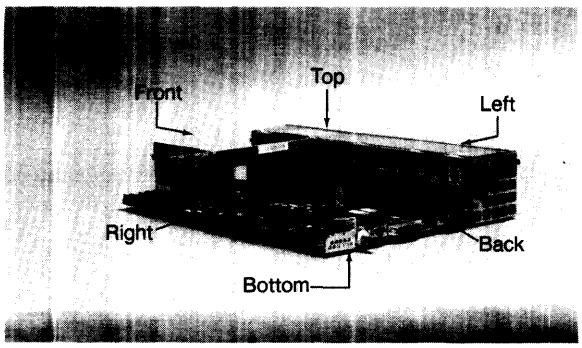


Figure 2-3. Hardware Orientation

DIO-I Accessory Cards

Preliminary Requirements

Turn OFF the SPU and remove these items:

1. Power cord.
2. Any interface cables connected to the DIO-I card.

Removal

1. Loosen the thumbscrews on each side of the DIO-I card's backpanel.
2. Slide the DIO-I card out of its slot.

Installation.

To install a DIO-I card, reverse steps 1 and 2 in the removal procedures, then reconnect the interface cables.

Note

RFI clips (5001-9039) must be installed on the DIO-I card backplate to ensure RFI is kept to minimum levels.

Case

The case needs to be removed to replace these printed circuit assemblies:

- RAM boards.
- Power supply.
- Fuse.
- Video/graphics boards
- DIO-I backplane and ribbon cables.
- SPU backplane.
- Processor board.
- LAN board.

Preliminary Requirements

Turn OFF the SPU and remove these items in the order listed:

1. Power cord.
2. Video and interface cables.

Removal

1. Remove the seven screws (Figure 2-4) holding the rear panel to the case.

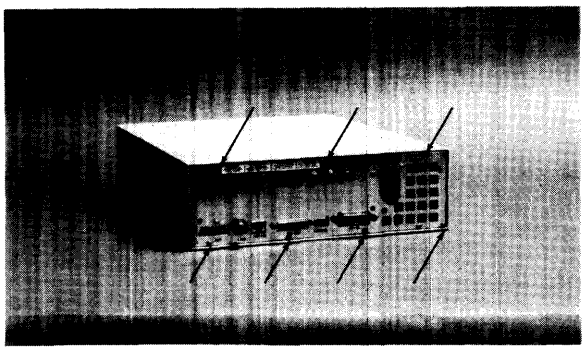


Figure 2-4. Rear Panel Case Screws

2. Set the SPU on its bottom.

CAUTION

After the case is removed, the ON/OFF switch shaft extending from the power supply can be easily broken. Do not set the internal assembly in a manner to put pressure on the switch shaft.

---

3. Slide the SPU's internal assembly out of the case.

Installation

To install the case:

1. Set the case on its bottom.
2. Ensure the RAM boards are fully seated in their connectors.
3. Start the internal assembly into the case.
4. Align the rails under the processor board with the rail guides in the bottom of the case.
5. Slide the internal assembly all the way into the case.
6. Install and fasten the seven rear panel screws.

Case or Front Panel Replacement

If the case or front panel is damaged, both parts must be replaced. The front panel cannot be removed from the case without damaging the metal fingers in the case. To replace either the case or front panel, these new parts are needed:

- Case.
- Front panel.
- Name label.
- Regulatory Label

Preliminary Requirements

Turn OFF the SPU and remove these items in the order listed:

1. Power cord.
2. Case.

Installing the Front Panel

1. Align the new front panel's attaching pins with their holes in the front of the case.
2. Press the front panel firmly and completely on to the case.
3. Remove the molded feet from the old case by unsnapping them from the bottom.
4. Install the molded feet into the new case.
5. Remove the new name label from its backing and press it into place in the upper left-hand recess on the front panel.
6. Remove the new regulatory label from its backing and press it into place on the bottom of the case over the voltage select switch hole like the old case.
7. Install the internal assembly in the case.

Fuse

Preliminary Requirements

Turn OFF the SPU and remove these items:

- Power cord.
- Internal assembly

Removal

1. Insert a flat-tipped screwdriver in the fuse holder and rotate it counter-clockwise and remove the fuse holder.
2. Remove the fuse from the fuse holder.

Installation.

To install a fuse, reverse steps 1 and 2 in the removal procedures.

Rear Panel

With the case slid off the internal assembly about two inches (5 cm), only the rear panel needs to be removed to replace the LAN boards.

For all other printed circuit assemblies, the internal assembly must be removed from the case.

Preliminary Requirements

Turn OFF the SPU and remove these items in the order listed:

1. Power cord.
2. Video and interface cables.
3. Any DIO-I card installed.

Removal

Refer to Figure 2-5 for rear panel fastener locations.

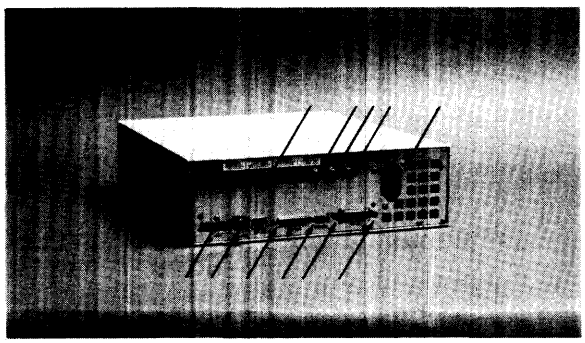


Figure 2-5. Rear Panel Fasteners

1. Remove the seven screws holding the rear panel to the case.
2. Remove the rear panel's interface port fasteners in the back panel as follows:
    a. Video connector lock nuts, using the 9/16-inch open-end wrench.
    b. HP-IB, using the 9/32-inch nutdriver.
    c. RS-232, using the 3/16-inch nutdriver.
    d. ThinLAN:
        - BNC connector nut, using the 9/16-inch open-end wrench.
        - Rear panel cover plate screw, using the Torx screwdriver.

    Note that the capacitor-washer next to the rear panel may be cracked. If so, it will need to be replaced during rear panel installation.
    e. AUI LAN: slide the connector clip to the right side (left, looking from the rear) to the unlocked position.
    f. LGB interface (if installed), use a #1 Pozidriv screwdriver.
3. If a DIO-I slot is installed, use a Torx T-10 screwdriver to remove the four screws holding the DIO-I card guide to the rear panel.
4. Remove the power supply grounding screw (Figure 2-5).
5. Pull the rear panel, power supply side first, away from the internal assembly.

Installation

To install the rear panel:

1. Place the rear panel in position on the internal assembly aligning the four power supply tabs and four SPU card cage alignment pins (two on each side) with their respective holes in the rear panel.
2. Reverse the first four removal steps.

Power Supply

Note

The power supply assembly does not have any internal replaceable assemblies except for the fuse. All parts, including the fan, line filter, fuse holder, printed circuit board and metal case are available only as a complete unit.

Preliminary Requirements

Turn OFF the SPU and remove these items in the order listed:

1. Power cord.
2. Video and interface cables.
3. Case.
4. Rear Panel.

Removal

1. Remove the power supply cover plate screw (Figure 2-6).

   This screw goes through the processor board extension and must be removed before the power supply can be removed from the processor board.

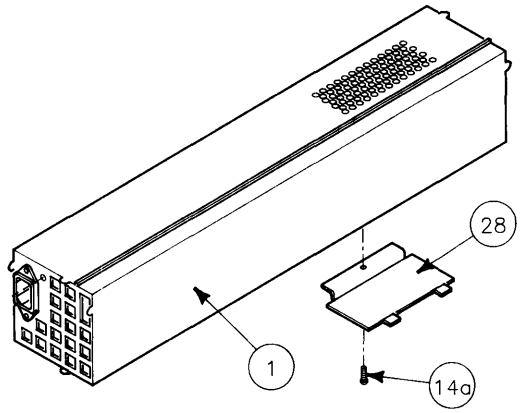


Figure 2-6. Power Supply Cover Plate

2. Raise the right edge of the cover plate and remove the cover plate from the power supply.
3. Lay the internal assembly on a flat surface.
4. Remove the power supply by sliding it to the left disconnecting the processor board's connector from the power supply.

CAUTION

Note the position of the voltage range select switch. The replacement power supply must have its voltage range switch in the same position.

Installation

To install a power supply, follow these procedures:

1. Verify the voltage select switch is in the correct position.
2. Set the power supply on its left side and position the processor board (or the rest of the internal assembly) as shown in Figure 2-7.

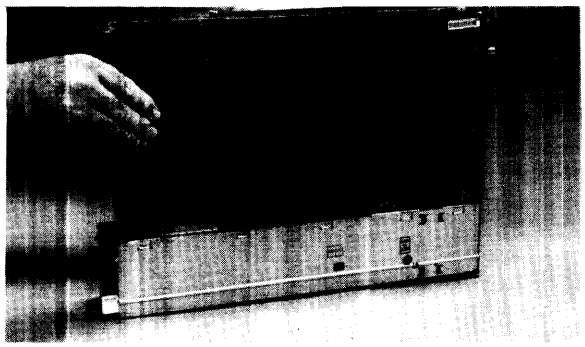


Figure 2-7. Positioning Power Supply and Internal Assembly for Installation

3. Look through the hole in the power supply and align the processor board's connector with the power supply connector.

   This permits proper alignment of the processor board's power supply connector to align correctly with the internal connector.

4. Install the power supply onto the processor board's power supply connector and ensure the alignment pins on the left-hand board guide fit into the holes on the power supply chassis.
5. Install the power supply cover plate and screw (Figure 2-6).
6. Replace the rear panel.
7. Replace the case.

Video/Graphics Boards

Preliminary Requirements

Turn OFF the SPU and remove these items in the order listed:

1. Power cord.
2. Video and interface cables.
3. Any DIO-I card installed.
4. Case.
5. Rear Panel

Removal

1. Hold the SPU backplane with one hand while pulling the video board out of its slot.
2. If a graphics accelerator board is attached, remove the screws holding the graphics board to the video board and remove it
3. Note the video board's configuration switch settings, if the video board has them.

Installing the Video Board Just Removed

1. If a graphics accelerator board was attached, replace it.
2. Install the video board in the top slot to where its connectors just touch the SPU backplane connectors.
3. Place one hand behind the SPU backplane for support and use your other hand to seat the video board in the SPU backplane connectors.

CAUTION

When a video board with two backplane connectors is installed, the smaller connector should not completely seat with the small backplane connector. A small gap may be visible between the video board and backplane small connectors. You should look down the backplane's top edge and verify it is straight after the video board is installed. If it's not, move the backplane connector just enough to make the backplane straight.

---

4. Replace in reverse order the items listed in the Preliminary Requirements.

Installing a New Video Board

Before installing a new video board, remove these parts from the new video board as follows:

1. Remove the lock nut(s) and washers from the new video board's BNC connector(s). A 9/16-inch or 5/8-inch open wrench may be used, depending on the nut size.
2. Remove the two screws holding the video board's backplate to the video board.

   These are usually #1 Pozidriv screws, except for the 98550-66573 video board which has a stand-off requiring a 5.5mm nutdriver to remove and install it.
3. Remove the backplate from the new video board.
4. If you're replacing a failed video board, remove the part number label from the failed board and install the backplate on the video board just removed. This is required so the failed video board will be complete when it's returned to the Board Exchange Program.
5. Verify the new video board's configuration switches are set the same as the old video board's switch settings.
6. If a graphics accelerator board was attached, connect it to the video board and screw it in place.
7. Install the video board in the top slot to where its connectors just touch the SPU backplane connectors.

CAUTION

When a video board with two backplane connectors is installed, the smaller connector should not completely seat with the small backplane connector. A small gap may be visible between the video board and backplane small connectors. You should look down the backplane's top edge and verify it is straight after the video board is installed. If it's not, move the backplane connector just enough to make the backplane straight.

8. Place one hand behind the SPU backplane for support and use the other hand to seat the video board completely in the SPU backplane connectors.
9. Install the new video board in the SPU's top slot.
10. Replace in reverse order the items listed in the Preliminary Requirements.

Installing a New Graphics Accelerator Board

Before installing a new graphics accelerator board, remove these parts from the new board as follows:

1. Remove the nylon key from the new graphics accelerator board.
2. Remove the stand-off from the graphics accelerator board with the 5.5mm nutdriver.
3. Install the graphics accellerator board on the 98550-66572 video board.
4. Find the four screws packaged with the new graphics accelerator board and use them to fasten the graphics accelerator board to the video board.
5. Install the video/graphics board in the top slot.

LGB Interface Board

Preliminary Requirements

Turn OFF the SPU and remove these items in the order listed:

1. Power cord.
2. All interface cables.
3. Any DIO-I card installed.
4. Case.
5. Rear Panel

Removal

To remove the LGB board, hold the SPU rear panel with one hand and pull the LGB interface board out of its slot.

Installing the LGB Board Just Removed

1. Reverse the three removal steps.
2. Replace in reverse order the items listed in the Preliminary Requirements.

Installing a New LGB Board

1. Remove the two #1 Pozidriv screws in the backplate next to the LGB interface port on the new board.
2. Remove the two #1 Pozidriv screws holding the back plate to the LGB board.
3. Remove the backplate and install it on the board you removed from the SPU.
4. Install the new LGB board in the top slot.
5. Replace in reverse order the items listed in the Preliminary Requirements.

RAM Boards

Preliminary Requirements

Turn OFF the SPU and remove these items in the order listed:

1. Power cord.
2. Video and interface cables.
3. Case.

Removal

On the processor board, each RAM board connector is hard-wired for a specific 4 Mbyte block of addresses. The left-hand connector (closest to the power supply) is RAM 1 and the right-hand connector (next to the edge of the processor board) is RAM 4. RAM board positions and the three most significant hexidecimal bits of the connector address is labled on the top of the SPU backplane.

Table 2-3 lists each RAM board connector's number, top address three MSBs, and the top and bottom addresses. Figure 2-8 will help identify them.

Table 2-3. RAM Board/Connector Numbers and Address Blocks

RAM Board Connector/Label	Top Address	Bottom Address
RAM 1/FFF	FFFFFFFF	FFC00000
RAM 2/FFB	FFBFFFFF	FF800000
RAM 3/FF7	FF7FFFFF	FF400000
RAM 4/FF3	FF3FFFFF	FF000000

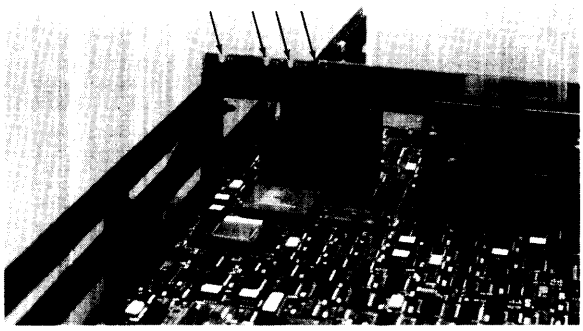


Figure 2-8. Processor Board RAM Connector Numbers and Addresses

To remove a RAM board:

1. Put your fingers on the processor board next to the RAM board, for support.
2. Pull the RAM board out from its connector.

Installation

Because the processor board's RAM connectors are wired for a specific address block and RAM is auto-configuring, the first RAM board installed must go in connector RAM 1, the second in connector RAM 2, and so on.

If connector RAM 1 is empty, or an empty connector exists between two RAM boards, all memory boards to the right of the empty connector will not be addressed.

To install a RAM board:

1. Place one hand under the processor board beneath the RAM board connectors as a support.
2. Place the RAM board over its connector and align the hooked tab with the notch in the SPU backplane.
2. Seat the RAM board in its connector.

DIO-I Slot

Preliminary Requirements

Turn OFF the SPU and remove these items in the order listed:

1. Power cord.
2. Video and interface cables.
3. Any DIO-I card installed.
4. Case.
5. Rear panel.
6. Video/graphics board.

Removal

1. Open the connector extractors and disconnect the two ribbon cables from the SPU backplane board.
2. Slide the DIO-I slot assembly out of the SPU's card guide.
3. If one or both of the DIO-I ribbon cables needs to be replaced, disconnect the ribbon cable(s) from the DIO-I backplane.
4. If the DIO-I backplane needs to be replaced, follow these procedures:
    a. Remove the screws holding the DIO-I backplane to the DIO-I card guides (Figure 2-9.)

