HP-UX CE Handbook

for HP 9000 Series 500 Computers

Manual Reorder No. 97089-90039

HP-UX

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Printing History

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

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

April 1985...Edition 1

Chapter 1
Product Information

Manual Purpose and Scope

This manual is a condensed guide for use by trained, HP-qualified service personnel when installing, troubleshooting, and repairing HP-UX operating systems running on HP 9000 Series 500 computers. It is a reference guide only, and assumes the user is familiar with other manuals and documentation provided with the HP-UX system. Some of the information provided is beyond the scope of normal HP Customer Engineers' responsibilities, but is included for reference in case of special needs.

Much additional information is available in the HP-UX documentation accompanying the system. Occasional references to other HP-UX manuals are included in this manual where information of interest in special situations is outside the defined scope of this manual.

System Software

HP-UX Operating Software is supplied in four versions: single-user and multi-user configurations for Model 520 systems, and the same for other Series 500 models. All versions are supplied on one or two CS/80 tape cartridges in two forms: HP-UX only (one tape) or bundled with other supported languages including Pascal, Fortran, DGL, AGP, and Asynchronous Communication (2 tapes). Each software version runs **only** on corresponding supported Series 500 computers. (Tape structure and contents will change with the future release of HP-UX 5.0)

Supported Revisions

This manual supports software release HP-UX 4.0. Do not attempt to mix with other release versions unless such mixing is supported and documented.

NOTE

Software tapes bearing different release version numbers should not be mixed. In other words, do not use one tape revision number with a different tape revision number (such as HP-UX 4.0 on one tape with Pascal or FORTRAN software for HP-UX 3.0 on a second tape).

The following lists show HP part numbers for software tapes. Due to software licensing agreements, these tapes cannot be ordered separately. If a defective tape must be replaced, contact your HP Systems Engineer for assistance.

Model 520 Software (HP-UX only – not bundled)

- HP 97070A Single-user HP-UX 4.0 Software tape: 97070-10035
- HP 97079A Multi-user HP-UX 4.0 software tape: 97079-10035

Software for Other Models (HP-UX only – not bundled)

- HP 97080A Single-user HP-UX 4.0 Software tape: 97080-10035
- HP 97089A Multi-user HP-UX 4.0 software tape: 97089-10035

Bundled Model 520 Single-user HP-UX Software

- Single-user Bundled HP-UX Operating System tape including HP-UX, Fortran, Pascal, DGL, and Aterm: 09020-10002
- Single-user AGP Software used with 09020-10002: 97075-13301

Bundled Model 520 Multi-user HP-UX Software

None.

Bundled Single-user HP-UX Software for Other Models

- Single-user Bundled HP-UX Operating System tape including HP-UX, Fortran, Pascal, DGL, and Aterm: 09040-12002
- Single-user AGP Software used with 09040-12002: 97075-13301

Bundled Multi-user HP-UX Software for Other Models

- Multi-user Bundled HP-UX Operating System tape including HP-UX, Fortran, Pascal, DGL, and Aterm: 09040-12002
- Multi-user AGP Software used with 09040-12002: 97085-13301

Manuals

The following manuals are included in all manual kits shipped with Series 500 HP-UX systems (binders are included in manual kit, but are not provided when manuals are ordered separately):

97076-90001 HP-UX Asynchronous Communications Guide
97084-90000 Device-independent Graphics Library (DGL) Programming Reference
97084-90001 HP-UX supplement for above
97084-90026 Graphics/9000 Device Handlers Manual (replaces 97084-90025)
97089-90000 The C Programming Language (Kernighan & Richie)
97089-90004 HP-UX Concepts and Tutorials (replaces 97089-90003)
97089-90048 Series 500 HP-UX System Administrator Manual
98680-90025 Introducing the UNIX System (McGraw-Hill)
98680-90045 HP-UX Portability Guide
98680-90070 HP-UX Quick Reference

Additional Manuals for Bundled Software

The following manuals are included with bundled software (in addition to the preceding list):

92836-90005 Structured FORTRAN 77 Programming with HP Computers
97081-90001 Fortran/9000 Reference for Series 500
97082-90001 Pascal/9000 Reference for Series 500
97085-90000 Advanced Graphics Package (AGP) User Guide
97085-90002 HP-UX Supplement for above
97085-90005 Advanced Graphics Package Reference Manual
98680-90021 Series 200/500 Fortran Comparison Notes

