Model 362/382 Controller and HP A2246A/A2247A Bus Expander

Service Handbook

HP 9000 Series 300 Controllers



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Manual updates may be issued between editions to correct errors or document product changes. To ensure that you receive these updates or new editions, you should subscribe to the appropriate product support service. See your Hewlett-Packard Sales Representative for details.

July, 1991 Edition 1

Safety Symbols and Conventions

The following conventions are used throughout this manual:

Note Notes contain important information set off from the text.

Caution Caution messages indicate procedures which, if not observed, could result in damage to equipment. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

Warning **Warning messages indicate procedures or practices which, if not observed, could result in personal injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.**

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Warning. This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

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Turvallisuusyhteenveto (Finland Only)

Laserturvallisuus
Luokan 1 Laserlaite
Klass 1 Laser Apparat
HP 9000 Model 382 tietokoneeseen voidaan asentaa muistilaitteeksi laitteensisäinen CD-ROM-levyasema, joka on laserlaite. Tällöin myös päälaitteena toimiva tietokone katsotaan laserlaitteeksi.

Kyseinen CD-ROM-livyasema on käyttäjän kannalta turvallinen luokan 1 laserlaite. Normaalissa käytössä levyaseman suojakotelo estää lasersäteen pääsyn laitteen ulkopuolelle.

HP 9000 Model 382 tietokoneen on tyyppihyväksynyt Suomessa laserturvallisuuden osalta Työsuojeluhallitus, Työsuojeluhallituksen hyväksyntänumero TSH 222/6019/90. Laitteiden turvallisuusluokka on määritetty valtioneuvoston päätöksen N:o 472/1985 ja standardin SFS-IEC 825 mukaisesti. Tiedot CD-ROM-levyasemassa käytettävän laserdiodin säteilyominaisuuksista:

Aallonpituus 780 nm
Teho 0,4 mW
Luokan 1 laser

Laser Safety Statement (For U.S.A. Only)

(For computers with a CD ROM disk drive installed.)

The CD ROM mass storage system is certified as a Class 1 laser product under the U.S. Department of Health and Human services (DHHS) Radiation Performance Standard according to the *Radiation Control for Health and Safety Act* of 1968.

This means that the mass storage system does not produce hazardous laser radiation. Since laser light emitted inside the mass storage system is completely confined within protective housings and external covers, the laser beam cannot escape from the machine during any phase of user operation.

Warning

- **Use of controls, adjustments, or performing procedures different from those specified in this manual may result in hazardous invisible laser radiation exposure. None of the mechanisms within the mass storage system contain customer or field-replaceable parts.**
- **The CD ROM drive becomes a Class 3B laser mechanism when disassembled. If the CD ROM drive is disassembled, exposure to the invisible laser beam and hazardous invisible laser radiation could result in blindness.** *Do NOT disassemble the CD ROM drive for any reason.*

Finding Service Information

To use the Service Information Locator, first find the type of information you need to reference in the left-hand column.Next, move to the right in that row to a referenced chapter number. Last, move up the column with the information's referenced chapter to the top. Across the top are manual titles and part numbers that have 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:** A.
- **Entire Manual:** All
- **Varies:** (Check Table of Contents or Index.)

In some cases, two or more references will be shown for a given information type. You should check all references to be sure you get the specific information you need.

For example, suppose you need to find out what the Repair Philosophy is for the Model 382 controller. Locating "Repair Philosophy" in the left-hand column, and moving to the right in that row, you'll notice that this information is in "Chapter 1" of a manual. At the top of this column is the manual's abbreviated title. Chapter 7 in this manual lists manual titles and part numbers for service information.

Manuals identified in this locator are abbreviated by their initials as listed in the following table.

Related Manual
Abbreviations and Manual Titles

Abbreviation	Manual Title(s)
SM	Service Manual
SHB	Service Handbook
PI	Product Installation Note/Manual/Guide
CG	Series 300 Configuration Guide
OG	Controller's Owner's or Getting Started Guide

Service Information Locator.

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1

Product Information

Controllers and Expanders

Features

HP 9000 Series 300 Model 362 and 382 controller systems are designed for the Measurement Automation markets using HP-UX or BASIC operating systems. They are object code compatible with most earlier Series 300 and Series 400 computers. Many capabilities of personal computers have been implemented. Key features include a low-cost 20 MIPS performance and a versatile I/O set including serial, and parallel interface ports. Optional internal mass storage devices include hard, flexible and CD ROM disk drives.

Two expanders permit adding accessory cards to increase system applications. An HP A2246A 4-slot DIO-I Bus Expander attaches to the top of either controller. An other expander, the HP A2247A 2-slot DIO-II expander may be used in the same way.

The controllers are similar to the HP A1314A, HP A1319A and HP A1324A R-Series Integrated Controllers. Similar architecture and assemblies are used.

Table 1-1 lists the features of the Model 362 and 382 Controllers.

Table 1-1. Model 362 and 382 Controller Features

Feature	Model 362 Controller	Model 382 Controller
CPU	MC68030 CPU @ 25 MHz	MC68040 CPU @ 25 MHz
Floating-point co-CPU	HP A2249A Co-CPU Upgrade	Part of MC68040
RAM	2 slots 2 to 16 Mbytes	4 slots; 8 to 32 Mbytes
Graphics	640 by 480 VGA color	1024 by 768 Hi-Res Color, or 640 by 480 VGA color
Standard interfaces	One RS-232 serial I/O port. One 25-pin HP Parallel port. One HP-IB IEEE 488 I/O port. One HP-HIL I/O port. Internal SCSI for internal drives. Speaker output.	One RS-232 serial I/O port. One HP Parallel port. One HP-IB IEEE 488 I/O port. One HP-HIL I/O port. Internal SCSI for internal drives. Speaker output.
Optional interfaces	HP A2256A SCSI Upgrade. HP A2255A LAN Board Upgrade.	HP A2256A SCSI Upgrade. HP A2255A LAN Board Upgrade.
Accessory card slots	One DIO-I card slot	One DIO-I card slot
Optional mass storage devices	HP A2252A 3.5-in flexible disk drive. HP A2253A CD-ROM drive. HP A2257A 52 Mbyte hard drive, BASIC only. HP A2258A 220 Mbyte hard drive. HP A2259A 420 Mbyte hard drive.	HP A2252A 3.5-in flexible drive. HP A2253A CD-ROM drive. HP A2257A 52 Mbyte hard drive, BASIC only. HP A2258A 220 Mbyte hard drive. HP A2259A 420 Mbyte hard drive.
Operating systems	BASIC.	HP-UX. BASIC BASIC-UX

Memory

User-installable RAM boards are used as follows:

- Model 362 controllers have two RAM slots and use one or two of the RAM boards that are also used in HP Vectra Personal Computers:
  - HP D2381A 2 Mbyte RAM board.
  - HP D2156A 4 Mbyte RAM board.
  - HP D22152 8 Mbyte RAM board.
- Model 382 controllers have four RAM slots and use these Error Checking and Correcting (ECC) RAM boards in pairs:
  - HP A2200A 4 Mbyte RAM board upgrade, two HP 98236A 2 Mbyte RAM boards.
  - HP A2201A 8 Mbyte RAM board upgrade, two HP 98236B 4 Mbyte RAM boards.
  - HP A2202A 16 Mbyte RAM board upgrade, two HP 98236C 8 Mbyte RAM boards.

System Graphics

Each controller's system board has built-in graphics circuits:

- Model 362 controller; 640 by 480 VGA compatible color graphics.
- Model 382 controller has one of two system boards with these graphics:
  - 1024 by 768 high-resolution color graphics.
  - 640 by 480 VGA compatible color graphics.

Bundled systems may include one of these monitors:

- HP D1182A 14-inch Color Monitor with Model 362 or 382 controller BASIC systems.
- HP A1497A 16-inch Color Monitor with Model 382 HP-UX controller systems.

Built-In Interfaces

Built-in interfaces have connectors on the rear panel. These interfaces are standard:

- HP-IB IEEE 488 Interface.
- Small Computer Systems Interface (SCSI) for internal drives only.
- RS-232 Serial Interface.
- HP Parallel Interface.
- Hewlett-Packard Human Interface Loop (HP-HIL).
- Speaker output.

Optional factory or customer-installed interfaces include:

- HP A2255A Local Area Network Interface Upgrade.
- HP A2256A External SCSI Interface Upgrade.

Internal Mass Storage Devices

Factory-installed and customer-installable mass storage devices include:

- HP A2252A 3.5-in flexible disk drive.
- HP A2253A CD-ROM disk drive.
- HP A2257A 52 Mbyte hard disk drive (BASIC only).
- HP A2258A 220 Mbyte hard disk drive.
- HP A2259A 420 Mbyte hard disk drive.

Most Hewlett-Packard HP-UX software will be distributed on CD ROM.

Keyboards

Table 1-2 lists the supported keyboards for operating systems on Model 362 and 382 controllers.

Table 1-2.
Supported Keyboards for Model 362 and 382 Controllers

Operating System	Model 362 Controller	Model 382 Controller
HP-UX		HP 46021B ITF Keyboard
BASIC	HP 46021B ITF Keyboard	HP 46021B ITF Keyboard
	HP 98203C Keyboard	HP 98203C Keyboard

Supported Accessory Cards

DIO-II Accessory Cards

The HP A2247A 4-slot bus expander accepts DIO-II accessory cards. These cards are also used on other Series 300 computers. Refer to Table 1-3 for the supported accessory cards.

Table 1-3.

DIO-II Accessory Cards in HP A2247A 2-Slot DIO-II Bus Expander	HP-UX Support?	BASIC Support?
HP 98297A Real Time Interface Card	Yes	No
HP 98638A 8-Port Multiplexer Card	Yes	No
HP 98641A RJE 2780/3780 Interface Card	Yes	No

DIO-I Accessory Cards

Model 362 and 382 controllers and the HP A2246A 4-slot bus expander accept DIO-I accessory cards. These cards are also used on other Series 300 and 200 computers. Refer to Table 1-4 for the supported accessory cards.

Table 1-4.

DIO-I Accessory Cards in Model 362 and 382 Controllers and HP A2246A 4-Slot DIO-I Bus Expander	HP-UX Support?	BASIC Support?
HP 98622A 16-Bit Parallel (GPIO) Interface Card	Yes	Yes
HP 98624A HP-IB (IEEE 488) Interface Card	Yes	Yes
HP 98625B High-Speed HP-IB (IEEE 488) Interface Card	Yes	Yes
HP 98626A RS-232-C Serial Interface Card	Yes	Yes
HP 98642A 4-Port Multiplexer Card	Yes	No
HP 98643A Local Area Network (IEEE 802.3) Interface Card	Yes	Yes
HP 98644A RS-232-C Serial Interface Card	Yes	Yes
HP 98658A Small Computer Systems Interface Card	Yes	Yes

Operating Systems

HP-UX

HP-UX 8.0 (or later) is supported only on the Model 382 Controller. It is preloaded on an internal hard disk drive. This allows users to start using their systems immediately after hardware installation; HP-UX does not have to be installed on-site. Table 1-5 lists the HP-UX operating systems and languages for the Model 382 controller.

Table 1-5. Model HP-UX Operating Systems and Languages

Operating system:	HP-UX 8.0 or later. HP-UX complies with the UNIX System V Interface Definition X/Open and POSIX Specifications and will be fully compliant with Operating Systems Foundation (OSF).
Window system:	X Window System Version 11 (X11) Release 4.
Languages:	C, Pascal, FORTRAN, Ada, Common LISP, C + +.

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.

Hardware Support

Field Repair Philosophy

Field Repair Philosophy for the Model 362 and 382 controllers, HP A2246A and HP 2247A Expanders 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. Component parts required for certain configurations are available. Other component parts are not available.

Some assemblies may be exchanged for rebuilt ones. Other assemblies are only available as new ones. Refer to Chapter 8, or the *Model 362/682 Controller and HP 2246/7A Bus Expander 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 controller products with Hewlett-Packard approved parts, accessories, peripherals, operating systems and application programs are supported by Hewlett-Packard. Any controller product 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.