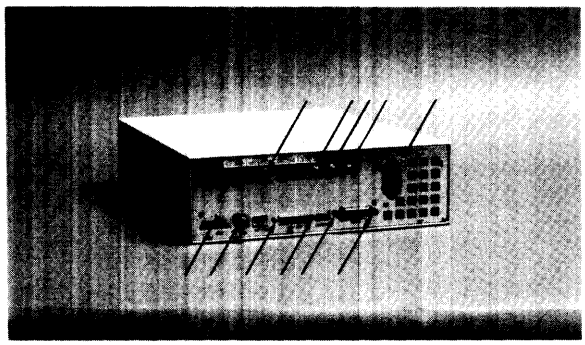


Figure 2-9. DIO-I Backplane Disassembly/Reassembly

    b. Remove the DIO-I backplane.
    c. To install the DIO-I backplane, reverse steps 4a and 4b above. Ensure the left and right DIO-I card guides are properly positioned (Figure 2-9).

Installation

To install the DIO-I slot, reverse steps 1 through 5.

SPU Backplane

Preliminary Requirements

Turn OFF the SPU and remove these items in the order listed:

1. Power cord.
2. Video and interface cables.
3. Case.
4. Video/graphics board.
5. DIO-I ribbon cables from SPU backplane.
6. RAM boards.

Removal

Remove the SPU backplane as follows:

1. Place your fingers on the processor board next to its backplane connector.
2. While holding down on the processor board, pull the SPU backplane out of its processor board connectors.

Installation

To install the SPU backplane:

1. Place one hand under the processor board beneath the SPU backplane connectors as a support.
2. Insert the the SPU backplane in its card guide slots with the connectors towards the rear of the SPU.
3. Connect the SPU backplane into the processor board's backplane connector.
4. Replace the assemblies listed in the Preliminary Requirements section in reverse order.

ThinLAN Board

Preliminary Requirements

Turn OFF the SPU and remove these items in the order listed:

1. Power cord.
2. Video and interface cables.
3. DIO-I card.
4. Rear panel.

Removal

1. Remove the nylon step washer from the ThinLAN BNC connector.
2. Slide the ThinLAN board out of its connector on the processor board.

   Do not remove the ThinLAN backplate as it is part of the ThinLAN board.

Installation

When the rear panel is removed, the capacitor-washer may be broken into several pieces. In this case it must be replaced with a new one during installation.

To install a ThinLAN board:

1. Install the ThinLAN board in its connector on the processor board.
2. Install the shoulder washer.
3. Install the rear panel.
4. If necessary, replace the capacitor-washer.
5. Install the flat washer and lock washer.
6. Install the nut on the BNC connector and lightly tighten it.

AUI LAN Board

Preliminary Requirements

Turn OFF the SPU and remove these items in the order listed:

1. Power cord.
2. Video and interface cables.
3. DIO-I card.
4. Rear panel.

Removal

Slide the AUI LAN board out of its connector on the processor board.

Installation

To install the AUI LAN board, reverse steps 1 and 2 above.

Processor Board

Preliminary Requirements

Turn OFF the SPU and remove these items in the order listed:

1. Power cord.
2. Video and interface cables.
3. Case.
4. DIO-I card.
5. RAM boards.
6. Power Supply
7. Rear panel.
8. DIO slot and ribbon cables.
9. Video/graphics board.
10. LAN board.
11. SPU backplane.

Removal

1. Slide the SPU card guides off from each side of the processor board.
2. All you have left is the processor board, so just set it down on a static-free surface.

Installation

To install the processor board:

1. Replace the SPU card guides on each side. Both card guides are the same and can be installed on either side of the processor board.
2. Replace the other assemblies in the reverse order listed in the Preliminary Requirements.

CAUTION

The capacitor-washer between the rear panel and the lockwasher on the ThinLAN BNC connector is extremely fragile and is easily broken. DO NOT tighten the ThinLAN port locknut too much.

Functional Description 3

Hardware Overview

Figure 3-1 is a block diagram of the SPU.

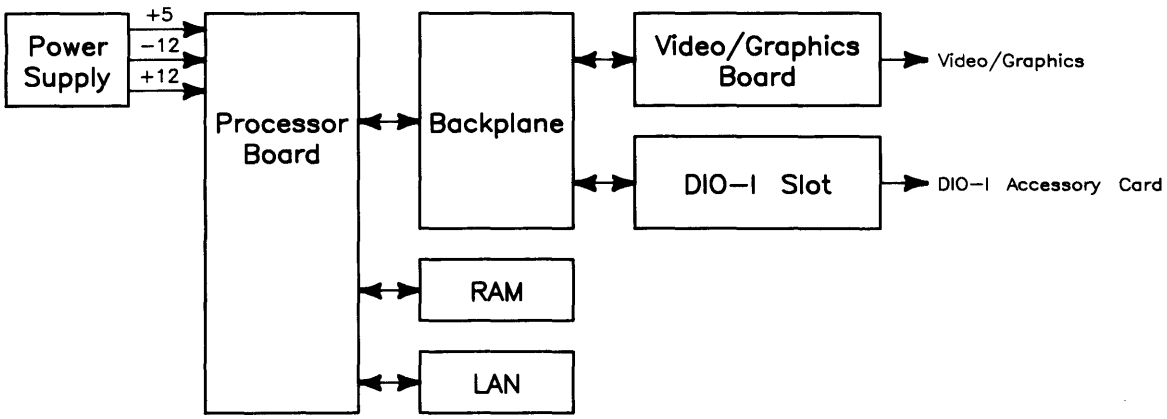


Figure 3-1. SPU Block Diagram

Processor Board

In the Model 340's SPU a processor board much like the Model 360's is used. It's major differences are that several interface circuits are used. A RAM controller circuit is used to manage up to four RAM array boards that connect into the processor board.

A 32-bit I/O bus interfaces this board with the add-on memory, video/graphics, and on-board interfaces. Two Boot ROMs and self-test LEDs comprise the fundamental hardware to self-test the SPU hardware and boot the operating system. DIO-I accessory cards are interfaced with a 16-bit bus.

Memory

Up to 16 Mbytes of parity RAM is supported. Each RAM board has 4 Mbytes and are autoconfiguring. Additional memory is available as an HP 98268A 4 Mbyte RAM Board Upgrade.

Video/Graphics

High-resolution color or monochrome video is processed by the video boards. Enhanced graphics are provided by a graphics accelerator board in the Model 340CH Option 556 and the Model 340SRX uses a local graphics bus interface. Several configurations are provided depending on the application and monitor used in each bundled workstation. Table 3-1 lists the video/graphics boards supported and their characteristics.

Table 3-1. Video/Graphics Boards

Part Number	Video Type	Resolution	Workstation	Typical Monitor
98544-66571	HR Monochrome	1024 by 768	Model 340M	HP 98786A 17-inch
98548-66570	HR Monochrome	1280 by 1024	Model 340MH	HP 98788A 19-inch
98549-66571	HR Color	1024 by 768	Model 340C+	HP 98785A 16-inch
98550-66572	HR Color	1280 by 1024	Model 340CH	HP 98789A 16-inch
98550-66572	HR Color	1280 by 1024	Model 340CH	HP 98789A 16-inch
98556-66570	2D Color Graphics		Opt. 556	
98720-66582	Local Graphics Bus		Model 340SRX	HP 98720A Display Controller HP 98789A 16-inch

Functional descriptions of these video/graphics boards are covered in their respective Familiarization Guides.

System Interfaces

Many interfaces, including HP-HIL, standard HP-IB, and RS-232, are on the processor board. Either an AUI LAN or a ThinLAN interface board attaches to the processor board. Optional DIO-I card SCSI and high-speed HP-IB interface are also available. Several DIO-I interface cards are also supported.

Power Supply

A sealed assembly, the power supply has no replaceable parts except for the fuse. When any part of the power supply fails (except for the fuse), replace the complete supply. Exchange power supplies are not available.

The unit contains the AC line input, RFI filters, on/off switch, fan, power rectifier circuit and dc output connector in a inclosed can.

Electrical dc output consist of three outputs with a common return and one output (9 V dc) which has it's own return. The outputs are

- 5.1 V dc @ 15 A.
- +12 V dc @ 2.3 A.
- −12 V dc @ 250 MA.
- 9 V dc @ 250 mA.

The 0.1 volts over the 5 V is for the electrical potential drop of the connector system. The +12, -12, and 9 V dc outputs are three terminal linear regulators and therefore have over current and thermal protection. 5.1 Vdc output is power limited by primary current limit. The 5.1 Vc dc also has a shut down comparator at about 6 volts. The -12 V dc output is reverse bias protected. The 9 v dc is a floating output for the local area network.

AC line current inrush is limited by negative temperature coefficient resistors and therefore do not limit the inrush of current if hot. The power supply also has a line select switch. The power supply will be damaged if this switch is set to 115 and ac line potential of 230 V ac is applied. Start up circuit is a line frequency transformer and therefore will not start on a dc line input. Start up time is a function of the line potential and at low line (100 V ac) is about 1 second.

The self enclosed fan is powered by the +12 V dc output and will not run if there is a +12 V dc short on the output. A thermal shut-down switch is attached to the +12 V dc/+5.1 V dc heat sink. This will provide protection from cooling failure such as blocked air vents, fan failure, or a short on the +12 V dc output.

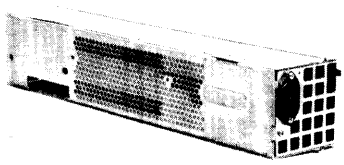


Figure 3-2. Power Supply

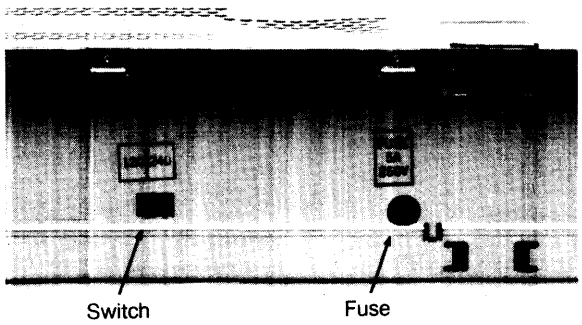


Figure 3-3. Power Supply Voltage Select Switch and Fuse

Test points on the processor board provide a means to check voltages. At the front edge of the processor board, four pads are labled for ground, +12 V dc, −12 V dc, and +5 V dc.

If the fuse blows, the power supply is probably bad and should be replaced.

Processor Board

Overview

A variety of CPU, memory, and interface circuits reside on the processor board. Circuits include:

- MC68030 CPU at 16.67 MHz.
- MC68882 Floating-Point Coprocessor.
- RAM controller.
- HP-IB (IEEE-488) Interface with two-channel DMA controller.
- RS-232C Serial Interface with DB25 connector.
- HP-HIL Interface.

Central Processing Unit

A Motorola MC68030 CPU is used. Its synchronous data bus is 32-bits wide for both addresses and data registers. The MC68030 CPU can address 4 Gbytes of RAM. Operating at 16.67 MHz, it is significantly faster than many workstation CPUs.

The CPU has 57 instruction types and handles 7 major data types. It also has 18 addressing modes, 6 maskable and 1 non-maskable interrupt levels. Six stack frames exist in the MC68030.

At power-up, the CPU executes instructions from the Boot ROMs to determine the presence of video circuits. Data in the video board's ID/FONT ROM is placed in a display controller register to set the display clock frequency.

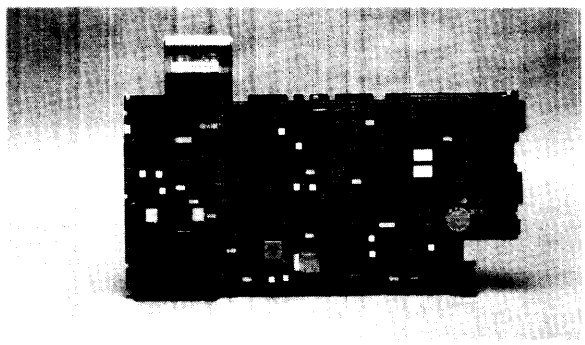


Figure 3-4. Processor Board

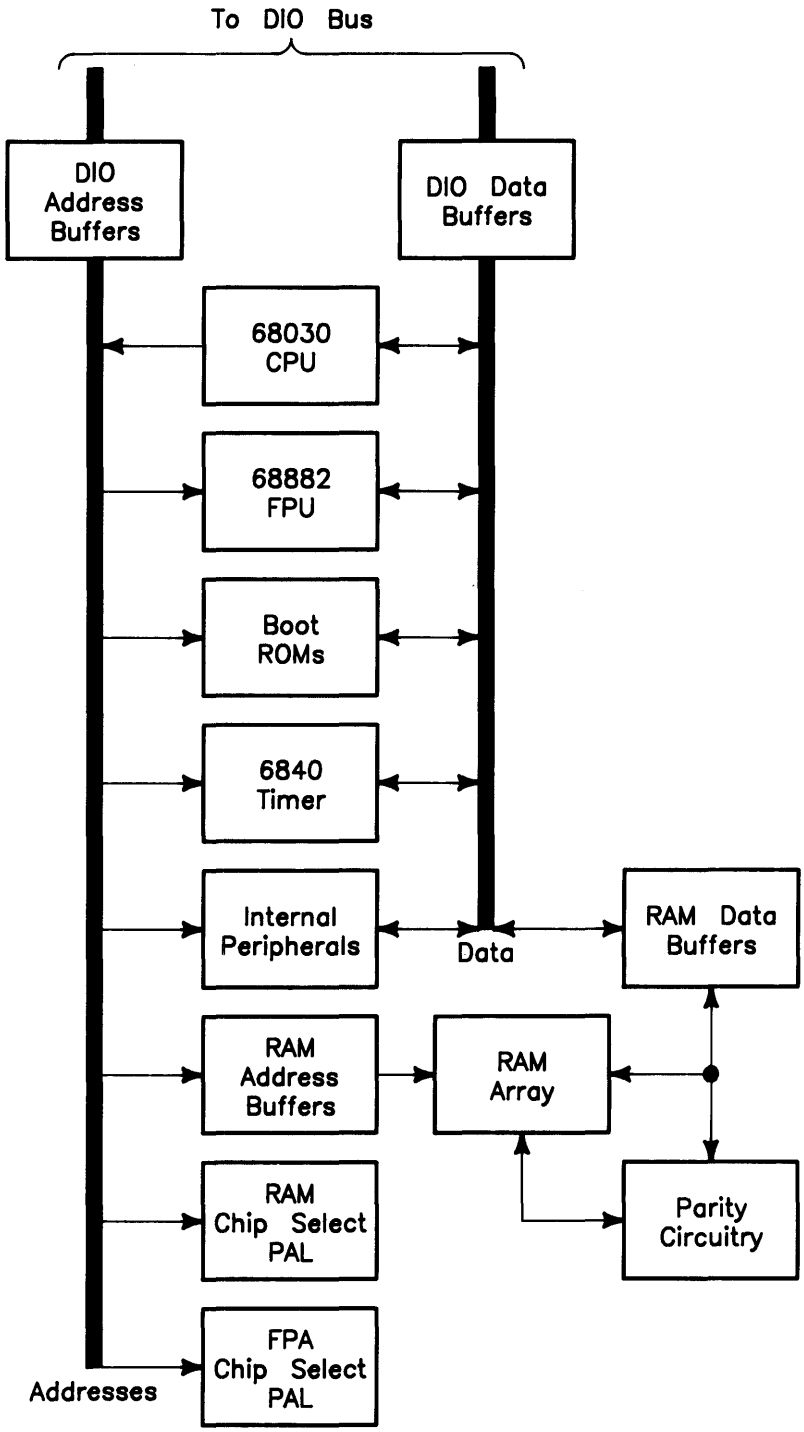


Figure 3-5. Processor Board Block Diagram

Co-Processor

An MC68882 floating-point co-processor is used to increase system performance when certain floating-point math routines are part of the application. It implements the required IEEE standard capabilities.

Floating-point instructions become part of the language of the CPU in its operation.

Boot ROMs and Self-Test LEDs

Two Boot ROMs whose instructions are executed by the CPU shortly after power up are used on this processor board.

Eight Self-Test LEDs are visible through a vertical slot in the rear panel. Different patterns of on and off (1s and 0s) correspond to binary or hexadecimal error codes. These codes help you find out what's working and what is not.

Chapter 4 provides an in-depth explanation of the Boot ROM functions. Chapter 5 explains the error codes and other troubleshooting processes.

I/O Bus

A 32-bit asynchronous DIO-II bus is used between the processor board and most video/graphics boards and the processor based interfaces. When the processor is not performing I/O cycles, it does not need the DIO-II bus at all.