Required Hardware

Any supported Series 500 computer having at least the following accessories and peripheral devices:

Series 500 HP-UX

 - Memory: 1.5 Mbytes **minimum**
 - HP 27110 HP-IB Interface (for system disc drive)
 - HP 27110 HP-IB Interface (for printer and other devices)
 - Internal keyboard and CRT or
        System Console terminal connected to multiplexer or serial interface
 - Multiplexer or serial interface connection to each remote terminal and/or computer
 - CS/80 disc drive with built-in CS-80 shared-controller cartridge tape drive
 - Internal or external HP-IB printer for system hardcopy output device
   (optional but rarely omitted)

CE Responsibilities

This section defines specific CE responsibilities. However, some activities that are usually the customer's responsibility may be performed by the CE when no significant additional time is required to perform the task, or performing the task eliminates the possibility of encountering a problem that would otherwise not be detected in a normal installation.

Responsible for:

- Verifying electrical power and site preparation before installing hardware
- Assembling hardware
- Performing hardware tests on system devices
- Loading software
- Running System Functional Tests
- Running file system check (fsck)

Not Responsible for:

- Site preparation
- Point-to-point wiring through conduit or wiring ducts
- Unpacking hardware
- Setting up device files for all peripheral devices in system
- Configuring software
- Adding user for remote port in single-user system
- Adding users for each port in multi-user system
- Adding other users
- Verifying datacomm links to terminals and remote computers
- Setting up passwords and system security
- Creating backup copies of the operating system
- Restoring systems using backup copies

Environmental

Environmental tolerance of HP-UX systems is determined by the most restrictive device(s) in system. See CE hardware handbooks for specific device requirements. Here are overall system considerations:

Temperature

- In most instances, temperature range is less important than rate of temperature change (disc drives especially sensitive). Limit CS/80 disc drives to 10°C per hour or less.

- Tapes and line printer paper are sensitive to widely varying temperature changes. When possible, store in environment similar to system operating environment for several days before use so material can adapt to actual operating conditions – increases operating reliability.

Relative Humidity

- Affects dimensional stability of hygroscopic materials such as magnetic tape and paper. Low humidity degrades tape pack tension; increases static electricity in printer paper. Floor coverings can be treated for improved static suppression. When applying anti-static sprays, do not allow overspray to enter equipment cooling openings where it can create electrical leakage paths inside the computer or peripheral.

- Moisture absorption in paper at high humidity can cause printer feed problems (paper swells as dew point is approached and condensation occurs. Moisture absorption into magnetic tape substrate film can cause tape distortion and oxide damage due to excessive tape pack pressure.

Guidelines

For tape cartridges, flexible discs, and computer paper products:

Temperature   10°C (50°F) minimum, 40°C (104°F) maximum

Relative Humidity   25% minimum, 80% maximum, non-condensing
                         (maximum wet-bulb temperature: 25.6°C)

Installation Overview
Series 500 HP-UX Installation Checklist

__ Install and test hardware

__ Verify correct part numbers on software media

__ Check CS/80 disc drive switch settings

__ Load Series 500 HP-UX system software tape into drive (Write enabled)

__ Verify that computer loader ROM is functioning

__ Load HP-UX subset system, then log on as the *root* user

__ Select *sysinstall* or *coreinstall* option

__ Set up correct installation parameters, then start installation

__ Installation program initializes installation (root) disc

__ Insert second software tape when first tape is unloaded if installing
bundled system software (*sysinstall* option)

__ Remove and store cartridge tape(s) when drive unloads each tape

__ Cycle power to reload system when installation program is finished

__ Log on again as *root* user

__ HP-UX is installed.

__ Run *fsck* to verify file structure integrity

__ Use HP-UX System Functional Tests to verify each peripheral

__ Set the System Clock

__ HP-UX is ready for adding peripheral device files and users.

__ Add any needed special (device) files not included in default file structure

__ Add special files and one user for each remote terminal/computer port

__ Make system back-up tape after device files are configured

__ Show System Administrator how to install password for *root* user

__ Show System Administrator how to add users and create back-up tape

__ Log off. HP-UX is ready for use.

Hardware Installation

Preparation

1. Verify power receptacle wiring and contact retention force for all electrical receptacles supplying power to system devices. If wiring is not correct and safe, do not install equipment until corrected.