Repair Services

Hewlett-Packard provides repair services in two ways:

- On-Site Repair.
- Customer Repair.

For On-Site Repair, an HP Customer Engineer goes to the customers site, troubleshoots, and repairs the hardware to the assembly level. The defective assembly is replaced with a new or rebuilt assembly. This service is available through a service contract or a time-and-materials basis.

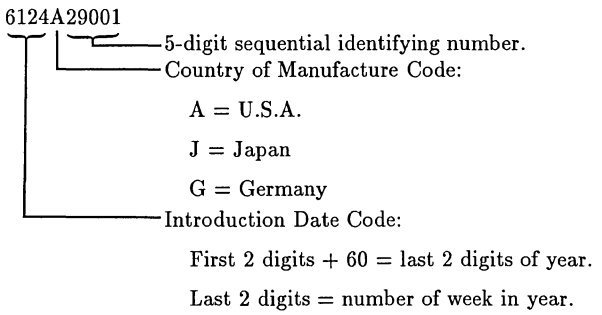
Customers have the option of repairing their own HP controller products. Contact your nearest Hewlett-Packard Sales and Service Office for information concerning service training, special tools and test equipment, and spare parts.

Hardware Support Services

There are many hardware support options available, from utilizing on-site maintenance groups to buying full support from the local sales office. Please contact your local Hewlett-Packard Sales and Service Office for these services.

Product Identification

On the bottom of each product, a label lists the products serial number. Its information can be interpreted as shown below for an example serial number 6124A29001:



2

Environmental, Installation and Preventive Maintenance

Technical Information

Note Technical information listed herein should not be interpreted as specifications. Official specifications are listed in the HP 9000 Model 362 and 382 Controller Technical Data Sheet.

Environmental

	Diskless	With Internal Drives
Operating temperature	0° - 55° C	5° - 40° C
Non-operating temperature	−40° - 70° C	−1-° C - 60° C
Heat dissipation	263 BTU	263 BTU
Humidity (non-condensing); operating	15 - 95%	20 - 80%
Humidity (non-condensing); non-operating	5 - 95%	10 - 90%
Maximum altitude, operating (to 47°C):	4570 metres (15,000 ft.)	3048 metres (10,000 ft.)
Maximum altitude, non-operating:	15 240 metres (50,000 ft.)	15 240 metres (50,000 ft.)

Electrical

Line voltage	100 - 120 V ac 48-66 Hz
	220 - 240 V ac 48-66 Hz
Model 362 Controller maximum current	1.27 A; 100 - 120 V ac
	0.78 A; 220 -240 V ac
Model 382 Controller maximum current	1.27 A; 100 - 120 V ac
	0.78 A; 220 -240 V ac
HP A2246A Expander maximum current	1.0 A; 100 - 120 V ac
	0.5 A; 220 - 240 V ac
HP A2247A Expander maximum current	1.0 A; 100 - 120 V ac
	0.5 A; 220 - 240 V ac
Model 362 Controller Power consumption	76 watts; 100 - 120 V ac
	80 watts; 220 - 240 V ac
Model 382 Controller Power consumption	76 watts; 100 - 120 V ac
	80 watts; 220 - 240 V ac
HP A2246A Bus Expander Power Consumption	56 watts; 100 - 120 V ac
	35 watts; 220 - 240 V ac
HP A2247A Bus Expander Power Consumption	56 watts; 100 - 120 V ac
	35 watts; 220 - 240 V ac

Regulatory

VDE Level:	B
FCC Class:	A
VCCI Class:	1
Safety:	UL, CSA, IEC

Physical

Controllers

Height:	102 mm (4-inches) with feet attached
	89 mm (3.5-inches) without feet
Width:	419 mm (16.5-inches)
Depth:	432 mm (17-inches)
Weight:	9.1 kg (20 pounds) without internal drives, excluding accessory card
	10.9 kg (24 pounds) with two internal drives, excluding accessory card

Expanders

Height:	102 mm (4-inches) with feet attached
	89 mm (3.5-inches) without feet
Width:	419 mm (16.5-inches)
Depth:	432 mm (17-inches)
Weight:	HP A2246A, 8.6 kg (19 pounds), excluding accessory cards
	HP A2247A, 9.1 kg (20 pounds), excluding accessory cards

Installation and Getting Started

Controller Systems and Products

Refer to Chapter 10 for documentation for installation and getting started with the Model 362 or 382 Controller, HP A2246A or A247A Expanders, and their controller systems.

Preventive Maintenance

There is no preventive maintenance for these products.

3

Configurations

Introduction

Several configuration situations exist with the Model 362 and 382 controllers. Each is explained in these sections:

- Controller System Bundles
- Keyboard Differences
- Boot ROM Functions
- Finding HP-UX SCSI Bus Addresses
- Internal Mass Storage Devices
- External SCSI Cables
- Supported Accessory Cards
- Graphics Configuration
- LAN Type

System Bundles

At introduction, controllers are shipped in several system bundles. These bundle configurations may change and some may be deleted or added. Table 3-1, Table 3-2 and Table 3-3 lists the introduction system bundles. Some bundles may include expanders, LAN and/or external SCSI interfaces.

Note HP A1097A/B 16-inch Color Monitors are not available as stand-alone products. Each is shipped with its system bundle. Corporate Price Lists do not include these monitors.

Up to 24 Mbytes of RAM can be factory installed; users must install any additional RAM themselves. Users may contact Hewlett-Packard and have the additional RAM installed.

Table 3-1. Model 382 Controller HP-UX System Bundles

Bundle Product Number	HP-UX Installed?	RAM	Graphics	Monitor	Mass Storage
HP A1474A	Opt.	4 MB	VGA	None	Optional
HP A2250A	Opt.	4 MB	VGA	HP D1182A 14-in VGA	Optional

Table 3-2. Model 362 and 382 Controller BASIC System Bundles

Bundle Product Number	RMB-UX Installed?	RAM	Graphics	Monitor	Mass Storage
HP A2241A	No	4 MB	VGA	None	Flex Drive
HP A2242A	Yes	8 MB	VGA	HP D1182A 14-in. VGA	Optional
HP A2245A	No	8 MB	Hi-Res	HP A1497A 16-in.	420 MB

Table 3-3. Model 382 Controller HP VEE-TEST System Bundle

Bundle Product Number	HP V-TEST Installed?	RAM	Graphics	Monitor	Mass Storage
HP A2243A	Opt.	16 MB	Hi-Res	HP A1497A 16-in.	Optional

Keyboard Differences

The Models 362 and 382 support two keyboards:

- HP 46021B ITF Keyboard
- HP 98203C Keyboard

Key Differences

The three keyboards available for the Models 362 and 382 controllers have significantly different key layouts and key names. The function of each key is implicit with its name. The HP 98203C keyboard was designed for use with the BASIC operating system while the ITF keyboard was designed as a general purpose keyboard. The keyboards are all HP-HIL keyboards.

The most important difference is the names for the return or enter key. On the HP 46021A keyboard, the key is [Return] and on the HP 98203C the key is [ENTER]. These keys perform the same function and will by identified in this document with the symbol [Return][ENTER] to emphasize that name difference. To complete a statement or command, just press either the [Return], [ENTER] or [Enter] key.

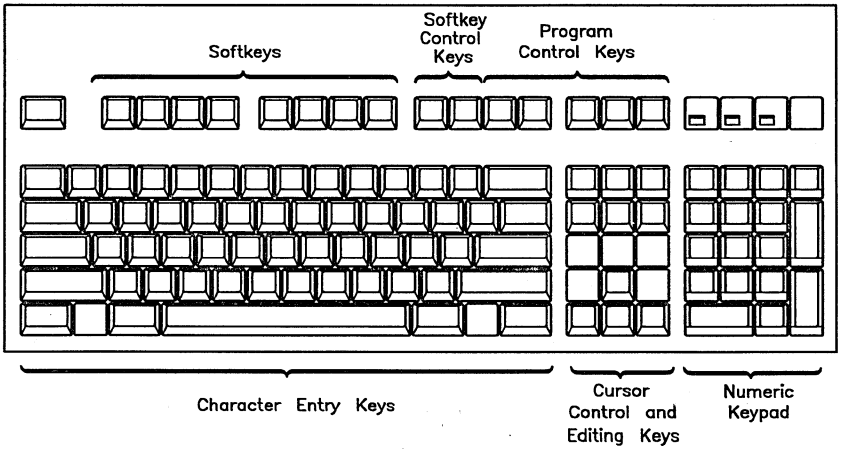


Figure 3-1. HP 46021B ITF Keyboard

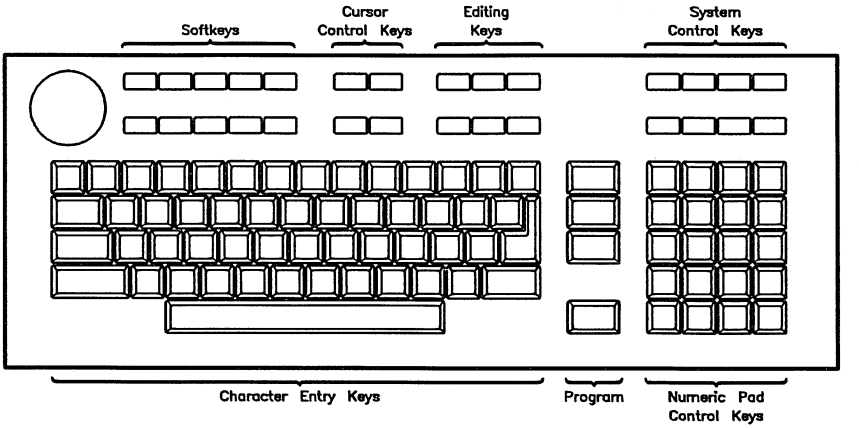


Figure 3-2. HP 98203C Keyboard

Boot ROM Functions

Configuration Control Mode

Configure Control Mode is run and controlled by your controller's Boot ROM. You do not need to have an operating system installed to use Configuration Control Mode. To enter Configuration Control Mode, do the following:

1. Turn on the monitor and the controller. The power-up messages will appear.
2. As soon as you hear two beeps or the line *HP-HIL.Keyboard* appears in the messages, press the Space Bar to prevent an operating system from booting.
3. Next, enter C Return/ENTER to enter Configuration Control Mode:
4. You should see this menu appear in the power-up display's upper right-hand corner:

```
 Configuration Control
Keys Control Class
----------------------------
1  I/O Configuration
2  Auto System Selection


A  Abort without changes
----------------------------
Type [key] RETURN ?
```

5. You are now in Configuration Control Mode.

Configuration Control Mode Menu

You have three choices on the Configuration Control Menu:

- Press 1 and enter Configurable Interface Mode.
- Press 2 and enter OS Selection Mode.
- Press A and return to the boot up process

Configuring the Internal Interfaces

Press [1] to configure the internal I/O interfaces.

If you see error messages, refer to the section in this chapter titled 'Configuration Error Messages.'

The Configurable Interface Menu replaces the Configuration Control Menu and looks similar to the following.

```
   Configurable Interfaces
Keys Interface  Select Code
--------------------------
  1  LAN               21
  2  SCSI              14
  3  HP Parallel       12
  4  RS-232             9
  5  HP-IB

  N  store New values
  D  store Default values
     (then cycle SPU power)
  A  Abort without changes
--------------------------
Type [key] RETURN ?
```

The order that interface identifiers appear and their respective number keys may be different on your controller. Only interfaces that are configurable from the Boot ROM's Configuration Control Mode will be listed. The Select Code currently assigned to the interfaces is shown in the column marked "Select Code".

- To change the configuration of an internal face, first press the appropriate identifying number. In our example, press [1] for LAN, [2] for SCSI, [3] for HP Parallel, [4] for RS-232, and [5] for HP-IB. Don't forget to press [Return]/[ENTER] to complete the command. For the HP-IB, there is no select code nor interrupt level, so the only change can be to make the internal HP-IB the System Controller.
- Make the appropriate changes on the interface menu presented.
- To store the new values, press [N].