Several different subsystems reside on the bus and interact with each other by using various bus signal lines. Interface select codes, addresses, and data are transmitted via this bus. Memory read/write cycles between the CPU and memory boards occur on the DIO-II bus.

Two connectors on the processor board transfers this bus to the SPU backplane. All video and graphics boards connect to this bus. When the DIO-I slot is installed, two SPU backplane connectors attaches to the DIO-I backplane through two ribbon cables.

No provisions exist to expand this bus outside the SPU to bus expanders.

Direct Memory Addressing

DMA chip architecture is a compatible superset of the Series 300 HP 98620B DMA Controller Card which is used with other Series 300 computers. The chip is a Standard-Cell design implemented in a CMOS process.

Processor Board Interfaces

Overview

The processor board's interfaces meets most, if not all, I/O needs of the Design Automation marketplace. These interfaces include:

- RS-232.
- HP-IB.
- HP-HIL.

To maintain software compatibility, the designs of several existing interface accessories used in other Series 300 computers were integrated together. Interface products emulated on the processor board are the same as the 98561-66532 Human Interface Card.

Each of these sections of the processor board operates independently from one another. Software compatibility is assured.

RS-232 Interface

An RS-232 Interface section is part of the processor board's electronics. Using an INS8250 UART, it's almost identical to the HP 98644A RS-232 Serial Interface Card. It differs from the HP 98644A Interface Card in that it:

- Allows interrupts at level 5 only. There are no switches to change the interrupt level is the same as the HP 98644 Card.
- Permanently sets the select code to 9.
- Does not allow reconfiguration to change the RS-232's ID to that of the HP 98626 card.

Two switches on the processor board are associated with RS-232. Accessible through the configuration switch port in the rear panel, they perform the following functions:

- **REM** – Controls the local/remote bit in the ID register.
- **MEN** – Sets the handshake input lines to their default condition, all ones.

In addition to the registers built into the INS8250 UART, two external register have also been implemented. Both sets of registers are multi-mapped within a 64 Kbyte region of memory associated with I/O select code 9.

HP-IB Interface

Hewlett-Packard Interface Bus (HP-IB) is HP's version of the IEEE 488 interface standard and is much like HP-IB implementations on other HP 9000 Series 200/300 computers. It uses a TMS9914 HP-IB controller which allows data transfer rates up to 450 Kbytes/second. The TMS9914 is a memory-mapped I/O device which is multiple-mapped within a 64 Kbyte block of memory.

Two registers control hardware which can generate an interrupt as a result of a HP-IB device responding to a parallel poll. It has the ability to generate an interrupt from a parallel poll response. For this feature, two registers external to the TMS9914 are used. These registers are in addition to the two external registers that exist for internal HP-IB interfaces in other Series 200 computers.

All registers associated with the HP-IB are multiple mapped within a 64 Kbyte block of memory in the internal I/O address range.

One configuration switch for HP-IB system controller is on the processor board. Accessible through the rear panel, the SC switch is set to 1 if the SPU is the system controller or 0 if not.

Configuration Switches

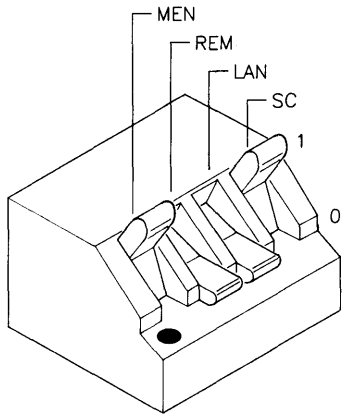
On the rear panel, a port through which a pointed object may be used to set the configuration switches.

Four DIP switches configure the processor board interfaces for:

- RS-232 Modem ENable.
- RS-232 REMemote enable.
- HP-IB system controller.
- LAN local/remote

Table 3-2 has a picture and explains the use of these switches.

Table 3-2. Interface Configuration Switches



Switch Label	Function/How It's Used
MEN	RS-232 Modem Enable 1 = Modem lines enabled (Shipped setting) 0 = Modem lines disabled
REM	RS-232 Remote Terminal Enable 1 = Remote Mode 0 = Local Mode (Shipped setting)
LAN	LAN Local/Remote 1 = Remote Mode (not currently used) 0 = Local Mode (Shipped setting)
SC	Internal HP-IB System Controller 1 = System Controller (Shipped setting) 0 = Not System Controller

HP-HIL Interface/Devices

Overview

Hewlett-Packard Human Interface Link (HP-HIL) is an HP standard for interfacing certain HP computers and SPUs to human input devices. Asynchronous serial communications protocol enables you to select a set of input devices, connect them to your SPU, and work with any application program.

A link controller on the processor board controls the HP-HIL. Each HP-HIL device has an circuit to interface information to and from the device. Limitations for the HP-HIL are:

- Up to seven devices can be on the link.
- Maximum distance between devices is 2.4 metres, total link maximum length is 16.8 metres. This does not include the 15 or 30 metre extensions.
- Series 300 Maximum link current is 1 A.

Link Controller

A block diagram of a typical link controller is shown in Figure 3-6.

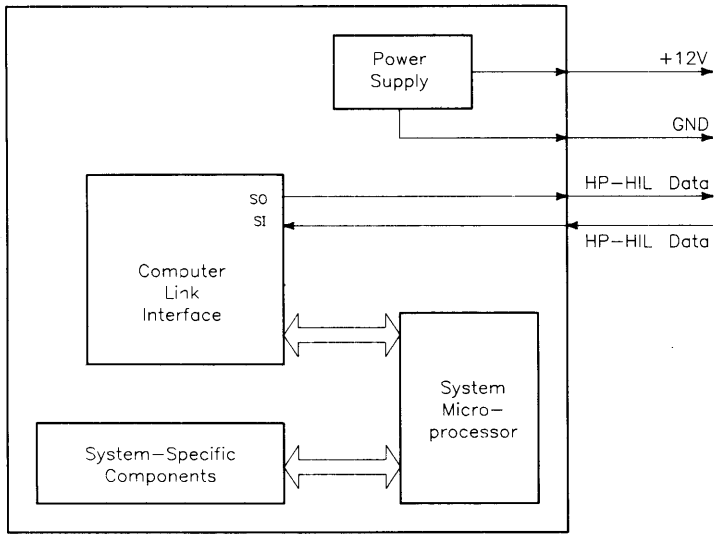


Figure 3-6. HP-HIL Link Controller Block Diagram

Power Supply. One voltage, +12 Vdc is taken from the SPU and output as a regulated power supply to external devices on the link. Up to 1 A can be supplied to devices. When configuring HP-HIL devices with Series 300 computers, care must be used to ensure the total power drawn by all devices does not exceed 1 A. In Table 3-3, devices are listed with their power requirements.

Table 3-3. HP-HIL Devices and Power Requirements

Product Number	Device Name	Milliamps	Watts
HP 35723A	Touchscreen Bezel	250	3.0
HP 46021A	ITF Keyboard	100	1.2
HP 46060A	HP Mouse	200	2.4
HP 46080A	Extension Module	25	0.3
HP 46081A	3 Metre Ext.	25	0.3
HP 46082A/B	15/30 Metre Extension[1]	50	0.6
HP 46083A	Rotary Control Knob	110	1.32
HP 46084A	ID Module	60	0.72
HP 46085A	Control Dials	350	4.2
HP 46086A	Button Box	80	0.96
HP 46087A/B[2]	"A"-Size Digitizer[2]	200	2.4
HP 46088A/B[2]	"B"-Size Digitizer[2]	200	2.4
HP 46089A	4-Button Cursor		
HP 46094A	Quadrature Port Device[3]	80	1.2
HP 46095A	Three-Button Mouse	80	0.96
HP 92916A	Barcode Reader	100	1.2

Notes: [1] Extensions have two boxes, each draws 25 mA.
[2] Includes HP 46089A 4-Button Cursor.
[3] Port devices require 80 mA; devices attached cannot exceed 120 mA.

Computer-Link Interface. DIO bus architecture is interfaced to the HP-HIL microprocessor in these circuits. They allow device input data to be used by the SPU.

Microprocessor. The HP-HIL microprocessor on the processor board provides support for link protocol and is responsible for:

- Configuring the link.
- Processing input device data.
- Error recovery.
- Initiating commands onto the link through the Link Interface.

Link Interface. Data is exchanged between the device and the SPU through the link interface. It accepts commands from the microprocessor for transmitting and receiving messages in an HP-HIL frame format.

Each frame is a 150 μsec long, 15-bit fixed format. A frame is shown in Figure 3-7.

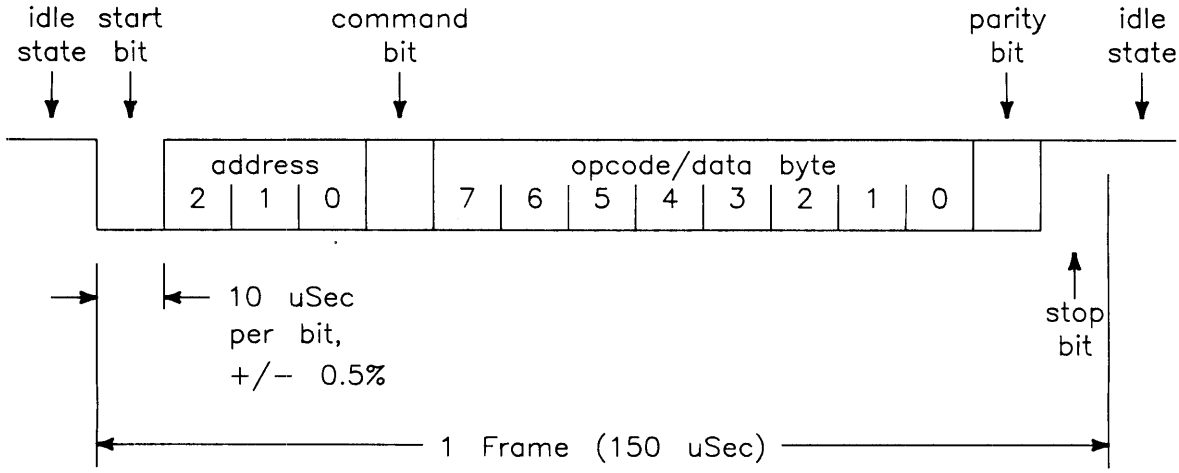


Figure 3-7. HP-HIL Frame Structure

Frames may be sent as fast as once each 154 μsec allowing data transfer rates of up to 6500 bytes/second. HP-HIL protocol performs automatic configuration, identification, and polling of up to seven devices. Error recovery, device and system reset, and simple output commands provide a simple device integration.

When the SPU is turned on, the link is polled for devices. Each device on the link has its own ID which is sent to the SPU and stored in memory. The link is polled 60 times per second. Should a device have data to input to the SPU, it sends its data frame to the SPU for processing. As each device's frames has its own address in a 3-bit word, no more than 7 devices can be used on the link at one time.

HP-HIL Cables

A four-wire cable connects HP-HIL devices to each other and to the SPU.

LAN Interface Boards

One of two LAN interface boards may be used in the SPU:

- ThinLAN with built-in MAU, 98571-66530, ordered as Option 017 to the workstation. It's also available as an HP 98237A ThinLAN Upgrade to convert an SPU that has the AUI LAN installed.
- AUI LAN, needs external MAU, 98571-66534, ordered as Option 015 to the workstation. It's also available as an HP 98235A AUI LAN Upgrade to convert an SPU that has the ThinLAN installed.

Local Area Network (LAN) functions are divided into three areas:

- Interface to the DIO bus.
- Shared memory area.
- Frontplane interface to the network.

Interface with the DIO bus includes select code decoding, interrupt control, data bus buffers and latches, and address multiplexers. A 32-bit wide data bus is used.

Configuration for LAN select code and interrupt levels are fixed by hardware as follows:

- Select Code at 21.
- Interrupt level at 5.

ThinLAN Board

Figure 3-8 is a picture of the ThinLAN interface board.

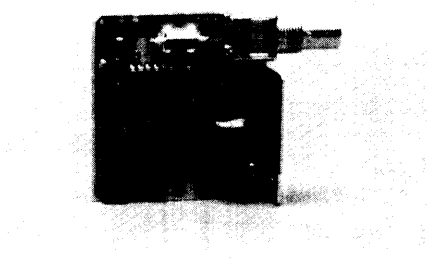


Figure 3-8. ThinLAN Interface Board (98571-66530)

The shared memory area has the memory controller circuits, 16 Kbytes of RAM, 64 nybbles of nonvolatile storage of the node address, and standard DIO control, status, and ID registers. Multiplexing of DIO information and the LAN chip set is also part of the controller circuit.

Frontplane circuits include the LAN chip set, timer, and the transceiver chip. The LAN chip set serves the dual function of a DMA controller and an Ethernet/EEEE 802.3 controller. Encoded data from the SIA is transmitted by the transceiver chip. Data from the network is sent by the transceiver chip to the SIA.

The LAN circuits are software cmpatible with the HP 98643A LAN/300 Link Card.

AUI LAN Board

Figure 3-9 is a picture of the AUI LAN interface board.

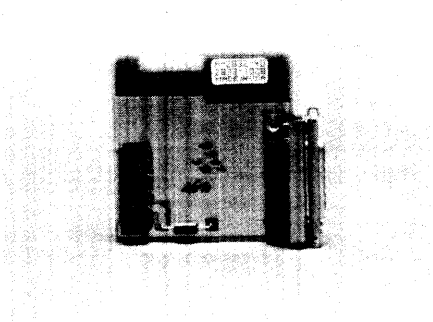


Figure 3-9. AUI LAN Interface Board (98571-66534)

When Option 015 is ordered, the factory installs the 98571-66534 board with an AUI LAN connector for hook-up to an external media attachment unit (MAU).

Circuits are the same as the ThinLAN board except for the MAU functions, which do not exist.

Memory

Introduction

Parity-checking RAM is used in the Model 340 Workstation's SPU. Either one, two, or four HP 98268A RAM boards may be installed in the four RAM board connectors on the processor board. The RAM boards are arrays of 4Mbytes each.

A RAM controller is located on the processor board. All RAM is auto-configuring; there are no configuration switches to set.

Note that other Series 300 computer RAM boards are not supported in Model 340 Workstation SPUs.

A picture of a RAM board is shown in Figure 3-10.

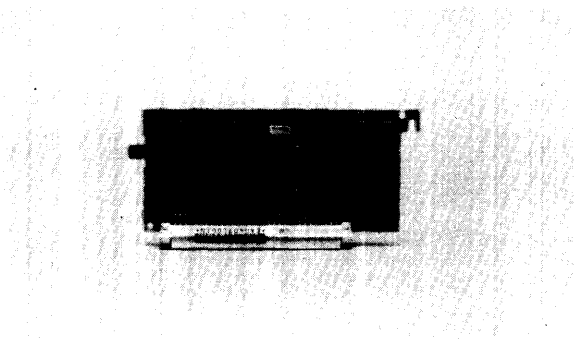


Figure 3-10. HP 98268A RAM Board

RAM Architecture

RAM consists of two logical units—one which stores the data in a RAM array and one which controls accesses to the RAM array and interfaces it to the SPU. Physically, the RAM array circuitry is located on a printed circuit board, called the RAM Array board, and the control and interface circuitry is located on the processor board.

The feature of these RAM boards which distinguishes them from ordinary RAM boards is the ability to detect and correct or report errors. This function is accomplished by the Check Bit Generator/Checker.

The RAM boards store data as a 32-bit word with an additional four bits to store parity information. Each byte has its own parity bit.

The Generator section of the Check Bit Generator/Checker produces the appropriate four bits for each 32-bit data word. These bits are stored in the RAM array with the data word. When the data word is read, the Generator/Checker reproduces the check bits and compares them to the check bits read from the storage location. If they differ, the Generator/Checker asserts interrupt level 7 if any error occurs.

During a write-to-memory operation, the SPU sends a data word to the RAM board along with the address of a storage location for the data word. During a read-from-memory operation, the SPU sends the storage location address only, and receives back the data word stored at that location.

The data word sent to the RAM board is temporarily stored in the Data_In Latch. The data is also sent to the Check Bit Generator/Checker, which generates the appropriate check bits and stores them temporarily in the Check_Bit_In Latch.

The RAM boards use dynamic RAM ICs which must be refreshed. This function is accomplished by the Refresh Controller, which generates refresh requests to the RAM Cycle Controller at the current refresh request rate.

A RAM Cycle Controller, in combination with the Refresh Controller, is the source of RAM Row Address Strobe (RAS), Column Address Strobe (CAS) and Write Enable (WE) signals. These signals are sent on to the Row and Column Multiplexor.