2. Unpack equipment; set near installed location. Leave accessories in anti-static containers.

3. Determine accessory slots to be used for each accessory and interface in the system.

4. Observe static discharge precautions (see Chapter 10) while installing accessories.

Minimum System

The following hardware is the minimum required for an operational HP-UX System. Other devices can be added to meet system needs.

- Series 500 Computer with at least 1.5 Mbytes of memory plus 256 Kbytes per user (actual amount needed per user varies, depending on type of use).
- CS/80 Disc drive with built-in tape drive, configured for shared-controller operation
- Built-in keyboard and CRT (Model 520), or external terminal (other models) for use as System Console
- Built-in (Model 520) or external line printer for System Printer (optional)
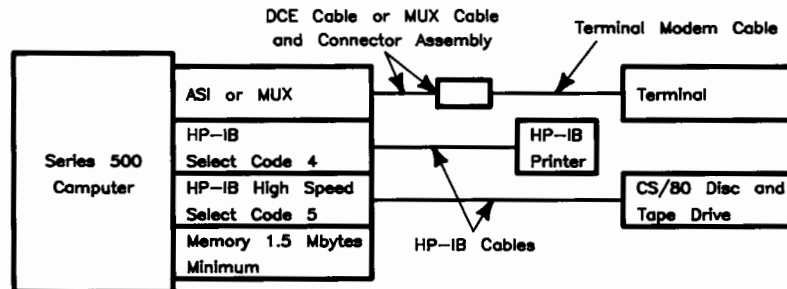
Typical Minimum System

Computer Assembly

Interface configuration switch settings are shown at the end of this section. Some steps may not apply if accessory does not exist in system.

1. Install memory cards in stack.

2. If system console is external terminal, install serial interface or multiplexer card at Select Code 0. If multiplexer is used, connect terminal to port 00.

3. If computer has external CRT graphics display, install HP 27112A GPIO card and external graphics processor or HP 97062A Color Interface (two interconnected cards consume two adjacent slots, but use only one select code), as appropriate. See configuration diagrams for card switch settings and cabling.

4. Install HP-IB interfaces for system discs, printer, and other devices. Set each interface to CONTROLLER, and select high/low-speed operation as appropriate.

    a. Install root disc interface at select code 05 and set up for high-speed operation. If a separate virtual memory disc is used, it can reside on same bus.

    b. High-speed CS/80 discs can be put on same bus (up to eight controllers). Tape drives, when connected to separate drive controllers, should reside on a slower bus.

    c. Place flexible disc drives and SS/80 drives on separate HP-IB interface instead of system disc bus. This secondary bus can also be used for CS/80 cartridge tape drives. Bus performance can be impaired if the bus is also shared by the system printer.

    d. If external printer is used, connect to separate interface when possible.

    e. Place graphics input devices (digitizers/tablets) on dedicated HP-IB interface. Bus sometimes hangs while waiting for tablet input responses.

    f. Plotters tend to dominate bus resources. They can share a bus with system printer when usage is not high. Otherwise, separate buses are recommended.

5. Install additional datacomm interfaces: RJE, ASI, MUX, LAN, etc., as needed.

Computer Installation

1. Set computer in operating position. If rack mounting, add rack-mount adapters, then set in rack on support rails. Attach rack-mount adapter brackets to side rails on front of rack.

2. Verify that ventilation and cabling clearance is adequate. In general, allow 7 cm (3 inches) clearance for air intake and exhaust on any side where there are ventilation holes, and sufficient space for cables exiting from computer rear panel. For HP-IB devices, allow 7 cm (2.75 inches) rear clearance for cables and ventilation. Allow additional space as needed for service access.

3. Make sure power switch is OFF, then install power cord.

4. Connect HP-IB cable to System Bus (disc) interface.

5. Connect HP-IB cable to each additional HP-IB interface.

6. Connect modem and other datacomm cables to datacomm/serial interfaces as appropriate.

7. Connect cables to GPIO or color interface cards.

Peripheral Device Installation

HP-IB bus and address assignments are relatively arbitrary as long as adequate attention is given to prevention of bus conflicts between devices that operate at different speeds and efficiency levels.