- To restore the original default values, press [D].
- To abort the process, leaving the values unchanged, press [A].
- Pressing [N], or [D], or [A] returns the system to the boot up process.

Internal Interface Default Values

Each of your controller's several internal interfaces is factory set to a default value. Table 3-4 lists the default configurations.

Table 3-4. Built-In Interface Default Configurations

Built-In Interface	Function	Default Configuration	Options
SCSI	Select Code	14	0 to 31
	Interrupt Level	3	3 to 6
	Bus Address	7	0 to 7
	Parity	Yes	No
LAN	Select Code	21	0 to 31
	Interrupt Level	5	3 to 6
HP Parallel	Select Code	12	0 to 31
	Interrupt Level	3	3 to 6
HP-IB	Select Code		n/a
	Interrupt Level		n/a

Example Interface Configuration

In this example, the SCSI interface will be reconfigured. Other interfaces use similar menus. To select and configure the SCSI Interface, do the following:

Start from Configuration Control Mode. That means the following Configuration Control menu is shown in your display's upper right-hand corner:

```
   Configurable Interfaces
Keys Interface  Select Code
--------------------------
  1  LAN               21
  2  SCSI              14
  3  HP Parallel       12
  4  HP-IB              9

  N  store New values
  D  store Default values
     (then cycle SPU power)
  A  Abort without changes
---------------------------
Type [key] RETURN ?
```

Press (2) (Enter)/(Return) to get the SCSI interface menu:

The Configurable Interfaces Menu gets replaced with this SCSI Menu:

```
    SCSI
Key Feature          Value
-------------------------
 1  Select Code         14
 2  Interrupt Level      3
 3  Parity               Y
 4  Bus Address          7

 X  to eXit menu
-------------------------
Type [key] RETURN ?
```

Use the specified keys to change the features listed. To change the Select Code, press [1], or the change the bus address, press [4]. When you select a value to change, the prompt line changes. For example, to change the SCSI's Select Code, do the following:

Press [1] [Return]/[ENTER]

Then the command line changes to:

```
1   Select Code        14
 used select codes are :
12 14 15 21
Type 0.. 31 except used RETURN ?
```

- The select code function line shows the current information.
- Select codes already used and not available and are listed in the third line.
- The prompt line is next.

To change the SCSI select code to 23, enter *23* [Enter]/[Return]. The display would not look like the following:

```
1   Select Code        23
 used select codes are :
12 15 21 23
Type 0.. 31 except used RETURN ?
```

Other interfaces and features would be selected and changed the same way. After you have made interface configuration changes your controller needs, exit the interface menu by entering [X] [Enter]/[Return]. The Configurable Interfaces Menu will re-appear.

Select any other interface and configure it according to your application needs.

After configuring your controller's internal interfaces as required store the new interface values in memory by entering [N] [Enter]/[Return].

The system will re-boot with the new values.

Auto System Selection Mode

Most users will leave this feature in the default setting, and can skip this section. To see if this feature is for you, ask yourself the following two questions:

1. Is my controller connected to a network that contains multiple operating systems?
2. Do I have a need to auto boot from a different operating system than the other people on the network?

Skip this section if you answered 'No' to either question. If you answered 'Yes' to both questions, follow these instructions to select your specific operating system to boot automatically.

1. Enter Auto System Selection Mode by entering (2) (Enter)/(Return) from the Configuration Control Mode.
2. The following menu will appear in the upper right corner:

```
  Auto System Selection
Keys  Option          Status
---------------------------

1  Scan for System      Y
2  Selected System      N
3  Store Selected Sys.  N

E  Execute
A  Abort without changes
---------------------------
Type [key] RETURN ?
```

Note Keep this perspective in mind: When the Auto System Selection screen is selected, what you see first is the way the controller is currently set. As you change different key options, the menu shows what will be, as soon as you execute the changes by pressing (E).

The Menu

While reading this section, remember that "Key" and "line" are used interchangeably; that is, you press [1] to select line 1. The letter *Y* means YES and *N* means NO.

- Default is Key 1 = Y, Key 2 = N and Key 3 = N.
- Pressing [1], [2], or [3] will change the way the autoboot selects and stores an operating system. Selecting a key also causes the Status value to toggle between Y and N.
- Pressing [E] executes the selected changes as the operating system re-boots.
- Pressing [A] will ignore any changes just made, and will re-start the Boot ROM using the previous setting.

Menu Options

- Key 1 = Y tells the controller to boot the first bootable operating system it finds.
- Key 2 = Y tells the controller to boot a specific operating system.
- Key 3 = Y causes the Boot ROM to store the specified operating system path in the EEPROM. This allows the selected system to auto-boot unattended.

Note that some key combinations are valid but others are either invalid or meaningless. The following are the valid combinations:

- Key 1 = Y and Key 2 = Y;

  This will cause the Boot ROM to try auto-booting from the selected system once. If the selected system can not be accessed because its power switch is off or data cable is not connected, then the first bootable system will be booted. This is the most useful selected system option.

- Key 1 = N and Key 2 = Y;

  This will cause the Boot ROM to try auto-booting from the selected system only, until it boots.

- Key 1 =Y and Key 2 = N;

This default mode causes the Boot ROM to boot the first bootable system it finds. No selected system specified.

Here are the invalid or meaningless combinations. The bootROM will toggle another line in order to produce a usable combination.

- Key 1 = N and Key 2 = N;

  Key 1 or Key 2 must = Y. Trying to set both to N is not allowed and the opposite key will be automatically toggled.

- Key 2 = Y and Key 3 = N;

  Changing Key 2 to Y will automatically set Key 3 to Y. This means a new system is to be selected, and Key 3 = Y says to store that new system in the EEPROM.

System Selection Example

Suppose that the operating system which you wish to select for automatic booting is labeled 2H in the list of bootable operating systems displayed when you do an attended boot(press SPACE before an operating system is booted). Furthermore, you want the controller to try to boot the system once, and if it is not accessible, to scan for and boot the default system.

This situation is listed as number one in the above list of valid combinations. To set it up, follow these steps:

1. Toggle Key 2 status to Y by entering 2 Enter/Return. Key 3 status will automatically toggle to Y.
2. Check to make sure Key 1 = Y.
3. Press: E Enter/Return

   At this point the screen clears and the system starts re-booting. When `HP-HIL.Keyboard` is displayed or the beeper sounds, press Space Bar to invoke Attended Mode. Wait until all the devices are listed on the left and all bootable operating systems are listed on the right. The display now looks almost identical to an attended mode power-up display. The one difference is an additional message on the next to bottom line indicating that the Boot ROM will store the selection.

4. Select the number-letter combination listed in front of the operating system you want to select. For our example, enter 2 H Enter/Return. The Boot ROM stores the selected system path information in the EEPROM while clearing the screen and re-booting. The selected system will now be booted.

This completes the process, and the selected system will continue to boot until a different unattended system is selected.

Error Messages

When you turn on your controller, one error condition is related to the internal interface configurations. If an error message appears, such as:

```
Configuration EEPROM Failed

Configure Mode Failed
```

one of several conditions may exist. A hardware problem with the Boot ROM or its associated circuits probably occurred. Refer to Table 3-5 for possible error messages you may see when entering Configuration Mode.

If the Boot ROM or EEPROM has problems after you enter one of the configuration commands, the mode lines display one of the error messages listed in Table 3-6.

Table 3-5. Configuration Mode Entry Error Messages

Error Message	Meaning and What To Do
(No error message) Cannot enter Configuration Mode.	If Configuration Mode does not start and no error message appears, a hardware failure probably occurred.
`Configure Mode Failed`	One or more of these situations exists:
`Configuration EEPROM Failed`	All of the interface values have been set to their default (factory) values. Some default and some changed values have been set. All the interface values have been set to their changed values. Some minor error occurred that should not affect the interface's configurations. Check your controller's Boot Mode Selection and Interface Configuration Modes and verify they are correct for your application.
`EEPROM Has Bad Information`	Configuration Mode started, main menu may appear, but something failed. Try again.
`EEPROM Load Section Missing`	Could not load new configuration data. Hardware failure.
`EEPROM Defaults Section Missing`	Default configurations could not be found. Hardware failure.
`Too much data to save`	Too many interfaces for EEPROM to manage. Reconfigure controller with fewer interfaces.

Table 3-6. Configuration Mode Exit Error Messages

Command	Error Message	Meaning and What To Do
N or D	`Too many configuration saves`	More than 64 000 saves were tried. Unlikely to occur.
N or D	`Can not save new configuration`	Something prevented saving the new configuration. Hardware failure.
N or D	`EEPROM can not save information`	EEPROM may not save any or all of the new configuration information. Hardware failure.
A	(No message should appear)	No error messages should appear when you abort configuration mode and reset your controller.

Finding the HP-UX SCSI Bus Addresses

Your system administrator should know what addresses your controller uses for each of its SCSI devices. Each SCSI device address must be unique. When adding a SCSI device, if the currently used values are not know, you can find out what bus addresses are already used by doing the following.

1. Type the 'SCSI Program' shown on the next page into a file called `check.c`:
2. Compile this program with the command: *cc check.c -o check* (Return)/(ENTER)
3. Run the program with root privileges, specifying the SCSI interface select code after the program name; e.g. `./check 14`. This will check select code 14.

HP-UX Program for SCSI Addresses

```
#include <stdio.h>
#include <fcntl.h>
#include <errno.h>
#include <sys/stat.h>
#include <sys/sysmacros.h>

main(argc, argv)
    int argc;
    char **argv;
{
    int  fd, ba, sc;
    char *tmpfile = tempnam("/tmp", "scsi");
    mode_t fmode = S_IFCHR | S_IRUSR | S_IRGRP | S_IROTH;
    /* check for an argument */
    if (argc != 2 || (sc = strtol(argv[1], (char **)NULL, 0)) == 0) {
       fprintf(stderr, "usage: %s select_code\n", *argv);
       exit(1);
    }
    /* walk through bus addresses 0 through 7 */
    for (ba = 0; ba < 8; ba++) {
      /* make the device file */
      if (mknod(tmpfile, fmode, makedev(47, makeminor(sc, ba, 0, 0))) < 0) {
          perror("mknod");      /* exit if we can't make the device file; */
          exit(1);         /* probably being run by non-root user    */
      }
      /* open device, or check for other than "no such device or address" */
      if ((fd = open(tmpfile, O_RDONLY)) >= 0 || errno != ENXIO) {
          printf("Device at select code %d, bus address %d\n", sc, ba);
          close(fd);
      }
      unlink(tmpfile);    /* remove the device file */
      }
  exit(0);
}
```

Internal Mass Storage Configurations

Hard Disk Drive Configurations

Caution Although the device is well-protected from physical shock when installed in the computer, it is very easily damaged when separate. Avoid dropping or striking the device. Handle it gently at all times.

Figure 3-3 shows you the configuration jumper locations. Jumpers and their settings are explained in Table 3-7.

Note the jumpers in the back of the drive are installed as follows:

- Jumpers installed on pins = "in."
- Jumpers removed from pins = "out."