The Row and Column Multiplexor logically ands the address from the Arbitration Controller with RAS and CAS. When the correct storage location is selected, the WE strobe pulse causes the data word and check bits to be transferred from the In Latches to permanent storage in the RAM Array.

Each RAM board has thirty-six 1 Mbit by 1 bit dynamic RAMs (DRAM). The excess above 32 DRAMs is required in order to accommodate the data integrity scheme (the Check Bit Generator/Checker is described above).

When the SPU desires information to be read from the RAM Array, it sends the address of the appropriate storage location to the RAM board. This address follows the same path as for writes. When the correct storage location has been selected by the Row and Column Multiplexor, a strobe pulse causes the contents to be transferred to the Data_Out Register and the Check_Bits_Out Register. The Check Bits are sent to the Check Bit Generator/Checker and processed as described above. The data word is sent back to the SPU along the same path as for incoming data.

RAM Configuration

All RAM is completely auto-configuring. But it's important to know which one of up to four RAM boards uses what address block. If a memory error is displayed during self-test, the failing address can be related to a specific RAM board.

A memory bus from the processor board's RAM controller circuits goes to each RAM board connector. Unlike other Series 300 computers, these connectors are not wired in parallel on the memory bus. Each RAM board connector is uniquely wired to the RAM addressing circuits for a specific block of RAM.

RAM blocks are 4Mbytes each. The CPU addresses memory from the top down with the top hexadecimal address being FFFFFFFF. Address FFFFFFFF is the first, or top address of the connector labeled RAM 1 closest to the power supply. The first RAM board installed must go in connector RAM 1, the second in connector RAM 2, and so on.

If an empty connector exists between installed RAM boards, all RAM boards beyond that empty connector will not be recognized.

Table 3-4 lists each RAM board/slot's address range. Figure 3-11 will help identify them.

Table 3-4. RAM Board/Slot Number and Address Block

RAM Board Connector/Label	Top Address	Bottom Address
RAM 1/FFF	FFFFFFFF	FFC00000
RAM 2/FFB	FFBFFFFF	FF800000
RAM 3/FF7	FF7FFFFF	FF400000
RAM 4/FF3	FF3FFFFF	FF000000

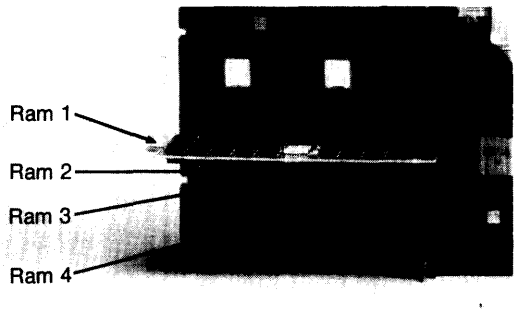


Figure 3-11. Processor Board RAM Connectors

Video/Graphics Boards

Video and graphics boards used in the Model 340 Workstation's SPUs are the same ones used in other Series 300 Computers. For service information, refer to the service documents listed in Table 3-5.

Table 3-5. Video/Graphics Boards Service Information

Workstation Model	Part Number	Title
340SRX	98720-90030	HP 98720A Graphics Display Station Hardware Support Document
340CH	98550-90000	HP 98550A Graphics Interface Familiarization Guide
	98556-90000	HP 98556A 2D Graphics Interface Familiarization Guide
340C+	98549-90000	HP 98549A Graphics Interface Familiarization Guide
340MH	98548-90000	HP 98548A Familiarization Guide
340M	98562-90030	Model 330/350 Service Information Manual

Small Computer Systems Interface

SCSI Overview

The DIO-I size HP 98658A SCSI Interface Card is available as Option 011. It's an interface providing a protocol that is a standard for a bus which enjoys a growing acceptance with all types of workstations. Its main advantages lie in its accaptance as a standard, speed and low hardware cost. It is defined by ANSI standard X3T9.2. Only HP 9000 Series 300 HP-UX Rev. 6.0 and later may be used with SCSI.

SCSI circuits are mounted on a DIO-I accessory card and is installed in the optional DIO-I slot. Interfacing is done with a 0.5 metre, shielded cable. Other devices are connected in daisy-chain fashion via shielded SCSI cables which are available from HP in various lengths. An SCSI terminator is required on the SCSI peripheral to allow proper operation. Figure 3-12 shows a typical system using the SCSI bus.

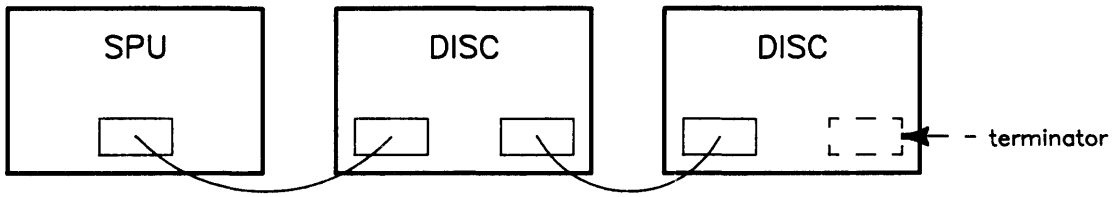


Figure 3-12. A Typical SCSI System

SCSI communicates with peripheral devices across the bus by means of a set of protocols called HP Common, which is Hewlett-Packard's version of the Common Command Set. These protocols are implemented in HP-UX revision 6.0 and all later revisions.

The use of disconnect/reselect by the peripherals is strongly encouraged for conventional hard disks. It is required in the case of lower performance peripherals, for reasons of efficient bus utilization.

Feature Set

Major features of the HP 98658A SCSI Interface Card are:

- Data transfer rates of up to 1.5 times that of high-speed HP-IB.
- Industry standard hardware and software.
- Access to broad range of peripheral features not offered by HP.
- Many compatible product offerings planned by HP.
- Configuration switches set select code, interrupt level and parity.

Unsupported SCSI Attributes

Differential Drive. Both single-ended and differential drive are part of the SCSI standard. However, the Model 340 SPU's SCSI option supports single-ended drive only.

Slow Devices. There is no intention of providing multiple SCSI busses in order to accomodate peripherals that utilize the bus inefficiently. The word "inefficient" can be quantified by defining these three classes of peripherals:

Class	Description
2	Bursts data in asynchronous or synchronous modes at a minimum of 1.5 megabytes per second. Disconnects from bus if needed such that no dead time in excess of 5 milliseconds is created on the bus. Maintains an average data rate in excess of 1 Mbyte per second after data transfer starts. Does not hold the bus longer than 100 milliseconds in normal operation.
1	Bursts data in asynchronous mode at a minimum rate of 1 Mbyte per second. Disconnects from bus if needed such that no dead time in excess of 40 milliseconds is created on the bus. Maintains an average data rate in excess of 400 Kbytes per second after data transfer starts. Does not hold the bus longer than 200 milliseconds during normal operation.
0	Any peripheral not meeting Class 1 specifications.

'Normal operation' is defined as a 16 Kbyte read or write for a random-access mass storage peripheral. For a physically streaming device, it is operation in streaming mode. For devices such a printers and optical scanners, it is continuous operation at full mechanical speed for the device.

Class 2 peripherals are preferred. Class 1 are acceptable, if a significant price advantage exists for a particular device. Class 0 devices are not supported by the SCSI card.

SCSI versus HP-IB

SCSI hardware in combination with HP Common is analogous to HP-IB hardware and CS80. The SCSI standard provides data transfer rates of up to four times that of HP-IB. Here are some other differences:

Interfacing to Peripherals. SCSI is limited to eight devices. With the SCSI card implementation, that means one mainframe and up to seven peripherals. By comparison, HP-IB is limited to 31 devices.

Termination. The SCSI bus must be terminated at both ends. HP-IB does not require termination.

Chaining. SCSI devices must be connected in daisy-chain fashion. HP-IB devices may be connected in any configuration, that is, chaining, starring or any combination.

Specific Connectors. Connection to the SCSI bus is by a 50 pin micro-ribbon cable with shielded connector. The HP-IB connector is a 24-pin D-style connector configured in two rows of 12 pins.

Configuration

SCSI Node Address. Each device on a SCSI bus must have a unique address from zero to seven, called the node address. The SCSI card is fixed at Node Address 0.

SCSI Bus Termination. The SCSI bus must be terminated at both ends. The SCSI circuit furnishes termination for the SPU end of the bus. Peripheral devices must have either no termination or optional termination, except that one peripheral device may be permanently terminated, provided that it goes on the end of the bus. Termination for devices with no termination is provided by the terminator included in the product. It is installed in the empty cable connector on the end device.

Parity. The SCSI card's parity configuration switch selects odd parity when set to OPEN. Data received with incorrect parity is logged as an error.

Select Code. Five configuration switches set the select code from 0 to 31.

Interrupt Level. Two configuration switches set the interrupt level from 3 through 6.

Adding or Removing a Device. You may want to remove a device or substitute one for another as part of the troubleshooting process (such as to confirm that a particular device is defective), but don't want to shut the HP-UX system down to do it. Here is how to add or remove a device without shutting down and turning off the system each time:

To remove a device:

1. Use the `unmount` command to unmount the device from the HP-UX operating system.
2. Turn off power to the device.
3. Disconnect the device from the SCSI bus.

If you are not going to add a device in the place of the one which you just removed, be sure to reconnect the bus. If the removed device was on the end, make sure that you move the termination to the previous device on the bus.

To add a device:

1. Connect the device to the SCSI bus.
2. Turn on power to the device.
3. Use the `mount` command to mount the device.

Cabling

Cable Options. There are three cable options in the SCSI protocol. The standard is an unshielded ribbon cable with 50 conductors.

- Alternative 1 is similar to the standard cable except that it is shielded.
- Alternative 2 is a shielded round cable with 25 pairs of twisted wire. Pin 1 is twisted with pin 26, and so forth.

Note that the ribbon cables are intended to connect devices which are mounted in the same enclosure. The Alternative I cable was chosen for the SCSI card because there is little chance that it will connect to a device in the same enclosure as the SPU. The shielded ribbon cable is entirely suitable for connecting devices which are located in one enclosure.

Connecting Cables. The SCSI option comes equipped with a 0.5-metre, Alternative II shielded (round) cable, for connecting the SPU to one peripheral device. Cables for connecting additional devices are available in various lengths from Direct Marketing Division (DMK).

Some cables manufactured under the name "Apple®" fit the mechanical specifications, but will not function properly with the SCSI card.

The alternative 2 cables for use with the SCSI card are identical to those used on differential SCSI busses.

Third-Party Issues

The SCSI option has a potential problem unlike most products, in that it is expected to be used in conjunction with non-HP equipment. Here are some of the possible pitfalls to be aware of:

- **Drivers:** Any peripheral device must have a driver in HP-UX. The one furnished in the software is intended for use with HP devices, and probably will not work with non-HP devices. Users of non-HP devices are expected to furnish their own driver. Normally, this will be written by the OEM or other volume supplier. However, there may be cases in which the user is not furnished with a suitable driver. Writing of this driver is still the user's responsibility, and not HP's.
- **Service:** Occasionally, a combination HP and third-party systems will fail to operate properly. HP's responsibility extends only to the end of the cable. Once the Customer Engineer has ascertained that the HP hardware and software is functioning correctly, it is up to the system owner to pursue a solution.

Several potential problems may occur with connecting non-HP peripherals. Users who connect non-HP peripherals will have to ensure that they have a suitable driver. Further, there is enough flexibility in the SCSI standard that a particular combination is not guaranteed to work. Also, if commands other than those in HP Common are utilized, the HP-UX drivers must be modified.

Functional Description

The architecture of the card is straightforward. The SCSI Protocol Controller (or SPC) is connected to the SCSI cable through single-ended line drivers. The other side of the SPC is connected through a DIO-like interface. to the SPU.

A picture of the HP 98658A SCSI Interface Card is shown in Figure 3-13.

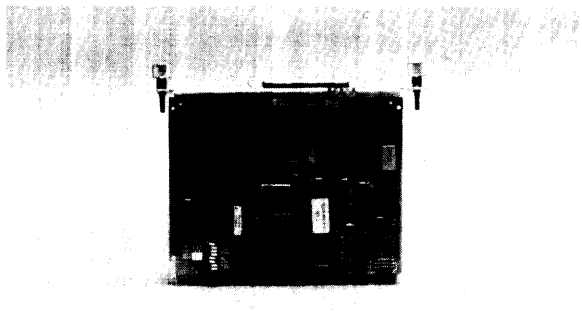


Figure 3-13. HP 98658A SCSI Interface Card

Internal registers of the SPC are memory-mapped into the address space of the card, and appear as 8-bit registers. These registers are readable at odd byte addresses. During writes, the proper parity bit is always generated and supplied to the SPC. Any data written by the CPU in the upper byte of a word transfer is ignored. A byte write to an even address will cause a bus error.

Parity generation is implemented for both the registers in the SPC and the DMA data path. Parity checking is done by the SPC for the DMA path, and the result is available in the SERR register. Due to the lack of parity on DIO, the actual parity bit cannot be transferred to or from system RAM. Parity is odd when the parity configuration switch is set to 1.

Data words (16-bit) can be transferred under DMA control between the interface and main system memory.

An interrupt circuit is available, and will normally be used to inform the host CPU of state changes on the bus. The host initiates a transaction with the mass storage device, and then responds to interrupts as it proceeds. The interrupt signal is generated by the SPC, and logically ANDed with the IE bit from DIO register 3. Therefore, even the 'unmaskable' interrupt described in the SPC manual can be inhibited.

An electronic fuse in the SCSI interface's +5 V dc power input will blow when excessive current is drawn. When trying to boot an OS through the SCSI interface and the SCSI electronic fuse blows, the fuse may be reset by re-starting the self-tests and boot sequence. Note that if the condition that caused the fuse to blow has not been corrected, the fuse will blow again as soon as the SPU is turned on.

If this fuse blows while HP-UX is executing, constant interrupts will occur. The SCSI driver to turn off the SCSI interface. If the SCSI disc drive is a root disc in the HP-UX system, that root disc drive will need to have its power cycled. However, if the root disc drive is used with HP-IB, the HP-UX system will continue running but no SCSI discs will function until the HP-UX system is taken down and power is cycled.

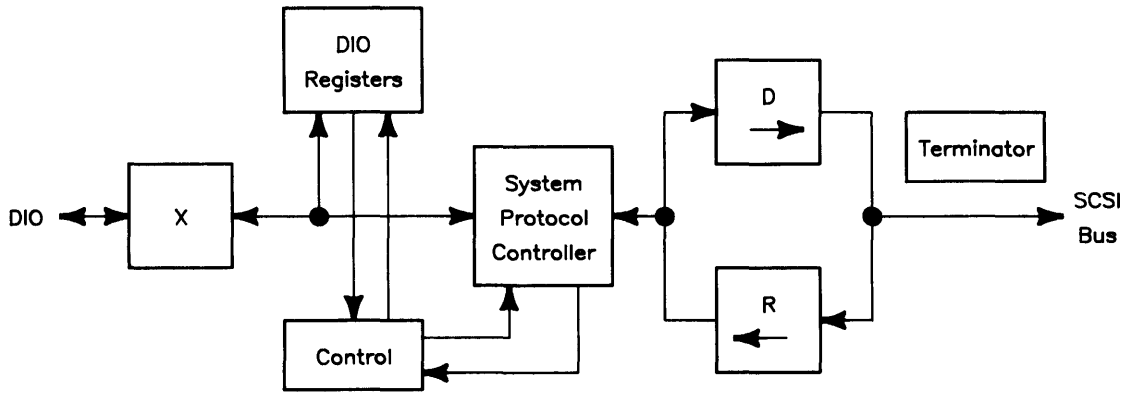


Figure 3-14. SCSI Block Diagram

Self-tests for SCSI are explained in Chapter 4 and 5.

High-Speed HP-IB

Overview

The high-speed HP-IB interface option is functionally identical to the HP 98625B card. It allows word wide transfers during DMA cycles and is fully supported by software. Because of limited space, the circuits are implemented on the video board instead of the SCSI circuits when the high-speed HP-IB option is ordered.

A picture of the video/high-speed HP-IB board is shown in Figure 3-15. A block diagram is shown in Figure 3-16.

The optional high-speed HP-IB interface configuration is fixed as follows:

- Select Code 14.
- Interrupt Level 4.
- System Controller.
- High-Speed.