1. Set up CS/80 primary (root) drive (see CS/80 handbooks for procedures).

2. Set up other CS/80 drives, if any.

3. Connect HP-IB cable from System Bus (disc) interface on computer to the system root-device drive. Chain additional cables from the first drive to other drives being installed on the System Bus (if any) up to a maximum of eight drives. If more than eight drives are being installed, an additional interface is required for each eight drive controllers.

4. Set up System Printer using any applicable procedures documented in printer manuals. Connect to separate HP-IB interface.

5. Connect other HP-IB peripherals to their assigned interface and set each to a non-conflicting bus address. Plotters and graphics tablets should each be placed on a dedicated bus when maximum performance is needed. Use HP-IB cables listed with HP 27110 configuration topic later in this chapter for all connections.

6. Note the address and select code of each HP-IB device in the system for use later when installing HP-UX operating software.

7. Connect remaining datacomm and graphics display cables to their respective terminals, modems, CRT displays, and other devices as appropriate.

    – Use DTE cable (27122-63001, formerly 8120-4311) to connect ASI card to modems.
    – Use DCE cable (27128-63002, formerly 8120-4309) for direct connections from ASI to terminals.
    – Use DTE cable and 5-wire adapter for direct connections from ASI to other
      HP-UX computers.

8. Verify that all cables are connected correctly and retainers are engaged.

Memory Configuration

Memory is installed on the CPU stack which has 12 slots. One slot is consumed by each CPU and IOP card; remaining slots can be used for memory. Each memory card contains memory control logic that automatically configures memory address ranges for that card.

Power Supply Loading

Some memory and processor combinations present power supply loading that is not sufficient to maintain proper voltage regulation. When such a combination is installed, a load card must also be installed to compensate. See the CE Handbook section for the computer being installed to determine whether a load card is needed or not.

1-Mbyte Memory Cards (HP 97046A/5061-7704)

1-Mbyte cards should be installed in pairs. Addresses are interleaved by memory control logic to improve cycle speeds, which necessitates pairing. There are no other restrictions in their use.

512-Kbyte Memory Cards (HP 97047A/5061-6805)

No special restrictions apply when installing 512-Kbyte memory cards.

Interface Configuration

and Installation Considerations

Select Codes

Series 500 interfaces have no interface select code switches. Select code is determined by plug-in slot location: 0 thru 7 are in the mainframe (only 2 thru 5 are available for plug-in cards in the Model 520), 8 thru 15 are in the first I/O Expander, and 16 thru 23 are in the second.

HP 27110A HP-IB Interface

Configuration requires setting eight switches and placing a load resistor pack as follows:

- Set switches on each end of DIP switch package (S1 and S8) DOWN (closed).

- Set all other switches UP (open) for normal speed operation.

- For high-speed operation (CS/80 disc drives and CIPER printers), set SLOW switch (S7) DOWN.

- For normal operation, place load resistor pack in U74 (storage) socket. For high-speed operation, move the pack to the U82 position (see photo).
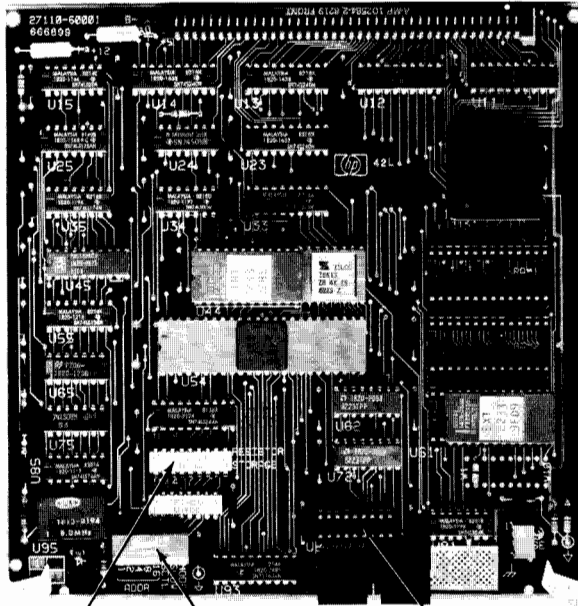
LOAD RESISTOR PACK
IN NORMAL-SPEED POSITION