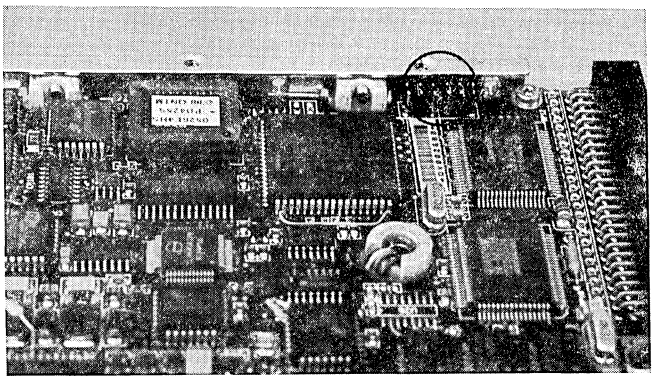


Figure 3-3. Hard Disk Drive Configuration Jumper Locations

Table 3-7. Hard Disk Drive Configuration Jumper Functions

Jumper Label	Function
SS	Self-Seek; In = disabled. Out = enabled. (Default) Drive self-tests at turn-on. LED is ON during test, OFF after self-test passes. Flashes if an error is detected.
EP	Enable Parity In = enabled. Out = disabled. (Default) Controls parity checking of data on SCSI bus.
WS	Wait/Spin In = enabled. Requires a stop/start unit command to spin drive motor. Out = disabled. (Default) Drive motor starts automatically at turn-on and is ready within 20 seconds.
A0, A1, A2	SCSI Bus Address; A0 is least significant bit. Shipped with address 6 set (jumpers on A1 and A2).

Self-Seek, Parity and Wait/Spin Jumpers

Hard disk drive jumpers SS, EP, and WS are factory set to the 'Out' condition; no jumpers installed. If you want to change these functions, use a pair of needlenose pliers to remove and/or install jumpers as required.

SCSI Bus Address Jumpers

Your hard disk drive must be set to a bus address that is different from other SCSI device bus addresses already used. Use a pair of needle-nose pliers to remove and install the configuration jumpers. Set your drive's SCSI configuration jumpers for the SCSI bus address it will use.

Refer to Table 3-8 for bus addresses and their jumper settings. For example, if you want to set your hard disk drive's address jumpers to address 6, you would set:

- Jumper A0 out.
- Jumper A1 in.
- Jumper A2 in.

Table 3-8. Hard Disk Drive SCSI Bus Address Jumper Settings

SCSI Address	Jumper A2	Jumper A1	Jumper A0
0	Out	Out	Out
1	Out	Out	In
2	Out	In	Out
3	Out	In	In
4	In	Out	Out
5	In	Out	In
6	In	In	Out

Flexible Disk Drive Configurations

Caution Although the device is well-protected from physical shock when installed in the computer, it is very easily damaged when separate. Avoid dropping or striking the device. Handle it gently at all times.

Figure 3-4 shows you the configuration jumper locations. Jumpers and their settings are explained in Table 3-9.

Note the flexible disk drive jumpers are installed as follows:

- Jumpers installed on pins = "in."
- Jumpers removed from pins = "out."

Caution Your flexible disk drive jumpers are used opposite to jumpers in your hard disk drives. For example, the three flexible disk drive bus address jumpers when set to bus address 0 are all 'in.' The same hard disk drive address jumpers set to bus address 0 are all 'out.'

Note Jumpers 0, 2DS and A through F are factory set and must not be changed.

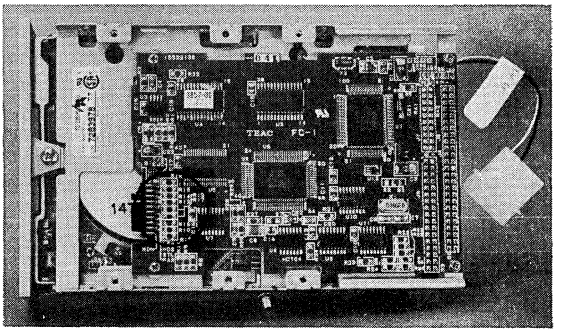


Figure 3-4. Flexible Disk Drive Configuration Jumper Locations

Table 3-9.
Flexible Disk Drive Configuration Bottom Jumper Functions

Jumper Label	Function
ID2, ID1, ID0	SCSI Bus Address jumpers. ID2 is most significant bit. Default settings: Address 3. ID2 = out; ID1 = in; ID0 = in.
T/S	 In = Out =
EJC	Eject mode In = Electrical eject mode (not used). Out = (default) Manual eject mode.
LEV	Pin 2 output of the density is enabled. In = enabled. (Default) Out = disabled.
HDS	In = enabled. (Default) Out = disabled.
STL	In = enabled. (Default) Out = disabled.
PAR	Enable Parity In = enabled. (Default) Controls parity checking of data on SCSI bus. Out = disabled.
MON	Motor ON In = disabled. Out = enabled. (Default) Drive motor is not turned on when the computer is turned on.

Function Jumpers

Only the SCSI address jumpers should be changed. You should not have to change the function jumpers. They should be left in their default condition.

SCSI Bus Address

Your flexible disk drive must be set to a bus address that is different from other SCSI device bus addresses already used. The factory default setting is address 3. Use a pair of needle-nose pliers to remove and install the configuration jumpers. Set your drive's SCSI configuration jumpers for the SCSI bus address it will use.

Refer to Table 3-10 for bus addresses and their jumper settings. Note that jumper ID 0 is next to the edge of the printed circuit board. For example, if you want to set your hard disk drive's address jumpers to address 5, you would set:

- Jumper ID 0 out.
- Jumper ID 1 in.
- Jumper ID 2 out.

Table 3-10.
Flexible Disk Drive SCSI Bus Addresses and Jumper Settings

SCSI Address	Jumper ID 2	Jumper ID 1	Jumper ID 0
0	In	In	In
1	In	In	In
2	In	In	Out
3	In	Out	In
4	Out	Out	Out
5	Out	In	In
6	Out	In	Out

CD ROM Disk Drive

Note CD ROM drives are only supported with the HP A2256A SCSI External Interface Upgrade installed. If no external SCSI devices are used in the system, a terminator must be plugged into the rear panel SCSI connector.

Figure 3-5 shows you the configuration jumper locations. Jumpers and their settings are explained in Table 3-11. Note the jumper positions that represent an 'out' and 'in.'

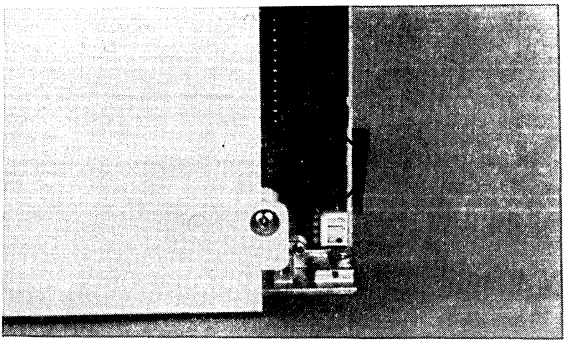


Figure 3-5. CD ROM Configuration Jumper Locations

Table 3-11. CD ROM Drive Configuration Jumper Functions

Jumper Label	Function
ID1,ID2,ID4	SCSI ID Address; Jumper ID1 is least significant bit. Shipped with address 2 set (default); jumper only on ID2
PRTY	Parity checking; Out = Disabled, In = Enabled.
PRV/ALW	Media removal; Out = eject button enabled, In = eject button ignored.
TEST	Test; for factory use only.
TERM	Termination power source; In = from drive, Out = from bus

SCSI Bus Address

Your CD ROM drive's SCSI ID jumpers must be set to the bus address it will use. Your CD ROM has bus address 2 factory set. Set your CD ROM's SCSI

ID configuration jumpers for SCSI bus address you will use in the range of 0 through 6. Refer to Table 3-12 for bus address settings

Table 3-12. CD ROM SCSI ID Addresses and Switch Settings

SCSI Address	ID1	ID2	ID4
0	0	0	0
1	1	0	0
2	0	1	0
3	1	1	0
4	0	0	1
5	1	0	1
6	0	1	1
7	1	1	1

Parity

You should leave the PRTY jumper in to enable parity checking of data.

Audio Use

'Audio Only Mode' is not supported.

External SCSI Cables

The SCSI cables connected to external devices have limits on their length. Cables must meet certain type and length requirements.

- SCSI Cable Restrictions.
- Supported SCSI Cables.
- Determining Controller SCSI Cable Lengths

SCSI Cable Rules

Rules for external SCSI cables are:

- Only SCSI cables approved by Hewlett-Packard are supported.
- Use the shortest possible cables.
- All internal and external SCSI devices must be counted. A total of 7 devices are allowed.
- Although up to seven SCSI disk drives (hard and magneto-optical), a limit of five disk volumes per controller may be mounted on the operating system at any one time.
- When adding third party SCSI devices, total SCSI cable length is limited to 4.6 meters (15 feet). Both controller and device internal and external cable length are included.

Note When using external SCSI cabling, you must use an active SCSI terminator at the last external device on the SCSI bus. Use only HP K2291 terminators insure reliable system operation.

Supported Accessory Cards

DIO-I Accessory Cards

The HP A2247A 4-slot bus expander accepts DIO-II accessory cards. These cards are also used on other Series 300 controller. Refer to Table 3-13 for the supported accessory cards.

Table 3-13.

DIO-II Accessory Cards in HP A2247A 2-Slot DIO-II Bus Expander	HP-UX Support?	BASIC Support?
HP 98297A Real Time Interface Card	Yes	No
HP 98638A 8-Port Multiplexer Card	Yes	No
HP 98641A RJE 2780/3780 Interface Card	Yes	No

Supported DIO-I Accessory Cards

Model 362 and 382 controllers and the HP A2246A 4-slot bus expander accept DIO-I accessory cards. These cards are also used on other Series 300 and 200 controller. Refer to Table 3-14 for the supported accessory cards.

Table 3-14.

DIO-I Accessory Cards in Model 362 and 382 Controllers and HP A2246A 4-Slot DIO-I Bus Expander	HP-UX Support?	BASIC Support?
HP 98622A 16-Bit Parallel (GPIO) Interface Card	Yes	Yes
HP 98624A HP-IB (IEEE 488) Interface Card	Yes	Yes
HP 98625B High-Speed HP-IB (IEEE 488) Interface Card	Yes	Yes
HP 98626A RS-232-C Serial Interface Card	Yes	Yes
HP 98642A 4-Port Multiplexer Card	Yes	No
HP 98643A Local Area Network (IEEE 802.3) Interface Card	Yes	Yes
HP 98644A RS-232-C Serial Interface Card	Yes	Yes
HP 98658A Small Controller Systems Interface Card	Yes	Yes

Graphics Configuration

There are two jumpers on the system board for on-board graphics configuration. The jumpers are marked `COLOR` and `ENABLE`. The default condition is with both jumpers nearest the markings. Moving the `ENABLE` jumper causes the on-board graphics circuitry to be disabled, allowing a supported graphics board to be used in the DIO slot. Only the `COLOR` graphics type is supported on Model 362 and 382 controllers. Refer to Figure 3-6 for jumper positions.

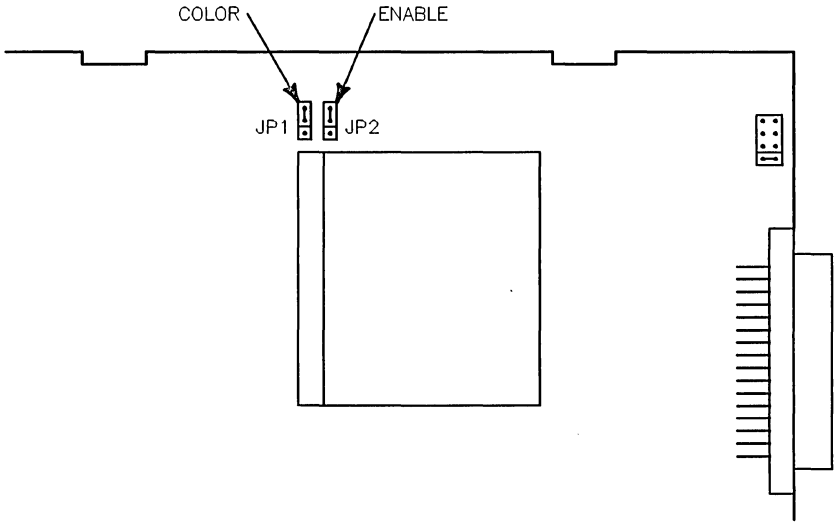


Figure 3-6. System Board Graphics Jumpers

LAN Type

A jumper on the top of the LAN board selects the LAN type. Figure 3-7 shows the two positions.