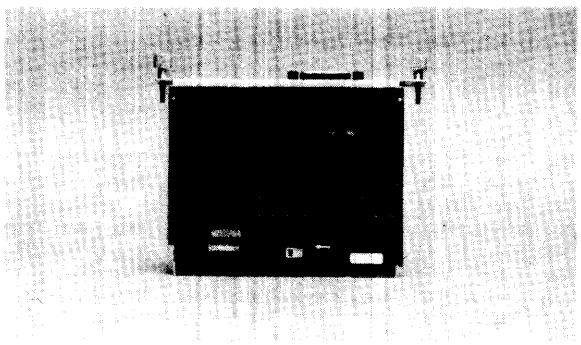


Figure 3-15. HP 98625A High-Speed HP-IB Interface Card

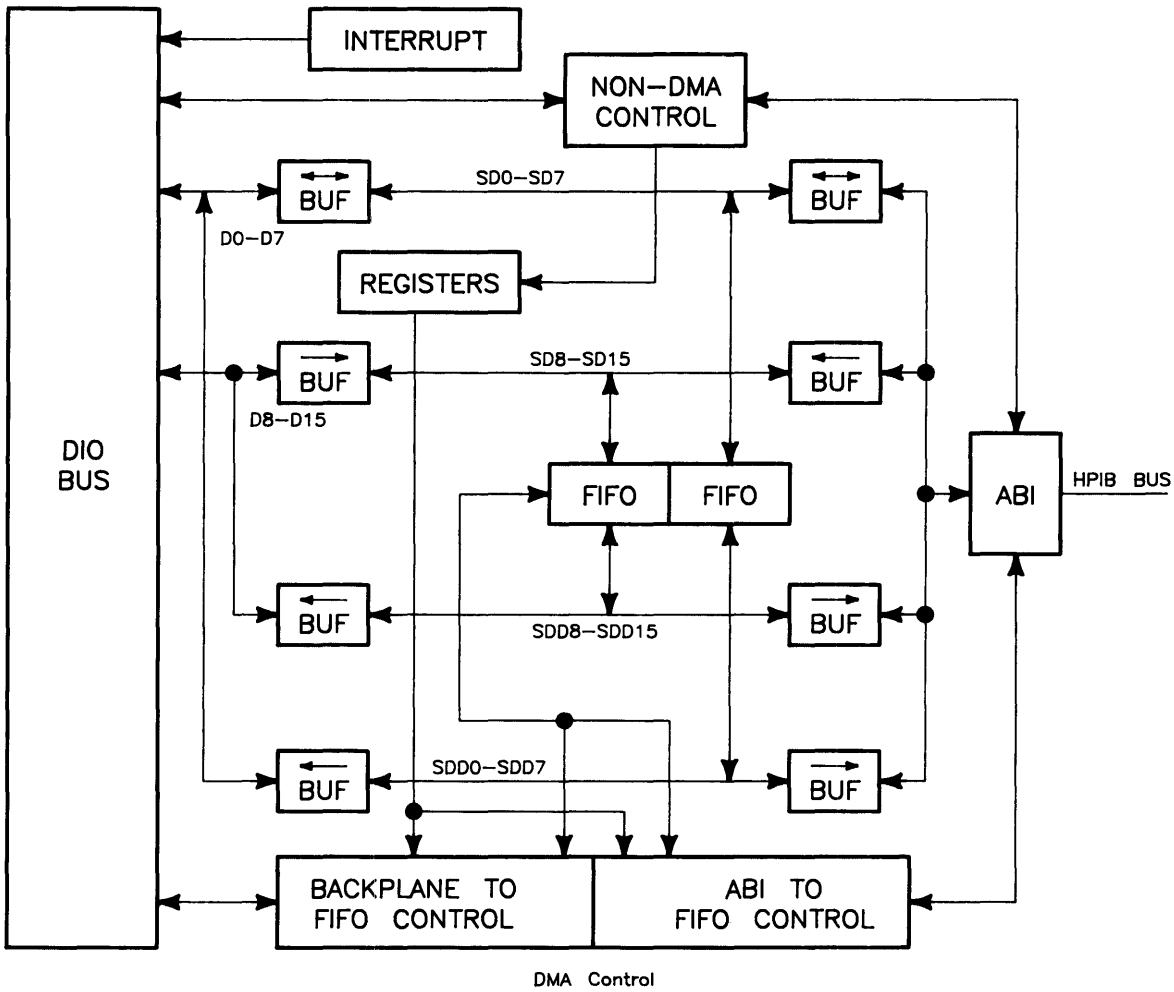


Figure 3-16. High-Speed HP-IB Block Diagram

Boot ROM Functions 4

Introduction

A Revision C1 Series 300 Boot ROM is used in the Model 340 Workstation SPUs. When the SPU is turned, two Boot ROM instruction sets are executed by the CPU:

- Power-Up/Self-Test Sequence.
- Booting Operating Systems.

Power-Up/Self-Test Sequence

When the SPU is turned on the CPU executes the power-up/self-test sequence before an operating system is booted. This is required to initialize and test hardware to make sure the SPU is ready to boot an operating system. The SPU's power-up sequence is shown below.

1. Test CPU.
2. Determine 24 or 32 bit address range.
3. Turn on self-test LEDs.
4. Test the top 16 Kbytes of RAM.
5. Set up data structures.
6. Search for any boot extension ROMs and call any valid ones.
7. Determine processor type.
8. Initialize and test processor board timer.
9. Reset all I/O.
10. Initialize the video circuits.
11. Checksum the Boot ROM.
12. Display CPU type.
13. Look for floating point co-processor.
14. Initialize keyboard electronics.
15. Drop interrupt level.
16. Preload for main RAM test.
17. Test processor board HP-IB.
18. Test DMA.
19. Test remaining RAM and set up bottom of memory.

20. Report any memory failures and the amount of memory found.
21. Initialize the bottom of memory.
22. Find, report, and test the following interfaces:
    a. Processor board HP-IB.
    b. Processor board RS-232.
    c. LAN.
    d. SCSI, if installed.
    e. High-speed HP-IB, if installed.
23. Video circuits are initialized and cleared.
24. Output final LED value.

Configure Mode Software Override

Configure mode is a Boot ROM feature that allows the modification of some power-up defaults independent of which language will eventually be booted. To enter configure mode press CTRL-C before a system is booted but after the keyboard is initialized (e.g. after the keyboard message is displayed).

All mass storage operations lock-out and defer the response to the CTRL-C (just as they defer RESETs). This is to prevent leaving a mass storage device stranded in a strange state (e.g. disc spinning).

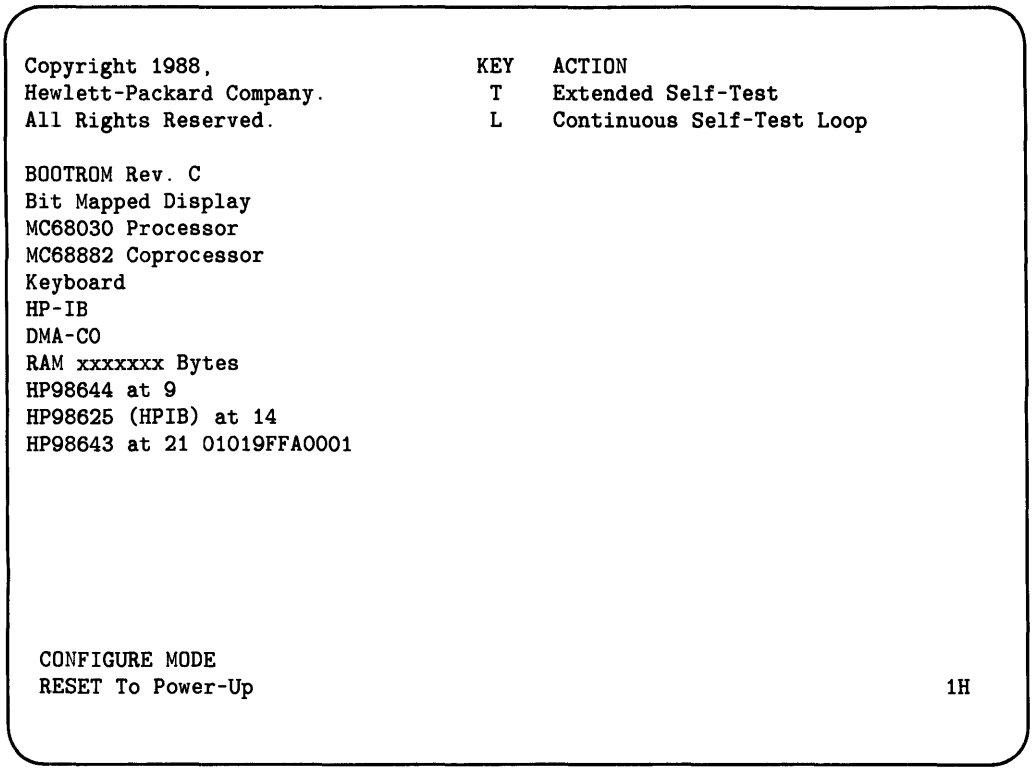


Figure 4-1. Example Power-Up Display in Configure Mode

Once in Configure Mode, two options are displayed. If no key is typed within approximately 5 minutes, the Boot ROM will time-out and start power-up over again. Regardless of the option chosen, most of the self-test will be repeated. If the memory test has already been completed and the extended self-test option is chosen, then the main memory test portion of the self-test will be repeated, otherwise it will not.

Extended Testing

If [T] is pressed, the self-test will be started over and the long memory test will be executed, taking approximately 4 seconds per megabyte rather than the default, short memory test taking approximately 1 second per megabyte. This mode will also invoke extended testing on LAN and SCSI interfaces (does external loopback and cable testing). The latter testing will request the user to power off any SCSI peripherals and attach the appropriate end of the SCSI test connector.

Extended Test Mode can be invoked while running in looping mode. The result is continuous extended testing. SCSI extended testing will not be done in this combination.

With a ThinLAN interface board installed, all extended test functions will work. When an AUI LAN interface board is installed, an external HP 30241A Backbone Media Attachment Unit (MAU) must be connected to the LAN interface port for extended test functions to work. If an external MAU is not connected, the extended test will report a failure.

Continuous Self-Test

Pressing [L] causes the Boot ROM to continuously repeat the self-test portion of its code. Entering configure mode while already in continuous self-test mode and choosing the "L" option, will stop the continuous self-test and will cause the Boot ROM to continue normal operation.

While in continuous self-test mode, the Boot ROM will not wait, beep or stop for most failures, but will just continue looping through self-test. The following failures will stop self-test looping:

- **A memory failure in the top 16K bytes.**

  In this case the Boot ROM stops with the display blanked and ooooooŏŏ on the LEDs.

- **Boot ROM checksum failure**

  In this case the Boot ROM stops with the message `CONTINUE AT OWN RISK (RETURN To Continue)` is displayed, the value ooooŏŏŏo on the LEDs, and then beeps appropriate low and high tones. Pressing [Return] will cause the Boot ROM to continue self-test looping.

The Human Interface

Some devices may act as the "console", or primary human interface, for the Boot ROM. As of this revision, the list of possible console devices is explained in the next section.

Output Devices

- Supported HP terminals are defined as those terminals supported by HP on HP-UX for Series 300. See the section of this chapter describing Remote Human Interface for Boot ROM requirements.
- Internal RS-232 controller with the remote bit set (with a supported HP terminal).
- The bit-mapped video circuit.

Only one output device at a time will be used as the console output device, however, the Boot ROM will initialize and clear the bit-mapped video circuit even if that circuit is not chosen as the console device. Note that if a device fails self-test then for the above algorithm, the device is considered "not present". The Boot ROM always tests a device before choosing it as the the console output device.

Input Devices

Two types of input devices are used:

- RS-232 controller on processor board with supported HP terminal.
- HP-HIL keyboard circuits on processor board.

Note that if a remote terminal is present in a system, both the HP-IL and RS-232 controllers will both be enabled.

If a keyboard controller fails, then it is considered to be "not present" and no keyboard failed message will be displayed. In this case, the RS-232 interface would be the only other input device providing the remote bit is set and a terminal is used. The Boot ROM always tests a device before choosing it as the console input device.

If no output device is present, but a keyboard is present, then that keyboard will still act as the console input device. Similarly, if no input device is present, but video circuits are present, then the video circuit will still act as the console output device. If neither an input device nor an output device is present, the Boot ROM will go ahead and automatically boot the default operating systems as long as no errors are discovered during self test (see the section on Self-Test for more details).

Remote terminals as consoles are discussed in more detail in the next section.

Remote Human Interface

Very early in the power-up sequence, a search is made for a RS-232 interface with its "remote" bit set. If one is found, it becomes the remote human interface. Note that the RS-232 appears as an HP 98644 card and will be treated as such by the Boot ROM.

To indicate that a remote human interface has been found (at, for example, select code 9), the first line of the display will show:

```
Remote Interface at 9
```

After this point the display will not change until a system is booted. The keyboard electronics will work just as they would if there were no remote console (see previous section for details).

Using a Remote Interface

To use the remote interface, an 80 wide terminal with at least 24 lines that accepts the following HP standard terminal escape sequences is required:

Key Sequence	Function
Escape H Escape J	To Clear Screen and reset cursor
Escape &aDDY	To Move Cursor to Row DD
Escape &aDDC	To Move Cursor to Column DD

The Boot ROM will use the baud rate, pacing, and line characteristics of the RS-232 interface.

Since the RS-232 circuit has no switches for the following functions, they will always be assigned the following characteristics when used as remote console by the Boot ROM:

- 8 bits/char,
- no parity,
- a single stop bit,
- 9600 baud, and
- XON/XOFF handshaking.

The display on the terminal will be the same as the display on a monitor. Keyboard functionality will also be the same, except that the [Break] key on the terminal is mapped to the [Reset] key on the local keyboard.

During the self-test of I/O cards, the circuit driving the remote interface will not be disturbed. It was tested earlier and passed.

Note that use of the [Enter] and [Tab] keys during Boot ROM execution can cause the terminal's display to become scrambled.

```
Copyright 1988,
Hewlett-Packard Company.
All Rights Reserved.

BOOTROM Rev. C1
MC68030 Processor
MC68882 Coprocessor
Bit Mapped Display
Keyboard Failed
HP-IB
HP98642 at 9 Failed
HP98629 at 20
Memory Failed at FFFC5932
 (W:BBBB4444, R:BBBB4464)
196448 Bytes









 WAITING 1 MINUTE (RETURN To Abort Wait)
```

RESET To Power-Up

Figure 4-2. Example Screen Display With Multiple Power-up Self-Test Errors

Memory Tests

Memory tests are performed on main memory. The same messages are used for reporting all memory failures, but they are interpreted slightly differently for word and byte memory tests.

For word wide memory test errors, the following message is displayed:

```
Memory Failed at AAAAAAAA
 (W:BBCCDDEE, R:FFGGHHII)
```

Where:

- W: BBCCDDEE is the write pattern,
- R: FFGGHHII is the read pattern,
- BB and FF are at address AAAAAAAA,
- CC and GG are at address AAAAAAAA+1,
- DD and EE are at address AAAAAAAA+2, and
- EE and II are at address AAAAAAAA+3.

For byte-wide display and interface circuit memory test errors, the following message is displayed:

```
Memory Failed at AAAAAAAA
 (W:BBCCDDEE, R:FFGGHHII)
```

Where:

- W: BBCCDDEE is the write pattern,
- R: FFGGHHII is the read pattern,
- BB and FF are at address AAAAAAAA,
- CC and GG are at address AAAAAAAA+2,
- DD and EE are at address AAAAAAAA+4, and
- EE and II are at address AAAAAAAA+6.

Parity checking is enabled during the memory test phase. Error messages are of two types:

```
parity bit error at FFFF1234
```

Means a failure was detected in the parity checking RAM for the address shown.

```
data parity error at FFFF4321
 (W:BBCCDDEE, R:FFGGHHII)
```

A RAM failure was detected at the address shown. The address in parity error messages is the lowest of four consecutive addresses. Errors could have occurred in any or all of these four addresses. Parity errors will be displayed during the TESTING MEMORY phase of the self-test and testing will continue.

Small Computer Systems Interface

SCSI Identification

The SCSI is identified by this message:

```
HP98265 (SCSI S 16) at 14
```

If two SCSI devices are listed at the same bus address, the SPU will stop. To correct this, make sure each SCSI device has its own unique address.

If all SCSI addresses are listed for the same device, change the address on the device to an other address other than 7. Address 7 is the SCSI interface and must not be used as a SCSI peripheral address.

SCSI Testing

There are two levels of SCSI testing: normal and extended.