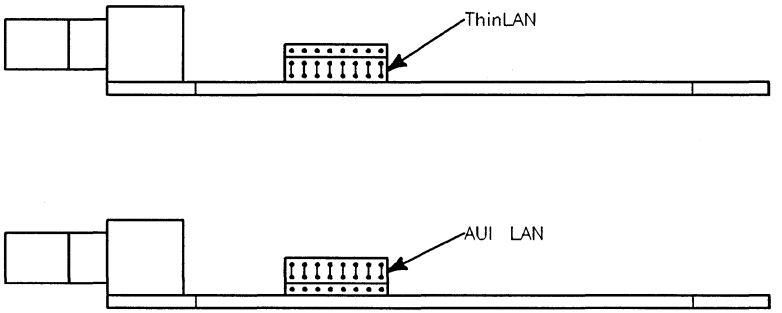


Figure 3-7. LAN Board Configuration Jumper

4

Troubleshooting

Introduction to Troubleshooting

Troubleshooting information and procedures for the Model 362 and 382 controllers is divided into these sections:

- Introduction to Troubleshooting
- Troubleshooting Procedures.
- Checkout Procedures.

Analytic Troubleshooting

Troubleshooting this controller 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 system occurs, remember these questions and get the answers to each of them.

Troubleshooting Procedures

Several levels of operations exist within Model 362/382 controllers. Each level has diagnostic or error-reporting capabilities:

- The Boot ROM level has:
  - Self Tests.
  - Test Mode.
- Series 300 Test Tools have:
  - Controller Tests.
  - System Functional Tests.
- HP-UX has ce.utilities.

Troubleshooting Flowcharts

This section provides flowcharts that route you through a series of standard troubleshooting procedures for Model 362/382 controllers.

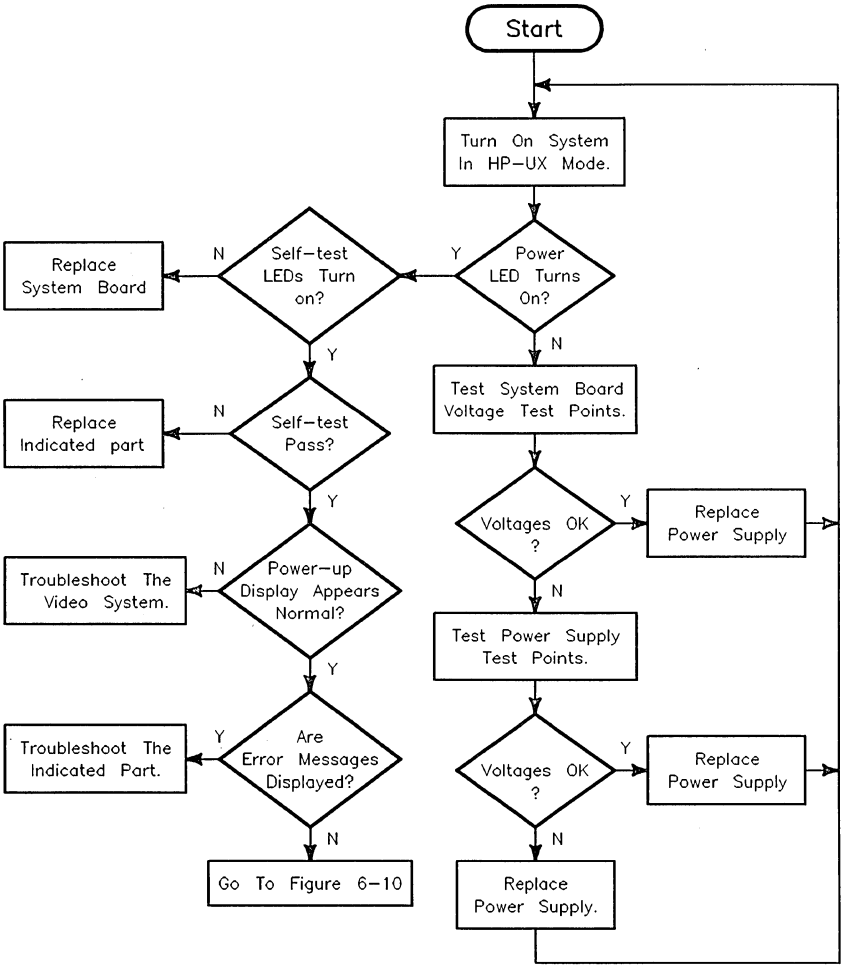


Figure 4-1. Troubleshooting: Main Flowchart

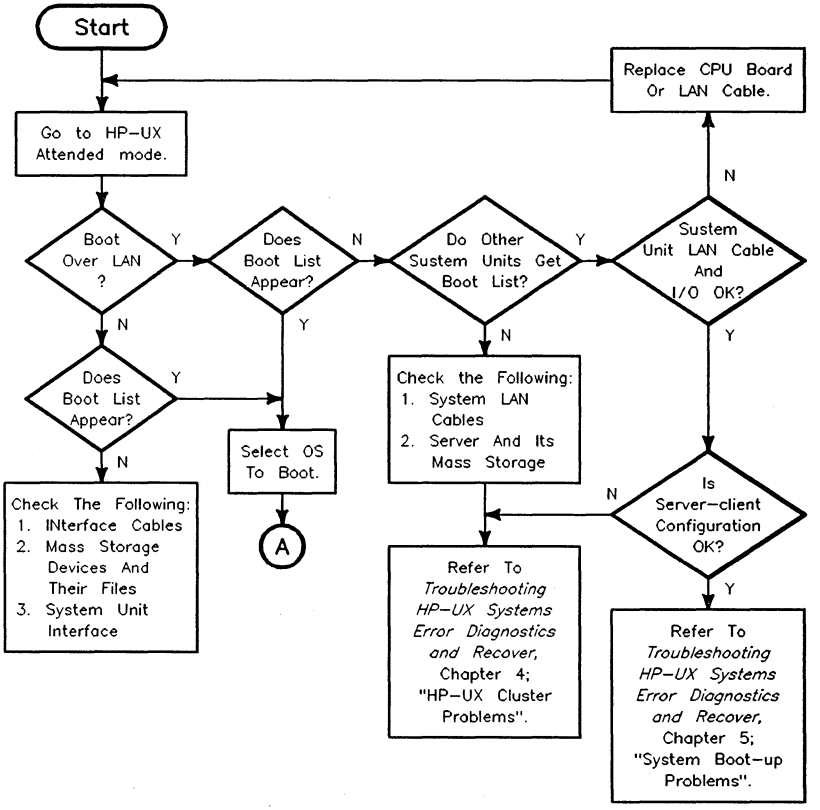


Figure 4-2. Troubleshooting: Problems While Booting

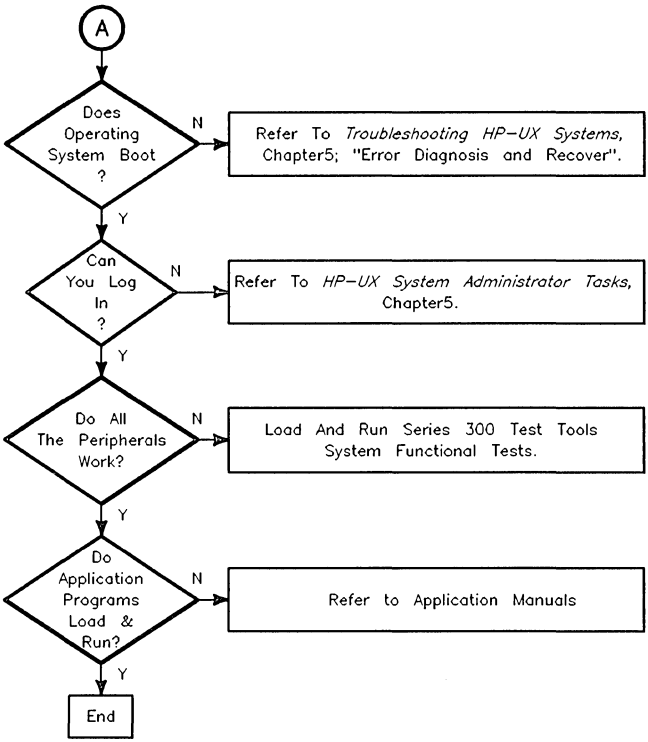


Figure 4-3. Troubleshooting: Problems While Booting (continued)

Controller Power Checkout Procedures

Power

This section provides the following hardware checkout procedures for Model 362/382 controller's power.

Caution Make sure that you are properly grounded before you attempt any of the following procedures. Use an anti-static mat with anti-static wrist straps and other static prevention devices whenever possible.

You must remove the controller cover to perform the following procedures.

Note Always replace the controller cover during troubleshooting sessions if the controller is to run for an extended period of time. The controller cover is used to maintain proper air flow cooling within the controller.

With the controller having a system board and power supply as the minimum configuration, check the voltages at the power connector on the top edge of the backplane board. Table 4-1 lists the voltages and their tolerances.

Table 4-1.
Voltage Test Points and Tolerances
Red Wire to Pin 1

Pin	Voltage	Lower Limit	Upper Limit
1	+5 Reg.	4.95	5.25
2	+5 SCSI	4.95	5.25
3	Ground		
4	+12 Fan	11.4	13.2
5	+5 Reg.	4.95	5.25
6	+12 Reg.	11.52	12.6
7	+5 Aux.	4.75	5.25
8	−12	−11.5	−13.2
9	+5 Reg.	4.95	5.25
10	Remote ON		
11	Ground		
12	(Key)		
13	Ground		
14	Ground		

Note If any voltage is out of tolerance or not present, the complete power supply assembly is replaced. There are no field replaceable fuses in the controller.

Memory Configurations and Addressing

Table 4-2 lists all supported memory configurations.

Model 362 Memory Troubleshooting

Here is a chart showing the address ranges and possible board combinations for a given total amount of memory:

Table 4-2. Model 362 Controller RAM Addresses vs. Boards

Total RAM	Address Ranges Upper to Lower	HP D2152A 8 MB Boards	HP D2156A 4 MB Boards	HP D2381A 2 MB Boards
2 Mbytes	FFFFFFFF - FFE00000		4 MB Block	2 MB Block
4 Mbytes	FFDFFFFF - FFC00000	8 MB Block		2 MB Block
6 Mbytes	FFBFFFFF - FFA00000		4 MB Block	2 MB Block
8 Mbytes	FF9FFFFF - FF800000			Not used
10 Mbytes	FF7FFFFF - FF600000		4 MB Block	2 MB Block
12 Mbytes	FF5FFFFF - FF400000	8 MB Block		Not used
14 Mbytes	FF3FFFFF - FF200000		Not used	Not used
16 Mbytes	FF1FFFFF - FF000000			Not used

At least one RAM board must be placed in slot **RAM 0**. Slot **RAM 1** may or may not have a board installed.

Example: Total Memory of 8 Mbytes. A controller having a total memory of 8 Mbytes with two RAM boards has:

- Two 4 Mbyte RAM boards; one in slot **RAM 1** and one in slot **RAM 0** that make up an 8 Mbyte block of memory with:
  - An upper block address of $FFFFFFFF_{16}$.
  - A lower block address of $FF800000_{16}$.

A memory failure at address $FF90A7C4_{16}$ is on the RAM board in slot **RAM 1**.

Model 382 Memory Troubleshooting

Table 4-3 lists the address ranges and possible board combinations for a given total amount of memory:

Table 4-3. Model 382 Controller RAM Addresses

Total RAM	Address Ranges Upper to Lower	HP A2202A 8 MB Boards	HP A2201A 4 MB Boards	HP A2200A 2 MB Boards
4 Mbytes	FFFFFFFF - FFC00000		8 MB Block	4 MB Block
8 Mbytes	FFBFFFFF - FF800000	16 MB Block		4 MB Block
12 Mbytes	FF7FFFFF - FF400000		8 MB Block	4 MB Block
16 Mbytes	FF3FFFFF - FF000000			Not used
20 Mbytes	FEFFFFFF - FEC00000		8 MB Block	4 MB Block
24 Mbytes	FEBFFFFF - FE800000	16 MB Block		Not used
28 Mbytes	FE7FFFFF - FE400000		Not used	Not used
32 Mbytes	FE3FFFFF - FE000000			Not used

Slots labeled RAM PAIR 0 must contain a board pair. If there are two board pairs, the pair in slots RAM PAIR 0 must be as large as or larger than the pair in slots labeled RAM PAIR 1.