Normal testing is done at powerup or if the Boot ROM is in LOOPING test mode. This test only checks the general functionality of various registers on the interface. It will only detect gross failures.

The identification line may be followed by one of these error messages:

```
register test failed
fuse burned out
```

If any of these messages appear, no attempt will be made to use the interface as a boot source.

The "fuse" is an electronic fuse which can be reset by either pressing [Reset] to cause the boot rom to restart or by cycling power to the SPU.

Extended testing includes three parts:

- Register test (as done in normal testing).

  This test is always run and if it fails, the remaining sections will be skipped.

- Loopback test.

  This test displays these messages in the order listed and the indicated actions are required:

  `Turn OFF ALL SCSI devices`, which means to turn off power to ALL SCSI peripherals. If a particular sequence is required for proper system shut-down, that sequence must be followed.

  `Disconnect cable at nearest device`, meaning remove the SCSI cable at the first SCSI peripheral down the SCSI interface from the SPU.

  `X cancels, RETURN continues testing`, wherein pressing [X] cancels the test or [Return] continues the SCSI test.

  This test checks transmit and receive functionality both with and without DMA interaction. If this test fails, cable test can still be executed. If the user cancels testing at this point by typing [X] in response to the prompt, this section and the following sections are skipped. It will take a second or so with bit-mapped video circuits to clear the display.

- Cable test.

  This test displays these messages in the order listed and the indicated actions are required:

  `Attach SINGLE-ENDED test connector`, meaning connect the single-ended part of the SCSI test connector (5061-6565) to the cable disconnected from the peripheral.

  `X cancels, RETURN continues testing`, the same as before.

  This test requires the use of a special test connector and should be skipped if one is not available. The purpose of this test is to check the cable for shorted or broken wires. If the loopback test failed, this test may also fail due to failed circuitry on the interface board rather than due to a bad cable. At the end of this test, it is very important that the test connector be removed. Failure to do so will cause the Boot ROM to hang while trying to use the interface connected to this cable.

- Reconfiguring the System.

  These messages are displayed after the SCSI tests are completed and the indicated actions are required:

  `Remove test connector`, here's when you remove the SCSI test connector from the cable. This message is only given if the cable test has been run.

  Note: The test connector must be removed before continuing. If the test connector is left on and operations are continued, the SPU will stop.

  `Connect cable to device`, meaning connect the SCSI interface cable to the SCSI peripheral it was earlier removed from.

  `Restore power to devices`, this is when you turn on all SCSI peripherals.

  `RETURN continues operations`, and pressing Return continues with the next part of the self-test and booting operations.

Booting Operating Systems

Boot System Selection

The Boot ROM provides two modes of operation, attended and unattended. These two modes allow a user to either select from multiple operating systems on multiple boot devices or to automatically boot a system with no human intervention.

Unattended Operation

In an unattended situation, the first system found will be loaded and given control. To find a system the Boot ROM will search a boot list (operating systems listed on the right-hand side of the power-up display) of prioritized devices. The first system found on one of these devices will be booted. If no system is found, the boot list will be searched again until a system is found. This allows discs not present at power-up be found after their initialization is complete.

Once a device has been successfully accessed, it will never be accessed again until re-power-up or a reset. This minimizes wear on mass storage devices and limits the confusion of systems disappearing and re-appearing on shared resources such as the LAN server.

To force the boot of a particular system when the machine is unattended, the user has the following options:

- Make sure that the system to be booted is the first to be found according to the boot list search. (This is quite easy to do simply by changing device addresses, select codes, or system names, or by moving systems. The prioritized boot list is discussed in detail latter in this chapter.)
- On a LAN server with multiple systems, the system administrator can determine what operating system is booted by each workstation.

Attended Operation

To force the boot of a system not chosen by the boot list, the user must enter "attended mode." This mode is entered by typing ␣ (space bar), Return, or any letter or number during power-up after the input portion of the human interface (i.e., the keyboard or terminal) has been initialized but before a default system is booted. A good way to do this is to hold down the space bar until the system selection menu is seen. This will cause a boot selection menu to be displayed. A user can be sure that the input human interface has been initialized when one of the following (depending on the human interface provided) is displayed in the self-test list:

```
Keyboard
```

The boot selection menu displays all accessible systems as the Boot ROM locates them. A system is selected by typing the two to three character string (a 1 to 2 digit number followed by a single letter) listed in the menu.

Note that the character used to enter attended mode is considered part of this string.

As the keys are pressed, they are identified the lower right hand corner of the display.

An example display is shown in Figure 4-3.

```
Copyright 1988,
Hewlett-Packard Company.              :HP7908, 803, 0
All Rights Reserved.                     1H  SYSTEM_HP-UX
                                      :REMOTE, 21, 0, 8
BOOTROM Rev. C1                          2H  SYSTEM_HP-UX
Bit Mapped Display
MC68030 Processor
MC68882 Coprocessor
Keyboard
HP-IB
RAM xxxxxxx Bytes
HP98625 (HPIB) at 14
HP98643 (LAN) at 21 08000900ABCD









 SEARCHING FOR A SYSTEM (RETURN To Pause)
 RESET To Power-Up                                                  1H
```

Figure 4-3. Example Display Listing Operating Systems

If you know that a particular choice is desired (such as "1H"), then you can type that response as the SPU powers up to make a selection. This simple human interface makes it possible to make a selection without even having or seeing a monitor. Note that only keys A-Z, a-z, and 0-9 are allowed to select a system. Other keys are simply ignored.

Because it is possible to find more systems than there are lines on the display, the search scan can be paused and continued by toggling the RETURN key. The line next to the bottom of the screen indicates the current state with one of two messages:

`SEARCHING FOR A SYSTEM (RETURN To Pause)`, or
`PAUSED (RETURN To Continue)`

The menu will wrap around to the top of the screen and overwrite itself whenever all available lines are used. When the Boot ROM is paused, all activity stops. Because the keyboard is polled, there may be a delay before a key press takes effect.

Boot System Priority Control

Devices are searched in priority order for systems. This priority order is determined by the boot list shown below:

1. Disc drives at select codes 0-31 on bus address 0, unit 0, volume 0
2. Remaining disc drives at select codes 0-31, bus addresses 0-7, units 0-16, volumes 0-7

Each device is allowed to have multiple systems. Again, if the SPU is unattended, it will boot the first system found. If the SPU is attended (i.e. a key was struck after the input human interface was initialized), it will display all systems found until a system is selected and that system is found.

For each category in the boot list, there is also an order of search based on address location. In all cases, lower addresses are found first. This means a device at select code 0 will be found before a device at select code 7. If a device has multiple addresses to locate it, then searching is done at a local level first. For example, after looking at select code 7, bus address 1, unit 1, the Boot ROM will look at select code 7, bus address 1, unit 2 before going to select code 8.

The boot list was designed to make it easy to change and control which system will be booted in the unattended mode. The guidelines used to establish the boot list are as follows:

- High priority addresses before low priority addresses.
- Local systems before remote systems (Local refers to dedicated devices and remote refers to shared devices.).
- Removable media before non-removable media.
- Small capacity devices before large capacity devices.

Default Mass Storage Is

The Boot ROM is responsible for setting up the default mass storage variable, DEFAULT_MSUS. It is used by systems for three purposes as the:

- Default MSUS for operating systems.
- Device from which to load an autostart program, and
- Device from which to do a secondary load.

The DEFAULT_MSUS is set to the following algorithm which is the:

- Same as the MSUS of the booted system, OR a A non-ROM value passed in DEFAULT_MSUS to the booter routine (this is done only by systems calling the booter, not by the Boot ROM itself), or
- First device found present in the boot list if ROM is specified in DEFAULT_MSUS and no media can be found (i.e., an on-line disc drive with no media present).

Supported Boot Configurations

Model 340 Workstation SPU's can boot operating systems via HP-IB. Media formats from which a system may be booted are:

- L.I.F.
- UNIX (Boot Area) (Note that this is different from HP-UX. See Chapter 5, the HP-UX Programmer's Guide, for details.)

The Boot ROM can boot systems from the following boot devices:

- AMIGO protocol HPIB Discs (e.g. 8290XM, 9895, L-Codes and 7906/20/25)
- CS/80 protocol HP-IB discs (e.g. 7908)
- SS/80 protocol HP-IB discs (e.g. 9122)
- CS/80 Tape.

Note

Some of these devices, namely the HP 7906/20/25, may not meet EMI requirements when used with Series 300 computers, but their support in the drivers comes inexpensively with other discs that are supported.

LAN Boot Operations

User Interface Specifications

LAN interfaces are identified by its product number or circuit equivalent, then (LAN), then the select code, and last the link address of the interface as:

```
HP98643 (LAN) at 21, 080009000001
```

Any time the interface is identified certain tests are also run before the test, the display will show

```
HP98643 (LAN) at 21
```

then

```
HP98643 (LAN) at 21, 080009000001
```

If a failure is detected in the powerup test, the following failure message will be displayed:

```
HP98643 (LAN) at 21, 080009000001 Failed
```

This shows that one of the internal tests on the card failed.

If extended testing is selected by pressing CTRL-C then T, the LAN circuits are subject to the normal testing plus external loopback tests. The following error messages may be displayed below the LAN identification message:

- `CABLE Failed`

  This shows that the cable is not connected or improperly terminated.

- `MAU Failed`

  This shows that the MAU circuitry failed. This is not likely on SPUs where the interface is built-in. On non-built-in LAN cards this could mean that the MAU was not plugged into the card.

- `NO HEARTBEAT`

  This message is only a warning. This shows that the interfaces self-test (done after every transmission) is failing.

If no servers respond to the Boot ROM's attempts to initiate a boot session then the user will see no other indication of LAN activity.

For each server that responds, display will show `:LAN`, followed by the select code, followed by either the servers name or its Link Address. Under this will appear the list of systems provided by that server:

```
:LAN, 21, 080009000008, or
:LAN, 21, (local server name)
```

If a system calls the Boot ROM to boot/reboot a system and a file name is specified and the msus is for LAN, the Boot ROM will retry indefinitly to contact the server at the given link address. All other devices have a fixed number of retries/timeout and will report No Medium or SYSTEM NOT FOUND.

The system call for a boot/reboot on LAN is the only time an indefinite retry/timeout is used.

Troubleshooting 5

Introduction

Analytic Troubleshooting

Troubleshooting SPUs is the process of getting answers to these five questions:

- What exactly is wrong, or what are the bad symptoms?
- Where are the bad symptoms appearing?
- When do the bad symptoms occur?
- How bad is the problem or to what extent does it occur?
- What actually caused the problem in the first place?

Getting the answers to these questions usually makes the troubleshooting process much more effective and less costly. When a failure in a workstation occurs, remember these questions and get the answers to each of them.

After you have all answers possible, decide what's the most probable cause of the problem. Sometimes you'll arrive at several choices for a cause. For each choice, qualify it against the answers to the questions above. The most probable cause is the one that logically justifies the correct answers to these questions.

Materials Required

Several items may be required to troubleshoot the SPU to the failed assembly:

- Model 340 Workstation SPU's Service Handbook
- Series 200/300 Test Tools Package.
- SCSI Test Connector (1252-2297).
- Digital Voltmeter.
- Anti-Static Workstation.

Test LED Displays

Eight test LEDs are located behind the rear panel and can be seen through the vertical slot in the rear panel. In this manual, the LED's are shown in the following context:

LED On	•
LED Off	○

Troubleshooting Procedures

Workstation Level

Workstation troubleshooting consists of finding out what part of it is not working correctly. A Model 340 Workstation consists of the SPU and its installed peripherals, power source, *and the users.* Each of these elements is subject to the environment which includes, physical, electrical, and human factors.

When part or all of the workstation fails, your initial activity should be finding the part that has the problem. One of the best things to do first is to talk to the users and ask them to give specific information on what they were doing when the workstation, or part of it, failed. You may have to duplicate their activities in order to make the failure occur. If the failure is intermittent, this process may take some time.

An important part of troubleshooting is to get the workstation in a minimum working configuration that shows the failure symptoms.

Running tests on the workstation can also be helpful. A test is nothing more than a specific action with the system that should result in a specific response. Simple tests are nothing more than typing in simple instructions on the keyboard and executing them. A command to print or plot specific data is an example. Mass storage, graphics, or other functions can be checked in the same way. These type of tests are called Quick Checks.

For quick checks, the HP 98613D Series 300 BASIC 5.2 operating system may be used. It allows short booting time, easy programming, and can serve as a test tool to check the workstation.

After determining what part, or product, of the system is failing, the next step is to find out what part of the product is causing the problem. In this case, it is assumed that the SPU has the problem. The rest of this chapter covers troubleshooting the SPU.

SPU Troubleshooting

Three levels of troubleshooting the SPU is explained. For each level different portions of the SPU must be operational. A summary of these levels and what must be operational is shown in Table 5-1.

In order to choose the best approach to start with, obtain as much information as possible from the user. If the unit is not working at all, the Inoperative Unit Procedure is a good place to start. If the user indicates that most of the unit is operating properly, the Functional Unit Procedure may be a good place to start. If the users information is not conclusive, use the following procedure to determine the problem area:

1. Turn the unit on and check for fan and Self-Test LED operation.
2. If the fan or LED's aren't working, go to the Inoperative Unit Procedure. If they do work, go to the Functional Unit Procedure.

Table 5-1. SPU Troubleshooting Procedures

Procedure	What MUST Function
Inoperative Unit	Nothing
Live Unit	Power Supply
Functional Unit	Power Supply Part of CPU circuits Part of interfaces Top 16K of RAM Some inputs from keyboard Video to operate monitor

Inoperative Unit Procedure

An Inoperative Unit is one which does not appear to function at all. No power-on or self-test LEDs, fan rotation, or response to keyboard inputs are typical symptoms. Nearly all inoperative units have one of these problems:

- Defective power supply.
- Voltage select connector in wrong position.
- Improper line voltage/frequency or defective power cord.

Follow this procedure to isolate the problem. If an assembly is defective, this procedure indicates which assembly should be replaced to eliminate the problem.

WARNING

Hazardous voltages are present in the SPU when it is plugged in. Turn the unit off and unplug the SPU before placing test leads, checking fuses, or removing/installing assemblies.

1. Check that the voltage select swith is correctly set. Refer to Chapter 3 in this manual or Chapter 2 in the Service Handbook for the correct procedures.
2. See if the power supply output voltages are correct. If they aren't, replace the power supply.
3. If the fan is not rotating, replace the power supply.

Live Unit Procedure

A live unit is one which has a properly functioning power supply but the SPU will not function. One of the assemblies installed (other than the power supply) is usually defective. Live units often are very difficult to troubleshoot, since a problem anywhere on the I/O bus in the SPU can shut the workstation down and prevent the execution of any instructions, even those from the Boot ROM.

The Live Unit Procedure is a method for finding the defective assembly which is preventing the processor from executing instructions. It assumes that the power supply is operating properly, and the self-test tried to run, but didn't.

If the power supply is not operating properly, refer to the Dead Unit Procedure. If the turn-on self-test runs enough to either display a failure, stalls in a meaningless state, or passes, refer to the Functional Unit Procedure.

Once the problem in the workstation has been isolated to the SPU, it's sometimes best to start with a minimum configuration.

Minimum Configuration

A minimum SPU configuration consists of:

- Power Supply.
- Processor Board.
- One RAM Board.

These are needed to start self-tests. All self-tests don't have to complete or pass, just start.

You may have to remove the video/graphics or interface boards for the SPU to function if a problem is on one of these boards.

Testing the minimum configuration is relatively simple. Just remove the internal assembly, RAM, video, SPU backplane and interface boards, then follow these steps:

1. Plug the SPU in and turn it on. The Self-Test LED's should ripple and change state several times.
2. If the LED's do not light or ripple, turn the SPU off, unplug it, and replace the processor board, then retest.
3. Turn it on, and watch the LEDs. If the LED's don't light or ripple, replace the power supply.

Functional Unit Troubleshooting

A functional unit is one that passes the minimum configuration test. It doesn't have to function properly, but at least start the self-test and light the test LEDs.

SCSI Test Connector

Note

To allow complete self-tests of the SPU when the SCSI board is installed, an SCSI test connector must be connected to the SCSI interface port or cable.

An SCSI test connector (1252-2297) provides loop-back test information to the SCSI interface. The connector can be used in either single-ended or differential configurations. It connects to the SCSI port like the cable.

Two loop-back configurations are present on the SCSI test connector:

- Single-Ended.
- Differential.

Each is explained in Table 5-2.