Example: Total Memory of 8 Mbytes. A controller having a total memory of 8 Mbytes with two RAM boards has:

- Two 4 Mbyte RAM boards located in slots RAM PAIR 0 that make up an 8 Mbyte block of memory with:
  - An upper block address of $FFFFFFFF_{16}$.
  - A lower block address of $FF800000_{16}$.
- RAM slots RAM PAIR 1 are empty.

- Block addresses whose LSD is:
  - F, E, D, C, 7, 6, 5, or 4 are on the RAM board in slot **RAM PAIR 0**, the slot closest to the controller's front.
  - B, A, 9, 8, 3, 2, 1, or 0 are on the RAM board in slot **RAM PAIR 0**, in the second slot back from the front.

A memory failure at address $FF90A7C4_{16}$ is on the RAM board in slot **RAM PAIR 0**, the slot closest to the front.

Example: Total Memory of 24 Mbytes. A controller having a total memory of 24 Mbytes with four RAM boards has:

- Two 8 Mbyte RAM boards located in slots **RAM PAIR 0** that make up a 16 Mbyte block of memory with:
  - An upper block address of $FFFFFFFF_{16}$.
  - A lower block address of $FF000000_{16}$.
- Two 4 Mbyte RAM boards located in slots **RAM PAIR 1** that make up an 8 Mbyte block of memory with:
  - An upper block address of $FEFFFFFF_{16}$.
  - A lower block address of $FE800000_{16}$.
- For each pair of RAM boardS, or memory block, whose LSD is:
  - F, E, D, C, 7, 6, 5, or 4 are on the RAM board in the first slot closest to the front of the pair.
  - B, A, 9, 8, 3, 2, 1, or 0 are on the RAM board in the rear-most slot of the pair.
- $FE90A7C4_{16}$ is on the RAM board in slot **RAM PAIR 1** closest to the front.

5

Diagnostics

Boot ROM Self-Tests

Several UNEXPECTED failure messages may be displayed at any time. When the CPU executes an instruction set, certain events are expected to occur. Should an interrupt (either internally from the CPU or externally from some other device) occur and cause a RAM or CPU address to be used out of sequence, the following error message is displayed:

```
UNEXPECTED USE OF (address)
```

Table 5-1 lists these messages. The five most significant digits of the address are $FFFFF_{16}$ so only the three least significant digits (LSD) are listed in the table. When a range of addresses is shown, adjacent addresses are six 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 system board should be replaced.
- CPU traps: Usually occurs when the operating system is being used. A CPU trap indicates something in the processor circuits didn't go right. If the error repeats, the system board should be replaced.
- Other errors: Several things on the system board in an interface or CPU circuit can cause these errors. If the error repeats, the system board should be replaced.

Table 5-1. 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
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	Co-processor exception vectors.

Failure Indications

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 Enter/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 monitor or terminal to warm up and for the user to read the error messages. These failures are usually non-fatal, so in unattended mode, the Boot ROM will still boot the first operating system it finds. Typing the Enter/Return key will terminate the beeping error code and abort the one-minute wait. Typing the Enter/Return key will also make the controller go into attended mode. This means that the Boot ROM will display all operating systems found and will not boot one until one is chosen and entered by the user.

General Description of Failure Codes

Table 5-2 lists 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. A grey dot indicate the LED in that position is on or off, depending on the binary code used to represent the device or failure type.

The test LEDs are mounted near the rear edge of the system board. They may be viewed by looking through a slot near the center of the rear panel, just above the interface connectors. LED on/off values are as shown in the following figure.

Table 5-2. General Failure LED Indications

LED Display	System Status
● ● ● ● ● ● ● ●	LEDs never accessed; replace system board.
○ ● ● ● ● ● ● ●	LEDs failed to acknowledge data

State and Failure Codes

Table 5-4 and Table 5-3 lists the LED state and failure codes used by the Boot ROMs. Codes are listed here in numerical order for easy reference.

Table 5-3. Self-Test LED State and Failure Codes for Interfaces

LEDs	Explanation
○ ○ ● ○ ○ ○ ○ ○	Failure: 4 μsec timer.
○ ○ ● ○ ○ ○ ● ○	Failure: system board HP-HIL circuit.
○ ○ ● ○ ● ○ ○ ○	Failure: DMA circuit.
○ ○ ● ○ ● ● ○ ○	Failure - video font ROM.
○ ○ ● ○ ● ● ○ ●	Failure: Video bit map circuit.
○ ● ○ ○ ○ ○ ○ ○	Failure: I/O circuit at indicated select code 0.
○ ● ○ ● ● ● ● ●	Failure: I/O circuit at select code 31.

Table 5-4. Self-Test LED Special State and Failure Codes

LEDs A B C D E F G H	Explanation
o o o o o o o o	No failure
o o o o o o o ●	Failed CPU register test.
o o o o o o ● o	Testing top 16 Kbytes of RAM.
o o o o o o ● ●	Failure in top 16 Kbytes of RAM.
o o o o o ● o o	Top 16 Kbytes of RAM missing or not found by CPU.
o o o o o ● ● ●	Starting Test Vector list.
o o o o ● o o o	Resetting all interfaces.
o o o o ● ● o o	Internal console checksum error
o o o o ● o ● o	Testing RAM for I/O on-board test code.
o ● ● ● o o o o	SGC slot 0 error
o ● ● ● o o o ●	SGC slot 1 error
o ● o ● o o ● o	SGC slot 2 error
o ● ● ● o o ● ●	SGC slot 3 error
o o o o ● ● ● o	Failed Boot ROM checksum.
o o o o ● ● ● ●	Pre-loading RAM for main test.
o o o ● o o o o	RAM Testing (main)
o o o ● o o o ●	Failure: Not enough RAM.
o o o ● o o ● o	Failure: ROM system.
o o o ● o o ● ●	Failure: Boot error.
o o o ● o ● o o	Failure: OS tried to start loading at too high of an address.
o o o ● o ● o ●	Failure: Not enough RAM to load OS.

Table 5-5. Boot ROM Displayed Error Messages

Error Message	Meaning and What to Do
`DATA PARITY ERROR AT` (address)	Parity error at (address). Replace memory module that has the indicated address.
`Memory Failed At` (address)	Memory failed at (address). Refer to memory address vs. memory block table and replace memory module.
`Memory Gone At` (address)	Memory not found at indicated address. Replace memory module that has the indicated address.
`Not Enough Memory`	Not enough memory to load operating system. Add more memory.
`Parity Bit Error At` (address)	Parity error at (address). Replace memory module that has the indicated address.
`System Would Load Too High`	An addressing error would make the operating system try to load at too high an address. Probable cause: ■ Bad media. ■ Data transfer error. ■ Bad system board or mass storage device. Try again. If error repeats, troubleshoot above items.
`System Not Found`	Selected operating system not found on mass storage devices. Verify operating system is available on a mass storage device, then try again. If error repeats, troubleshoot processor, interface and mass storage.
`Unexpected Use Of` (address)	Possible CPU related error. Refer to Table 6-3.
`Configuration EEPROM Failed`	Configuration EEPROM or associated circuits may not be working correctly. One of these situations may exist: ■ Some default and some new configuration value are set. ■ Some error occurred that should not affect operation. Try again. If error repeats, replace the system board.

Table 5-5. Boot ROM Displayed Error Messages (continued)

Error Message	Meaning and What to Do
EEPROM Has Bad Information	Configuration Mode started, main menu may appear, but something failed. Try again. Replace system board. If Configuration Mode does not start and no error message appears, a hardware failure probably occurred. Replace system board.
EEPROM Load Section Missing	Could not load new configuration data. Hardware failure. Replace system board.
EEPROM Defaults Section Missing	Default configurations could not be found. Hardware failure. Replace system board.
Too much data to save	Too many interfaces for EEPROM to manage. Reconfigure controller with fewer interfaces.

Test Mode

When your display's last lines show:

```
RESET to Restart, SPACE to clear input   Waiting for System Selection     ?
```

you may press [T] and this Test Mode display appears in the screen's upper right-hand corner:

```
      Self Test Controls
Keys   Test Option    Selected
------------------------------
 1     Continuous          N
 2     Extended            N
 3     Test Memory         Y

 D     set Defaults
 R     Run Tests
------------------------------
Type [key] RETURN ?
```

Self Test Control Menu

A Self Test Controls menu has three columns to provide you with these controls:

- `Keys`; the keyboard keys used to select the test option you want to run.
- `Test Option`; the type of test to run.
- `Selected`; indicates the yes/no (Y/N) status of the option.

You will find explanations for each Self-Test Controls Menu item in the next few subsections.

Continuous Self-Tests

Continuous Self-Tests cause the Boot ROM to continuously repeat the self-tests. Entering configure mode while already in continuous self-test mode and choosing the Continuous option stops the continuous self-test and causes the Boot ROM to resume normal operation.

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

- A memory failure in the top 16 KB of memory. The Boot ROM stops with the display blanked.
- Boot ROM checksum failure. The Boot ROM stops with these messages displayed:

  ```
  Continue AT Own Risk
  RETURN To Continue
  ```

  Something in the Boot ROM has changed. It may have a bad instruction or cannot execute instructions properly. If you continue, something may not work correctly. The system board should be replaced.

  Pressing Enter/Return causes the Boot ROM to continue self-test looping.

Extended Self-Tests

When you select Extended, the self-test starts over and the long memory test will be run. It takes about 4 seconds per megabyte. The standard, or default, memory test takes about 1 second per megabyte.

This mode also invokes extended testing on LAN by doing external loopback and cable testing.

With the LAN interface, all extended test functions will work. If an external Media Attachment Unit is not connected for AUI interfaces, the extended test will report a failure.

Test Memory

Memory tests are performed on main memory. Both read/write and parity tests are run. You will see error messages displayed if memory fails. Memory error messages are interpreted differently for each type of memory test.

For word-wide main memory error messages, these messages appear at the bottom of your display in this format:

```
Memory Failed at (address)
(W:BBCCDDEE, R:BBCCDDEF)
```

In the above message, the hex address had the hex data BBCCDDEE written (W) into and read (R) out of the address. If the read data is different than the write data as shown in the above example in the least significant hex digits, that indicates an error.

Parity error messages are of two types:

```
Parity Bit Error At (address)
```

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

```
Data Parity Error AT (address)
```

means a RAM failure was detected at the indicated address. 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 Test Memory phase of the self-test and testing will continue.

Memory Configurations and Addressing

Refer to Chapter 4 for tables listing memory configurations and addressing.

Set Defaults

Typing the command (D) sets the 'Test Memory' default value to 'yes' for testing.

Run Tests

When you are ready to run the self-tests with the options you have selected, type the command (R).

SCSI Interface and Device Testing

Two levels of SCSI testing can be used with Model 362/382 controllers.

- Normal testing can be done on controllers with internal SCSI mass storage devices.
- The SCSI exerciser can also be done.

Normal SCSI Testing

Normal testing is done at power-up 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 either of these messages appear, no attempt will be made to use the interface as a boot source. The 'fuse' may be reset by resetting the controller or cycling controller power.

SCSI Exerciser Testing

The SCSI Disk Exerciser program can be used to verify the correct operation of SCSI direct access devices. Follow these steps to use the SCSI exerciser:

1. From the HP-UX prompt, type this command to access the directory with the SCSI exerciser file:

   ```
   /usr/diag/CE.utilities/SCSIdisk (Enter)/(Return)
   ```

2. Type this command to start the SCSI exerciser:

   ```
   ./exerciser (Enter)/(Return)
   ```

3. Note the typical device file for a SCSI device:

   ```
   crw-rw-rw-   1 root     sys       47 0x0e0400 Feb 22 10:12 4s0
   ```

   which is for a SCSI interface at select code 14, and a disk at SCSI address 4.

   If you need to create a device file, the following command should create a device file for a typical internal disk:

   ```
   /etc/mknod /dev/rdsk/0s0 c 47 0x0e0000 (Enter)/(Return)
   ```

Here are the available SCSI exerciser functions:

Table 5-6. SCSI Exerciser Functions

Key	Exerciser Description
D	Device selection: Allows a new device to be selected.
R	Read check entire disk. Each pass can take a half hour or more, depending on the capacity and speed of the disk. The number of passes are determined by the 'N' command. This command reads 64K bytes in each read operation. A butterfly pattern is used, with successive read operations alternating from the next lowest unread address to the next highest unread address until the entire disk has been read tested. If an error occurs, the logical blocks within the 64K block are read successively. For each logical block that can not be read, an error is reported, and if autosparing has been selected, the block is spared.
B	Block read. Display the contents of the disk block in hex.
N	Select the number of passes that the read or Write function are to make.
I	Display the inquiry data and the capacity of the disk.
L	Display the drive's log information. This function is only available on HP fixed drives. It uses the Access Log HP specific SCSI command to report the data logged by the disk drive itself.
S	Run Self-test. This can take up to a minute on some drives. Note that if it is run on the root disk, the controller will effectively lock up until the test completes. The operations performed by this self-test vary from drive to drive, but it is not destructive.
C	Enter CE mode. The user is prompted for a password, which is the same as the password used to enter CE mode in the CS80 exerciser. This mode allows the user to perform tasks which can erase data on the disks.
Q	Exit the program.

Using The HP-UX ce.utilities

Follow these steps to use the HP-UX ce.utilities:

1. If not already connected, connect a tape drive on the controller for the System Support Tape.

2. From the Auto System Select Mode note the tape drive with the System Support Tape with these operating systems:

   ```
   SYSTEM_SF

   SYSTEM_S3
   ```

3. Select SYSTEM_SF as the temporary operating system to boot if you want to run the Series 300 System Functional Tests.
4. Select SYSTEM_S3 as the temporary operating system to boot if you want to run the Series 300 Controller Tests.
5. Refer to the System Support Tape User's Guide and the Series 300 Test Tools Manual for detailed instructions.
6. To continue and run specific CE.utilities tests, boot the HP-UX operating system. The remaining steps of this procedure can only be performed with the HP-UX operating system running.
7. To list all tests on the tape, type this command where drive is the device file name of the tape drive:

   ```
   lifls /dev/drive (Enter)/(Return)
   ```

8. To find out what files are available for a certain test, type this command:

   ```
   lifcp -r /dev/drive: filename1 - | cpio -ictv (Enter)/(Return)
   ```

   where filename1 is one of these four CE.utility tests:

   ```
   CRTADJ        FLOAT          ECC
                  SFT
   ```

Note CS/80, VME, HP 98720A and HP98730A tests are not supported on Model 362/382 controllers. Also, the ECC test only applies to the Model 382, as the Model 362 does not have ECC memory.

---

9. If you want to list the file names for a specific ce.utility test in a new file, type this command where filename2 is the name of the file you want to list the files in:

   ```
   lifcp -r /dev/drive: filename1 - | cpio -ictv  filename2 (Enter)/(Return)
   ```

10. To list the files type the command:

    `more filename2` Enter/Return

11. To find out what CE.utilities tests are already on the HP-UX operating system, type one of these command sets:

    `cd /usr/diag/CE.utilities` Enter/Return

    `ls` Enter/Return

    or

    `cd /usr/diag/install` Enter/Return

    `ls` Enter/Return

12. If you want to run a test that is not already on HP-UX, you must first copy the test from the tape to the HP-UX file system. A new directory, /usr/CE.utilities, will automatically be created and the files from the tape will be copied into it. Type this command where test is one of the eight test files you want to copy from the tape to the file system:

    `lifcp -r /dev/drive:test - | cpio -icdvxm` Enter/Return

    Information on each CE.utility test may be found as follows:

    a. CRTADJ: refer to System Support Tape User's Guide.

    b. FLOAT: type these commands

       `cd /usr/CE.utilities/Floatcard` Enter/Return

       `./help` Enter/Return

       and a help file will appear on the screen.

    c. SFT: refer to the Series 300 Test Tools Manual.

    d. ECC: type these commands:

       `cd /etc` Enter/Return

       `man ecclogger` Enter/Return

       for information on setting up and execution the ECC tests.

Refer to the *System Support Tape User's Guide* and the *Series 300 Test Tools Manual* for detailed information on running the CE.utilities.

6

Adjustments

There are no adjustments to the Model 362 or 382 Controllers.

7

Peripherals

Refer to the *HP 9000 Series 300 Configuration Guide* for current supported:

- Peripherals.
- Operating Systems.
- Configurations.

8

Parts Lists

Introduction

Field replaceable parts are listed in this chapter for the:

- Model 362 Controller.
- Model 382 Controller.
- HP A2246A DIO-I Bus Expander.
- HP A2247A DIO-II Bus Expander.

Components, such as ICs, are not available for field repair.

Parts are available direct from:

Support Materials Organization

Hewlett-Packard Company

8050 Foothills Boulevard

Roseville, California 95678 USA

Telephone: (916) 786-8000

Model 362 and 382 Controllers

Table 8-1. Model 362 and 382 Controller Electrical Parts List

Ref. No.	Description	New Part Number	Exchange Part Number	Notes
1	Power supply	0950-2119		
2a	System board	A1473-66510	A1473-69510	for Model 362
2b	System Board, VGA graphics	A1474-66510	A1474-69510	for Model 382
2c	System Board, Med-res. graphics	A1474-66511	A1474-69511	for Model 382
3a	HP 98236A 2 Mbyte RAM board	98236-66520	98236-66520	for Model 382
3b	HP 98236B 4 Mbyte RAM board	98236-66522	98236-66522	for Model 382
3c	HP 98236C 8 Mbyte RAM board	98236-66524	98236-66524	for Model 382
4a	HP D2381A 2 Mbyte RAM board	D2381-63001		for Model 362
4b	HP D2156A 4 Mbyte RAM board	D2156-63001	D2156-69001	for Model 362
4c	HP D2152A 8 Mbyte RAM board	D2152-63001	D2152-69001	for Model 362
5	LAN board	A1473-66530		
6	DIO-I backplane board	A1473-66501		
7	3.5-in. flexible disk drive	0950-2118		
8	Flex disk drive power cable	A1499-62020		
9	210 Mbyte hard disk drive	0950-2223		
10	420 Mbyte hard disk drive	0950-2168		
11	CD ROM disk drive	1150-1832		
12	52 Mbyte hard disk drive	0950-2247		
13	Power switch assembly	A1473-61601		
14	HP Parallel ribbon cable	A1473-61604		
15a	SCSI cable, internal	A1473-61602		Internal drives only
15b	SCSI cable, internal/external	A1473-61603		Internal drives and rear panel
16	Fan	5180-0496		

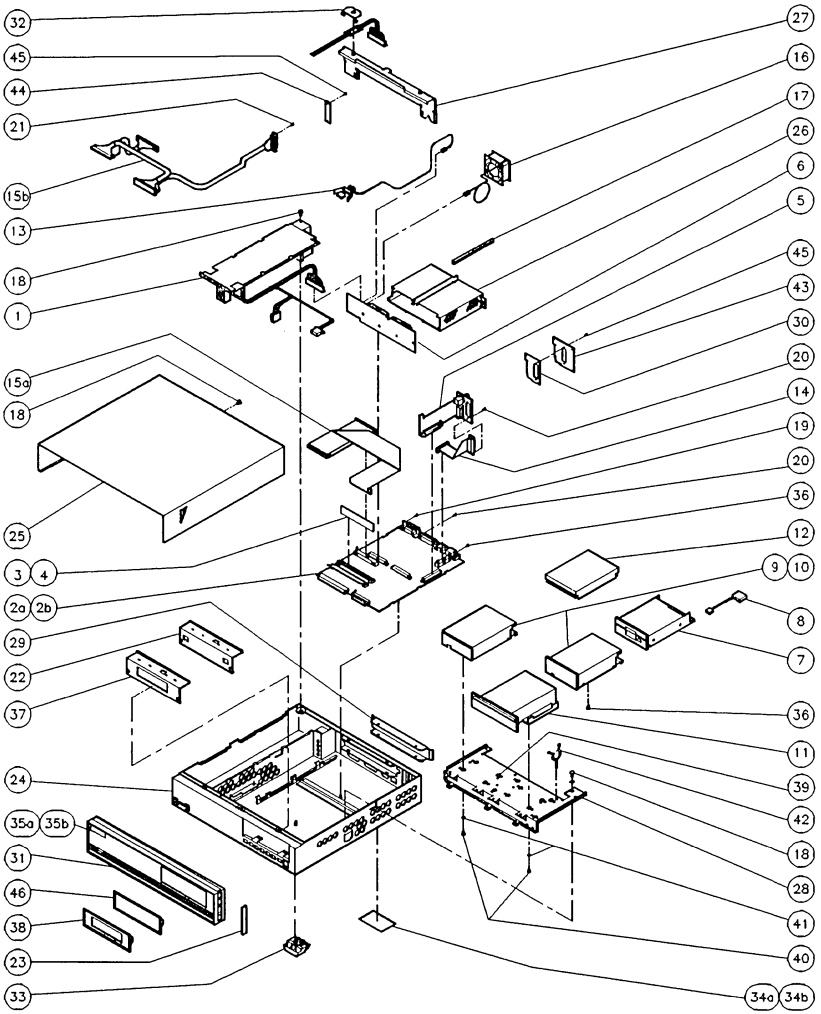


Figure 8-1. Model 362 and 382 Controller Exploded View

Table 8-2. Model 362 and 382 Controller Mechanical Parts List

Ref.	Description	Part Number	Notes
17	Card guide snap mount	007689	
18	Screw; M4X6 pan head	015933	
19	Jackscrew; HP-IB connector	0380-0643	
20	Jackscrew; interface connector	0380-3087	
21	SCSI jack screw	5180-1344	
22	Mass storage RFI cover plate	5001-7478	
23	Side trim	5001-0538	
24	Chassis	5001-7466	
25	Top cover	5001-7467	
26	DIO-I card cage	5001-7468	
27	DIO-I card cage support	5001-7469	
28	Mass storage tray	5001-7470	
29	DIO-I slot cover plate	5001-7473	
30	LAN RFI cover plate	5002-2107	
31	Front panel (bezel)	5041-2490	
32	Wire hold-down	5041-2497	
33	Foot	5041-8801	
34a	UL/CSA label; Model 362	A1473-84001	
34b	UL/CSA label; Model 382	A1474-84001	
34c	Regulatory label		
34d	Battery warning label		
35a	Nameplate (front panel)	A1473-84002	for Model 362
35b	Nameplate (front panel)	A1474-84002	for Model 382
36	Screw; M3X.0.5	0515-1146	
37	Flexible drive RFI cover plate	5001-7487	

Table 8-2.
Model 362 and 382 Controller Mechanical Parts List (continued)

Ref.	Description	Part Number	Notes
38	Flex disk drive filler plate	5041-2493	
39	Hard disk isolation grommet	0400-0353	
40	Shoulder screw	3030-0994	
41	Washer	3050-0893	
42	Cable clamp	1400-1547	
43	SCSI/LAN RFI cover plate	5001-7474	
44	SCSI RFI cover plate	A1630-00028	
45	Screw, LAN/SCSI RFI cover plate	0380-3070	
46	Blank trim plate	5041-2492	