Table 5-2. SCSI Test Connector Configurations

SCSI Type	
Single-Ended	Connects to SCSI interface port on rear of SPU, or Connects to peripheral end of SCSI interface cable, or Replaces SCSI Terminator on SCSI peripheral.
Differential	Not implemented for Model 340 Workstations.

Minimum Configuration

For the SPU to pass the minimum configuration functions correctly, the LED's should end up as oooo oooo.

Once the minimum configuration self-test passes, you're ready to start testing a functional unit with the self-tests.

1. Plug the SPU in, turn it on and watch the LED's go through self-test.
2. If a failure is indicated, refer to the LED, refer to the tables at the end of this chapter to determine the failed assembly.

Table 5-3. Minimum Functional System

Assembly	Minimum Functions Performed
Power Supply	All voltages normal and within specifications.
Processor Board	CPU executes self-test, cycles memory, most instructions executed OK.
	Memory addresses, read/writes, and refreshes.
	Inputs/Outputs data between CPU and peripherals via HP-IB, HP-HIL, RS-232 or video/graphics interfaces. **Note: If an SCSI interface option is installed, the SCSI terminator must be installed to allow complete SCSI self-tests.**
	Processes and outputs video.
Keyboard	Inputs information.
Disc Drive	Stores, reads, writes data.
Monitor	Displays information.

Once these functions work, a similar process can be used to install and check other system functions. This also may be a good point to load and run one of the tests in the Series 200/300 Test Tools Package. Refer to the Test Tools Manual for tests information such as:

- Minimum Hardware Configuration Required.
- Test Loading and Running.
- Interpreting Test Results.

Series 300 Test Tools are explained in a later section.

Self-Test

Use the self-test to troubleshoot a unit which can execute some instructions, but cannot accept, store or output data correctly. This means that the basic elements of the SPU are functioning. The basic elements include the power supply, processor board, and at least the first 16 Kbytes of RAM. If any of these are not known to be functional, refer to the Initial Troubleshooting Procedure section.

The self-test checks most assemblies in the SPU. Both pass and error displays in binary are shown by the LED display. LED's are located behind the rear panel and are visible through the vertical slot in the rear panel.

For a functional description of the self-tests, refer to Chapter 4.

Failure Indications

As the self-test progresses, the LED's display the current state. At the end of the test, a power-up with no errors is indicated by all LEDs turned off and by immediate entry into the boot scanner.

Should a failure occur during the self-tests, it will be indicated on the LEDs at the end of the tests. If there was more than one failure, the highest priority failure will be indicated on the LEDs. All the LED values are shown in Table 5-6.

The highest priority failure is also output to the beeper, if present. The lower seven bits of the LED value are beeped in seven tones as follows:,

- Most significant bit first.
- One second beep per bit.
- A zero (LED off) is represented by a low tone.
- A one (LED on) is represented by a high tone.

If no failure occurs, the beeper will not sound off. If the failure was a Boot ROM checksum error, the following message will be displayed:

```
CONTINUE AT OWN RISK (Press RETURN To Continue)
```

Once this message has been printed, the [Return] key must be pressed to continue to the boot scanner. The probability is fairly low that the error will adversely affect the user, but if it does, it could be catastrophic.

For all other failures, the message:

```
WAITING 1 MINUTE (Press RETURN To Abort Wait)
```

will be displayed.

The Boot ROM will time out after approximately one minute and will then continue into the boot scanner. This allows time for the display to warm up and for the user to read the error messages. These failures are usually non-fatal so, in an Unattended Mode, the Boot ROM will still boot the first OS it finds. Pressing [Return] will terminate the beeping error code and abort the one minute wait. Pressing [Return] will also make the SPU revert to the Attended Mode. This means that the Boot ROM will display all OSes found and will not boot one until one is chosen and entered by the user.

SCSI Interface Fusing

An electronic fuse in the SCSI interface's +5 V dc power input will blow when excessive current is drawn. When trying to boot an OS through the SCSI interface and the SCSI electronic fuse blows, the fuse may be reset by re-starting the self-tests and boot sequence. Note that if the condition that caused the fuse to blow has not been corrected, the fuse will blow again as soon as the SPU is turned on.

If this fuse blows while HP-UX is executing, constant RST interrupts will occur. The SCSI driver to turn off the SCSI interface. If the SCSI disc drive is a root disc in the HP-UX system, that root disc drive will need to have its power cycled. However, if the root disc drive is used with HP-IB, the HP-UX system will continue running but no SCSI discs will function until the HP-UX system is taken down and power is cycled.

General Description of LED Failure Codes

Failure Indications

If a failure occurred during the self-tests, then that failure will be indicated on the LEDs at the end of the tests. If there was more than one failure, the highest priority failure will be indicated on the LEDs. All the LED values are listed below.

The highest priority failure is also sounded off on the beeper, if present. The lower 7 bits of the LED value are sounded off, most significant bit first, one second per bit, with a zero represented by a low tone and a one represented by a high tone. If no failure occurs, the beeper will not sound off.

This means that the Boot ROM will display all systems found and will not boot a system until one in chosen and entered by the user.

Table 5-5 shows the general meaning of error codes. These codes are explained further in other tables. LED patterns are represented by a black dot for on and a white dot for off. Letter designators indicate the LED in that position is on or off, depending on the binary code used to represent the device or failure type.

Table 5-5. General Failure LED Indications

Upper 2 Bits Fail Indicator	LED Code and Failure Description
State Indication Only:	○○SS SSSS Where SS SSSS Indicates State of Power-up
Required Device Missing or DTACK Failure:	○●DD DDDD Where DD DDDD Indicates Device
Failing Device:	●○DD DDDD Where DD DDDD Indicates Device
Special Codes (Special Case Highest Priority Codes):	●●●● ●●●● LEDs Never Accessed (or Unused Code)
	○●●● ●●●● LEDs Failed to DTACK
	○○○○ ○○○● Timer on processor board has failed or is missing.

Lower 2 Bits State or Device Codes	LED Code and Failure Description
Miscellaneous (Highest Priority):	XX○○ FFFF Where FFFF indicates Failure (Xs are don't-care bits)
Internal Peripheral Failure (Medium Priority):	XX○● PPPP Where PPPP is Peripheral Number
I/O Card Failure (Lowest Priority):	XX●S SSSS Where S SSSS is Select Code

LED State and Failure Codes

Table 5-6 lists the LED failure codes used in the SPU's Boot ROMs. Codes are listed here in numerical order for easy reference, and then again in order of occurrence and priority.

Table 5-6a. Self-Test LED Special State and Failure Codes (In numerical order)

LEDs	Explanation	Problem Solution
oooo oooo	No failure	
oooo ooo●	Failed CPU register test.	Replace processor board
oooo oo●o	Testing top 16 Kbytes of RAM.	
oooo oo●●	Failure in top 16 Kbytes of RAM.	Replace RAM-1 board
oooo o●oo	Top 16 Kbytes of RAM missing or not found by CPU.	Replace RAM-1 board or processor board
oooo o●●●	Starting test vector list.	
oooo ●ooo	Resetting all interfaces.	
oooo ●oo●	Searching for console display.	
oooo ●●oo	Internal bit-mapped display checksum.	
oooo ●●●o	Failed Boot ROM checksum.	Replace processor board.
oooo ●●●●	Pre-loading RAM for main test.	
ooo● oooo	RAM Testing	
ooo● ooo●	Failure: Not enough RAM.	Replace RAM-1 board.
ooo● oo●●	Failure: Boot error.	Replace processor board. Replace OS media.
ooo● o●oo	Failure: OS tried to start loading at too high of an address.	Replace OS media. Replace processor board.
ooo● o●o●	Failure: Not enough RAM to load OS.	Upgrade to more RAM. Use smaller OS.

Table 5-6b. Self-Test LED State and Failure Codes for Interfaces (In numerical order)

LEDs	Explanation	Problem Solution
oo●o oooo	Failure: 4 ms timer.	Replace processor board.
oo●o oo●o	Failure: Processor board keyboard circuit.	Replace processor board.
oo●o o●oo	Failure: Processor board HP-IB circuit	Replace processor board.
oo●o ●ooo	Failure: Processor board DMA circuit.	Replace processor board.
oo●o ●●oo	Failure - one of these: Font ROM is bad. Font ROM is not useable. Could not find US ASCII character set.	Replace video board.
oo●o ●●o●	Failure: Video board bit map circuit.	Replace video board.
o●oo ●●●o	Failure: High-speed HP-IB or SCSI circuit.	Replace High-speed HP-IB or SCSI board.
o●oo ●oo●	Failure: RS-232 circuit.	Replace processor board.
o●oo o●oo	Failure: SCSI circuit.	Replace SCSI board.

Table 5-7. Turn-On, Self-Test, and Boot Displayed Messages

Displayed Message	Explanation and Procedure
RAM FAILED ABOVE FFFFC000	Failure in top 16 Kbytes of RAM. Replace RAM-1 board.
RAM GONE ABOVE FFFFC000	CPU could not find top 16 Kbytes of RAM. Replace RAM-1 board or processor board.
TESTING MEMORY	User RAM is being tested.
LOADING MEMORY	RAM is loading with Boot ROM code.
BOOTING A SYSTEM	An OS is being loaded into RAM.
SEARCHING FOR A SYSTEM (RETURN To Pause)	Looking for an OS on mass storage devices. Press [Return] to stop the search.
PAUSED (RETURN To Continue)	SPU has paused. Press [Return] To Continue.
CONFIGURE MODE	Self-test is in configure mode. Press [T] for extended self-test. Press [L] for continuous self-test.
SELF-TEST MODE	SPU is in self-test mode.
RESET To Power-Up	Press [Reset] to re-start power up sequence.
RESET TO RE-Try	Press [Reset] to re-try what failed before.
CONTINUE AT OWN RISK (RETURN To Continue)	A self-test was not completed. You may continue but errors may occur. Press [Return] to re-start power up sequence.
WAITING 1 MINUTE (RETURN To Abort Wait)	SPU has paused while you decide what to do next. Press [Return] to abort wait and continue.
UNEXPECTED USE OF HHHHHHHH	Refer to Table 5-8.
NOT ENOUGH MEMORY	Not enough RAM to load OS.
SYSTEM WOULD LOAD TOO HIGH	An addressing error would make the OS start loading at too high of a RAM address. One of these situations probably occurred: 1. Bad OS media. 2. Error in information transfer. 3. Error in CPU, I/O or mass storage hardware. Try again. If error message repeats, troubleshoot or replace the above items.
SYSTEM NOT FOUND	Selected OS was not found on available mass storage devices. Verify desired OS is on a mass storage device and retry.
Bit Mapped Display	Bit-mapped video circuits on video board identified.
Keyboard	Processor board's keyboard circuits identified.
HP-IB	Processor board's HP-IB circuits identified.

Table 5-7. Turn-On, Self-Test, and Boot Displayed Messages (cont.)

Displayed Message	Explanation and Procedure
HPXXXXX	Interface (HP XXXXX, or equivalent) identified. XXXXX refers to the product number that would be displayed.
DMA-CO	Processor board's DMA circuits identified.
MC68030 Processor	MC68030 CPU identified.
MC68882 CoProcessor	MC68882 Floating-Point Co-processor identified.
RAM BBBBBBB Bytes	BBBBBBB is the amount of RAM in bytes the self-test found in the SPU.
MEMORY FAILED AT HHHHHHHH	Memory failed at hex address HHHHHHHH. Replace the RAM board that has the failed memory address.
DATA PARITY ERROR AT HHHHHHHH	A parity error occurred with hex address HHHHHHHH. Replace the RAM board that has the failed memory address.
PARITY BIT ERROR AT HHHHHHHH	A parity bit error occurred with hex address HHHHHHHH. Replace the RAM board that has the failed memory address.
MEMORY GONE AT HHHHHHHH	A read or write cycle was attempted at address HHHHHHHH but no memory found at that address. Replace the RAM board that has the failed memory address.
XXXXX at SC	A circuit equivalent to an HP product (XXXXX) and type was found at select code SC.
Remote Interface at SC	A remote interface was identified at select code SC.
HP98265 (SCSI S 16)at SC	SCSI identified as S (single-ended) and 16-bit DMA capable at select code SC.

Other Failure Indications

'UNEXPECTED' Error Messages

Several "UNEXPECTED" failure messages may be displayed at any time. Table 5-8 lists these messages. The addresses 5 most significant digits are FFFFF so only the 3 least significant digits (LSD) are used in the table. When a range of addresses is shown, each address in the range is 6 addresses apart.

When an "UNEXPECTED" failure message equates to an interrupt level, vectored interrupt, or trap, the following situations normally exist:

- **Interrupt level 1 through 7:** Can happen at any time and are usually caused by an interface set to the indicated interrupt level. If the error repeats, the interface should be replaced.
- **CPU traps:** Usually occurs when the operating system is being used. A CPU trap indicates something in the CPU didn't go right. If the error repeats, the processor board should be replaced or use a fresh copy of the operating system.
- **Other errors:** Several things can cause these errors, either on the processor board on in an interface circuit. If the error repeats, the processor board or interface should be replaced.

  If messages are meaningless or garbled, something went wrong and can compound the situation. Restart or cycle power to the SPU. If messages are still incoherent, the processor board or another interface circuit may need to be replaced.

Table 5-8. "UNEXPECTED USE OF (address)" Failure Messages

3 Hex LSDs	What Unexpected Event Occurred
FFA	Bus error
FF4	Address error
FFE	Illegal instruction
FE8	Zero by zero trap
FE2	Check trap
FDC	TRAPV TRAP
FD6	Privilege violation
FD0	Trace trap
FCA	1010 Opcode
FC4	1111 Opcode
FBE	Interrupt level 1 (keyboard)
FB8	Interrupt level 2 (not used)
FB2	Interrupt level 3
FAC	Interrupt level 4
FA6	Interrupt level 5
FA0	Interrupt level 6
F9A	Interrupt level 7 (RESET from keyboard)
F3A to F94	CPU Traps
F34	Reset from keyboard
F2E	Keyboard timeout (fast handshake)
F28	Battery backup interrupt
F22	NMI from the backplane
F1C	Spurious interrupt
EEC to F16	Vectored interrupts
EE6	Format error, co-processor violation or unknown.
EE0	MC68882 Co-processor exception vectors.

LAN Boot Failures

If a failure is detected in the powerup test, the following failure message will be displayed:

```
HP98643 (LAN) at 21, 080009000001 Failed
```

This shows that one of the internal tests on the LAN board failed.

If extended testing is selected by pressing CTRL-C then T, the LAN board is subject to the normal testing plus external loopback tests. The following error messages may be displayed below the LAN identification message:

- `CABLE Failed`

  This shows that the cable is not connected or improperly terminated.

- `MAU Failed`

  This shows that the external media access unit (MAU) circuitry failed. This is usually found with AUI LAN configurations and not with ThinLAN configurations where the interface is built-in.

- `NO HEARTBEAT`

  This message is only a warning. This shows that the interfaces self-test (done after every transmission) is failing.

If no servers respond to the Boot ROM's attempts to initiate a boot session then the user will see no other indication of LAN activity.

LAN Boot Error Messages

LAN error messages will show at the lower left of the display and consist of an error name followed by the same identification string shown above the list of system names.

Table 5-9. LAN Boot Error Messages

Error Message	Meaning
`SYSTEM NOT FOUND`	The server could not open the selected file, or the file was of the wrong type.
`No Server`	The server did not respond to a boot request.
`Not Ready`	LAN hardware powerup or reset failed.
`Read Error`	The open operation worked but the server has since then failed to respond to a read request or the server sent end of file.
	The server failed to respond to a read request or the server sent eof.
`Bad Hardware`	The LAN hardware failed to respond to some operation or reported a catastrophic error.
`Bad State`	Damaged Boot ROM code

Diagnostic Programs

Three types of diagnostic programs are available to test the Model 340 Workstation:

- HP-UX Diagnostics
- Series 200/300 Test Tools
- Series 300 System Support Tape

An overview of each is listed in Table 5-10.

Table 5-10. Diagnostic Programs Overview

Diagnostic Program	Media	Part Number	Diagnostics Available
HP-UX ce.utilities	Tape Disc	Series 300 HP-UX Rev. 6.2	CRT Adjustments Floating-Point Coprocessor Tests Display Controller Tests System Functional Tests CS/80 Exercisers (VMEbus Expander and Error Checking Correcting RAM Tests are available but not supported on Model 340 Workstations.)
Series 200/300 Test Tools	Tape 3.5-in. Disc	09800-12300 09800-12700	Computer Tests System Functional Tests CS/80 Exercisers
Series 300 System Support Tape Rev. 2.1	Tape	98561-10835	CRT Adjustments Floating-Point Coprocessor Tests Display Controller Tests Computer Tests System Functional Tests CS/80 Exercisers (VMEbus Expander and Error Checking Correcting RAM Tests are available but not supported on Model 340 Workstations.)