HP A2246A DIO-I Bus Expander

Table 8-3. HP A2246A DIO-I Bus Expander Parts List

Ref. No.	Description	New Part Number	Notes
1	Power supply	0950-2119	
2	Fan	5180-0496	
3	Power cord adapter	8120-1575	
4	DIO-I backplane	A1474-66501	
5	Screw, M4X6 #1 Phillips	015933	
6	Bushing	0400-0215	
7	Screw, M3X6 flat-head	0515-0219	
8	Screw, M3X12	0515-0408	
9	Chassis	5001-7481	
10	Top cover	5001-7482	
11	System board support	5001-7483	
12	Right card guide	5001-7484	
13	Left card guide	5001-7485	
14	Safety shield	5001-7486	
15	Cable shield	5001-7487	
16	Mounting standoff	5001-7495	
17	Gang card guide	5041-2414	
18	Front bezel, panel	5041-2491	
19	Wire hold down	5041-2497	
20	DIO-I slot blank cover	7101-0591	
21	Label ID/INFO/UL/CSA	A1474-84005	
22	Side trim panel	5001-0538	
23	Label; front panel	A1474-84004	
24	Cable clamp	1400-1547	
25	Screw; M3X0.5	0515-1146	

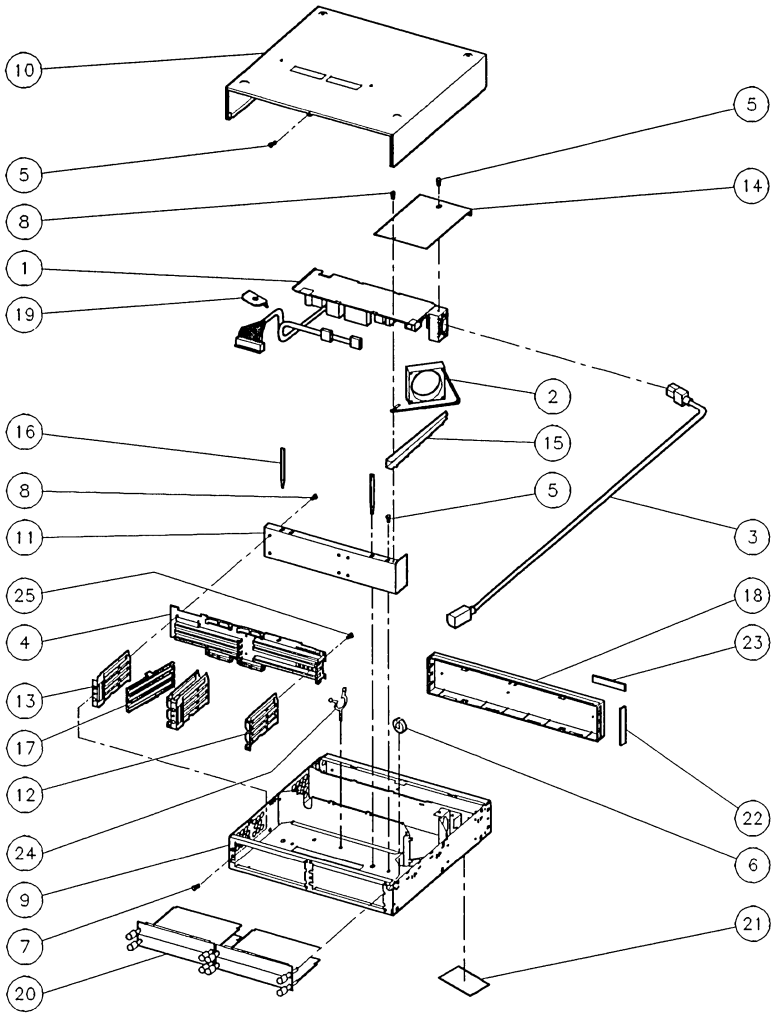


Figure 8-2. HP A2246A DIO-I Bus Expander Exploded View

HP A2247A DIO-II Bus Expander

Table 8-4. HP A2247A DIO-II Bus Expander Parts List

Ref. No.	Description	New Part Number	Notes
1	Power supply	0950-2119	
2	Fan	5180-5246	
3	Flex circuit	A1474-66502	
4	Screw, M3X6 flat-head	0515-0219	
5	Screw, M4X6 #1 Phillips	015933	
6	Screw, M3X.0.5	0515-1146	
7	Top cover	5001-7482	
8	Chassis	5001-7488	
9	Top flex support	5001-7489	
10	Screw; M3X12	0515-0418	
11	Card cage	5001-7491	
12	Bottom flex support	5001-7492	
13	Mounting standoff	5001-7495	
14	Label, front panel	A1474-84004	
15	DIO-II slot blank cover	98561-04107	
16	Label, ID/INFO/UL/CSA	A1474-84006	
17	Side trim panel	5001-0538	
18	Cable clamp	1400-1547	
19	Front panel	5041-2491	
20	Backplane support	5001-7490	

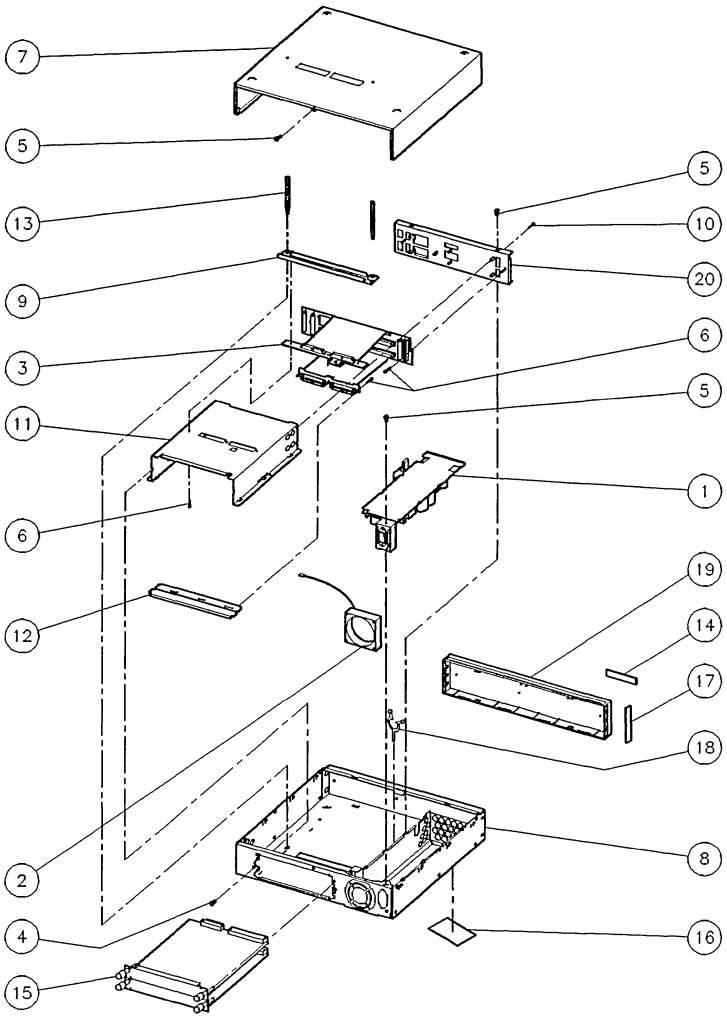


Figure 8-3. HP A2247A DIO-II Bus Expander Exploded View

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Diagrams

Controllers

Functional Block Diagram

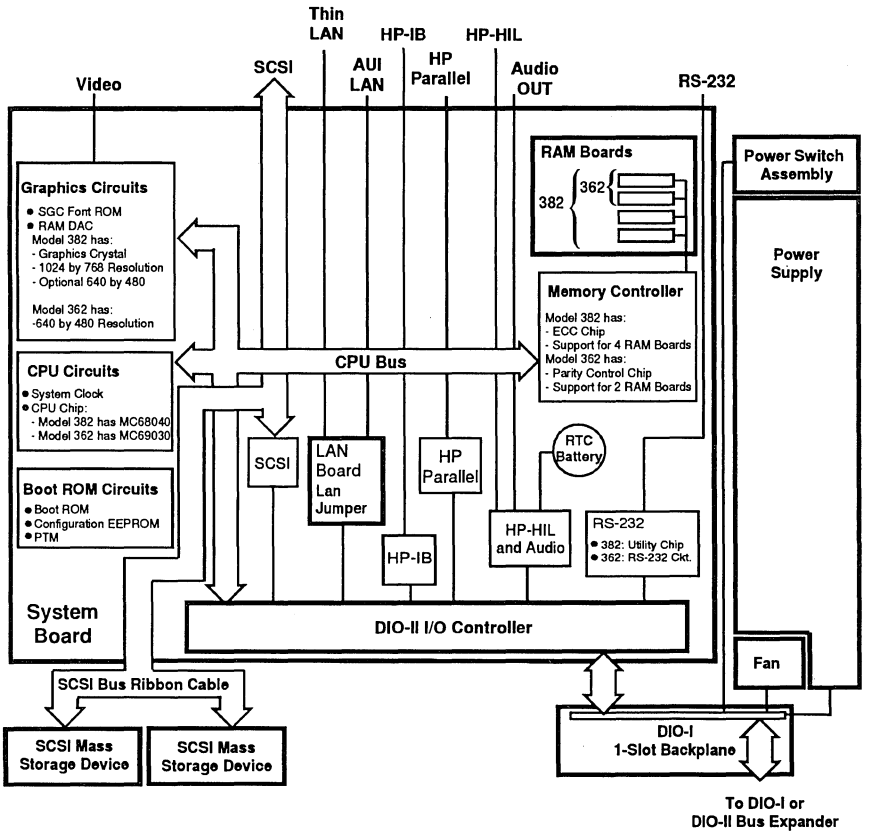


Figure 9-1. Model 362 and 382 Controller Functional Block Diagram

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References

Service Documentation

Table 10-1. Related Service Documentation

Manual Title	Part Number
HP 9000 Model 362/382 Controller and HP A2246/7A Bus Expanders Service Manual	A1473-90030
HP 9000 Model 362/382 Controller and HP A2246/7A Bus Expanders Service Handbook	A1473-90039
HP 9000 Model 362/382 Controller and HP A2246/7A Bus Expanders Service Training Video Workbook	A1473+49A-90001
HP D1182A 14-in. VGA Color Monitor Service Manual	D1182-90002
Servicing Hewlett-Packard Workstation Monitors (for HP C1497A 16-in Color Monitor)	5960-1511

System Installation and Getting Started Documentation

Table 10-2.
System Installation and Getting Started Documentation

Manual Title	Part Number
Installation Guide; Model 362/382 Controller and HP A2246/7 Bus Expanders	A1473-90010
Model 382 and R/382 Controller HP-UX Owner's Guide	A1473-90011
Installing and Maintaining HP BASIC/UX 6.2	98616-90100

Upgrade Documentation

Table 10-3. Upgrade Documentation

Manual Title	Part Number
HP A2252A 3.5-in. Flexible Disk Drive Upgrade Installation Guide	A2252-90010
HP A2253A CD ROM Disk Drive Upgrade Installation Guide	A2253-90010
HP A2254A DDS Tape Drive Upgrade Installation Guide	A2254-90010
HP A2255A LAN Interface Upgrade Installation Guide	A2255-90010
HP A2256A SCSI External Interface Upgrade Installation Guide	A2256-90010
HP A2257A 52 Mbyte Hard Disk Drive Upgrade Installation Guide	A2257-90010
HP A2258A 210 Mbyte and HP A2259A 420 Mbyte Hard Disk Drives Drive Upgrade Installation Guide	A2258-90010
Model 362 Controller Memory Installation Guide	A1473-90012
HP A2246A 4-Slot Bus Expander Installation Guide	A2246-90010
HP A2247A 2-Slot Bus Expander Installation Guide	A2247-90010
HP A2200/1/2A Memory Upgrade	A2200-90011
HP A2244A System Board Upgrade	A2244-90010
HP A2249A Floating-Point Accelerator Upgrade Installation Guide	A2249-90010

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Service Notes

Place Service Notes Here

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