HP-UX Diagnostics

In the HP-UX operating system Programming Environment, a series of diagnostics called *ce.utilities* provide extensive testing of the workstation.

Series 200/300 Test Tools

Overview

Series 200/300 Test Tools is a software package for verifying the integrity of Series 200 and 300 system installations. While the tests do not provide totally comprehensive system diagnostics, they are a valuable tool for trained service personnel when installing, servicing, and troubleshooting these workstations. The tests can also be used by less-experienced users and operators for determining whether or not professional assistance is needed to identify and fix a system malfunction.

The tests described in this manual are for testing and troubleshooting Series 300 systems that do not require formal verification of operation before use. Series 300 HP-UX systems have a more critical need for system verification tests, so these tests are also used as part of the standard HP-UX operating system (HP-UX System Functional Tests and CS/80 Exerciser programs are very similar to the equivalent tests described in this manual). The Series 300 Computer Tests described in Part II of this manual can be used for troubleshooting beyond the testing level provided by HP-UX test programs, provided the system being tested has an external flexible disc drive for loading and running the test software.

Series 200/300 Test Tools provide the following test capabilities when combined with the SPU's Boot ROM self-test:

- Computer Tests.
- System Functional Tests.
- CS/80 Disc Drive Tests.

These tests are also included in HP-UX ce.utilities and the System Support Tape tests.

Computer Tests

Series 300 Computer Tests for the Model 340 Workstaion's SPU are supplied on one of two discs, the other is for for Series 200 computers. They test the boards in the SPU (except the power supply).

System Functional Tests

Five discs contain these tests. The first disc contains the test operating system environment and the main menu; the other discs contains the test programs. These tests are used to verify communication between the SPU and supported peripherals. They do not add significantly to the confidence levels achieved by the Boot ROM self-test program, though they expand confidence in overall system integrity by providing visible proof that communication with selected peripherals is correct and that interfacing is connected and set up correctly. The tests do not provide any worst-case tests at maximum speed or similar margin-of-safety tests.

CS/80 Exercisers

CS/80 Exerciser Programs are supplied on a single disc and is used to verify that CS/80 disc drives are correctly connected to the SPU, and that the SPU can successfully write and retrieve data to and from the disc or tape. The Pascal-based program also provides access to CS/80 disc and tape error logs for analyzing drive and media performance. This information is useful for troubleshooting, and for planning preventive maintenance programs.

Package Contents

The combined Series 200/300 Test Tools software package is provided on both 3.5-inch and 5.25-inch flexible discs as listed in Table 5-11.

Table 5-11. Series 200/300 Test Tools Package Contents

Part Description	3.5-in. Disc Part Number	5.25-in. Disc Part Number
Series 200/300 Test Tools, complete package consisting of:	09800-12300	09800-12500
Series 200/300 Test Tools Manual	09800-90001	09800-90001
Series 200 Computer Tests Disc Rev. 1.0	09800-10336	09800-10536
Series 300 Computer Tests Disc Rev. 3.0	98561-10334	
Series 200/300 System Functional Tests Discs:		
SFT0 Disc Rev. 1.2	09800-11334	09800-11534
SFT1 Disc Rev. 1.2	09800-11335	09800-11535
SFT2 Disc Rev. 1.2	09800-11336	09800-11536
SFT3 Disc Rev. 1.2	09800-11337	09800-11537
SFT4 Disc Rev. 1.2	09800-11338	09800-11538
CS/80 Exerciser Disc Rev. 3.1	09800-11304	09800-11600

Series 300 System Support Tape

Both the Series 200/300 Test Tools and Series 300 HP-UX ce.utilities tests are combined in this tape. Their use is explained in the Series 300 System Support Tape Users Manual (98561-90634).

Parts Lists 6

Parts Information

Introduction

Field replaceable parts are listed in this chapter for the Model 340 Workstation SPUs. Components, such as ICs, are not available for field repair.

Parts are available direct from:

Support Materials Operation
3625 Cincinnati Avenue
Rocklin, California 95677-1297 USA

Telephone: (916) 768-8000

Parts may be ordered through your local HP Sales and Service Office. To help get parts as soon as possible, please write the address and telephone number of your local HP Office in the spaces below.

Name: _____

Address: _____

City, State ZIP: _____

Telephone: _____

Cooperative Support Program

HP's Cooperative Support Program is available for customers that can provide technical assistance, manual updates, and other helpful information for hardware support. Your local HP Sales and Service Office can provide the information for this support service.

Exchange Parts

Exchange parts are available for some items at a reduced cost. When an exchange part is ordered, your account will be charged for a new part. Customers have 15 days to return the failed part to receive credit for the difference between a new and exchange part.

Please return failed exchange parts to your local HP Sales and Service Office as soon as possible. Place them in anti-static bags (see Parts List for part numbers) and package them securely in a sturdy container. It's a good idea to save the containers and static-free bags you receive parts in and use them to ship parts in.

Parts List

Parts listed in this section apply to only the Model 340 Workstation's SPU.

Table 6-1. Electrical Parts List

Ref. No.	New Part Number	Exchange Part Number	Description	Notes
1	0950-1985		Power Supply	
	2110-0010		Fuse, 5 A	
2	98571-63510	98571-69510	Processor board	
3	98268-63520	98268-69520	RAM board	
4a	98571-63530		ThinLAN board	
4b	98571-66534		AUI LAN board	
5	98571-63501		SPU backplane	
6a	98544-66571	98544-69571	340M Video board	Must remove backplate
6b	98548-66570	98548-69570	340MH Video board	Must remove backplate
6c	98549-66571	98549-69571	340C+ Video board	Must remove backplate
6d	98550-66572	98550-69572	340CH Video board	Must remove backplate
6e	98720-66582	98720-69582	340SRX LGB board	Must remove backplate
6f	98556-66570	98556-69570	Graphics accelerator board	
	98658-66501	98658-69501	SCSI interface card	
	98625-66502	98625-69502	HS HP-IB interface card	
7	98571-66506		DIO-I backplane	
8	98561-61601		Cable-DIO short	
9	98561-61602		Cable-DIO long	
	1252-2297		Terminator-SCSI Single Ended	
	98700-61603		RGB Video Cable	
	98730-61600		LGB I/O Cable	

Table 6-2. Static-Free Bags

Part Number	Size	Description
9222-0980	9-inch by 15-inch	Cushioned pouch, for processor/video boards

Table 6-3. Mechanical Parts List

Ref. No.	Part Number	Description
10	5001-9033	Case
11	35751-40001	Cover-front
12	09121-48303	Foot-molded
13	98571-44701	Board support
14a	0515-1851	Screw-machine
14b	0515-0372	Screw-machine
14c	0515-0219	Flathead screw (DIO/LGB)
15a	5001-9038	Panel-rear w/o DIO slot
15b	5001-9036	Panel-rear LGB
15c	5001-9037	Panel-rear DIO slot
16	3050-1291	Washer-shoulder
17	0160-6777	Capacitor-washer
18	3050-0604	Washer-flat

Ref. No.	Part Number	Description
19	0380-0643	Jackscrew-HPIB
20	2190-0409	Washer-Lock (RS-232)
21	1251-7812	Jackscrew-RS232
22	2190-0407	Washer-lock (HP-IB)
23	2190-0054	Washer-lock (RGB/LAN)
24	2940-0256	Nut-hex (RGB/LAN)
25	5001-9040	Bracket-DIO left
26	5001-9041	Bracket-DIO right
27	0403-0268	DIO-I card guide
28	5001-9042	Power supply plate
29	98571-84001	Voltage/current label
30	98571-84002	Regulatory label
31	98571-84003	Front panel label

Table 6-4. Miscellaneous Mechanical Parts

Part Number	Description
2190-0016	RCA video lock washer
2950-0001	RCA video hex nut
6960-0084	Plug-hole (LAN)
6960-0002	Plug-hole (RGB)
6960-0145	Plug-hole (Mono)
5001-9039	DIO-I Card Clip-RFI spring
5180-0409	DIO-I Cover Plate Clip-RFI spring
5001-9016	DIO-I Slot Cover Plate

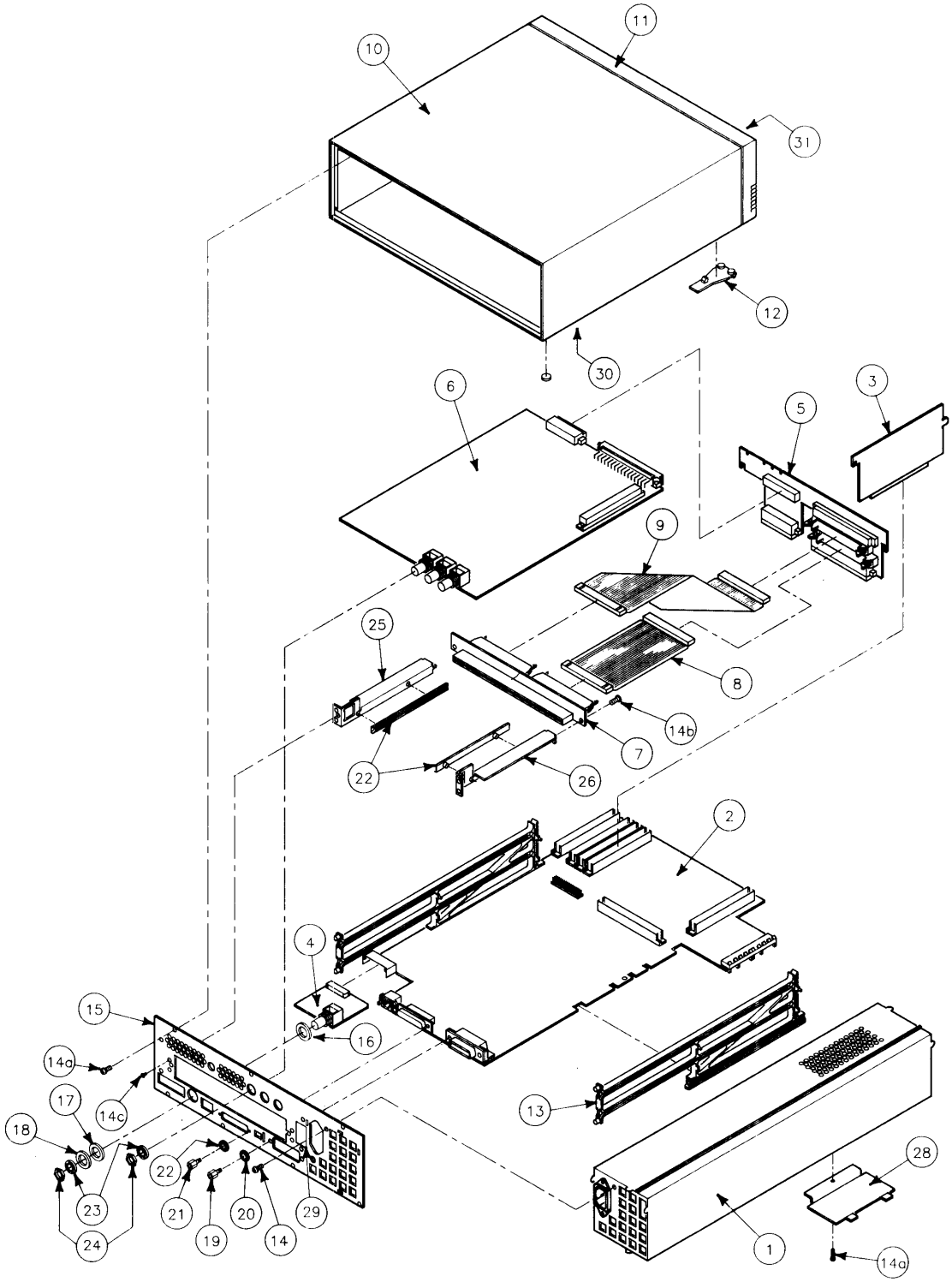


Figure 6-1. SPU Exploded View

References 7

Introduction

Information in this chapter should help you in various situations. The references include part numbers of many hardware documents for Model 340 Workstations.

Service Information Locator

In the front of this manual, and in the front of the Model 340 Workstation SPU's Service Handbook, is a Service Information Locator. It lists subjects and shows chapter numbers in other Hardware Support Documents that has the information.

Localized System Identification

Model 340 Workstations have keyboards and display characters localized for the language spoken and written in several countries. When an HP field office orders a workstation, a letter suffix is added to the field office ordering number to ensure the correct keyboard and character font is bundled with the hardware. When a replacement keyboard is ordered, the same localized system suffix would be ordered. Table 7-1 identifies the letter suffixes to product numbers for these systems.

For example, a system ordered from an HP Sales Office in Japan, the localized system suffix would be ABJ.

Table 7-1. Localized System Suffixes

Local Language	Localized System Suffix
U.S.A English	ABA
French Canadian	ABC
German	ABD
Spanish	ABE
French	ABF
Dutch	ABH
Katakana (Japanese)	ABJ
European ACSII	ABK
Canadian English	L
Latin	ABM
Norwegian	ABN
Swiss German	ABP
Swiss French	ABQ
Swedish	ABS
United Kingdom	ABU
Belgium	ABW
Finnish	ABX
Danish	ABY
Italian	ABZ
Taiwan	AB0
Korean	AB1
Kanji	ACA

Related Hardware Documentation

Hardware Support Documentation

Table 7-2. Hardware Support Documentation

Printed Pages Part Number	Manual Title
09000-90041	HP 9000 Series 200/300/500 Site Preparation Manual
98561-90020	Series 300 Configuration Reference Manual
98561-90634	Series 300 System Support Tape Users Manual
09800-90001	HP 9000 Series 200/300 Test Tools Manual
98571-90030	HP 9000 Series 300 Model 340 Workstation's SPU Service Information Manual
98571-90039	HP 9000 Series 300 Model 340 Workstation's SPU Service Handbook

Table 7-3. Video/Graphics Boards Service Information

Workstation Model	Part Number	Title
Model 340SRX	98720-90030	HP 98720A Graphics Display Station Hardware Support Document
Model 340CH	98550-90000	HP 98550A Graphics Interface Familiarization Guide
	98556-90000	HP 98556A 2D Graphics Interface Familiarization Guide
Model 340C+	98549-90000	HP 98549A Graphics Interface Familiarization Guide
Model 340MH	98548-90000	HP 98548A Familiarization Guide
Model 340M	98562-90030	Model 330/350 Service Information Manual

Installation Manuals/Notes

Table 7-4. Installation Manuals/Guides/Notes

Printed Pages Part Number	Manual Title
98563-90603	Model 340M Workstation Installation Guide
98563-90602	Model 340MH Workstation Installation Guide
98564-90605	Models 340C+ and 340CH Workstation Installation Guide
98573-90602	Model 340SRX Workstation Installation Guide
98561-90000	HP 9000 Series 300 Installation Reference
98013-90601	HP 98013A DIO Slot Upgrade Installation Note
98237-90601	HP 98235A and 98237A LAN Upgrade Installation Note
98268-90601	HP 98268A 4 Mbyte RAM Upgrade Installation Note
98561-90027	HP 9000 Series 300 Peripheral Installation Guide

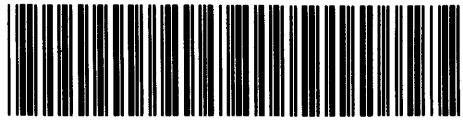
Document Binders

Table 7-5. Document Binders

Binder Part Number	Description
9282-1077	1-inch, 3-ring, 8.5 by 11-inch page size, 300 pages
9282-1078	1.5-inch, 3-ring, 8.5 by 11-inch page size, 350 pages
9282-1079	2-inch, 3-ring, 8.5 by 11-inch page size, 600 pages
9282-1080	2.5-inch, 3-ring, 8.5 by 11-inch page size, 750 pages
9282-1081	1-inch, 3-ring, 7 by 8.5-inch page size, 300 pages
9282-1082	1.25-inch, 3-ring, 7 by 8.5-inch page size, 450 pages
9282-1080	1.5-inch, 3-ring, 7 by 8.5-inch page size, 600 pages



HP Part Number
98571-90030
Microfiche No. 98571-99030
Printed in U.S.A. E1088



98571-90630
For Internal Use Only