MOVE LOAD RESISTOR PACK
HERE FOR HIGH-SPEED OPERATION
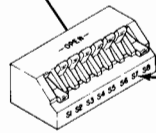
S7:
•UP FOR NORMAL SPEED
•DOWN FOR HIGH SPEED

HP 27110A HP-IB Interface Card

Cable Information
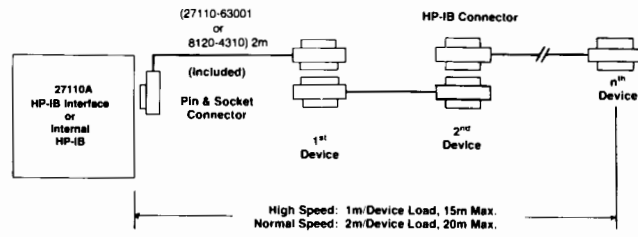
HP-IB Cables Used With HP 27110A

Product Number	Length (in metres)
92220R	0.3
10833D	0.5
45529A	1.0
45529B	2.0
45529C	4.0
5060-9459	6.0
5060-9460	8.0

HP 27110A HP-IB Interface Card

HP 27112A GPIO Interface

Used with HP 98070A Graphics Processor. Switch cluster SW1 is on left side of cable connector. All eight switches should be DOWN.

SW2 is on right side of cable connector. Set S1, S2, and S5 UP, S3 and S4 DOWN as indicated:

SW1

S7:
•UP FOR 9885M/S
•DOWN FOR 97060A

SW2

S3:
•UP FOR 9885M/S
•DOWN FOR 97060A
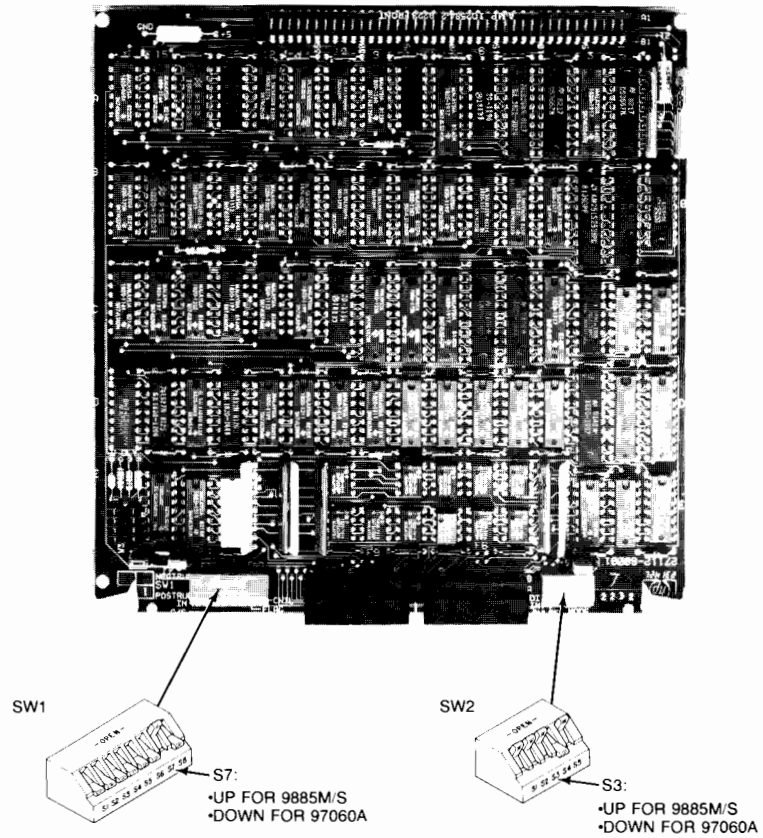
HP 27112 General-Purpose I/O Interface Card

HP 27122A RJE Interface

Used for synchronous data communication. No configuration required. Use 27122-63001 cable from interface to modem (8120-4311 cable used on earlier equipment).

HP 27123A SRM Interface

Used to interconnect with Shared Resource Management System. 27123-63001 interface cable (8120-4269 cable on earlier equipment) can power an SRM multiplexer or connect to an HP 97061A/B/C/D SRM cable.

To configure, set switches S1 through S8 on card to binary equivalent of decimal node address. S1 is MSB, S8 is LSB, UP = 1, DOWN = 0.

Cabling
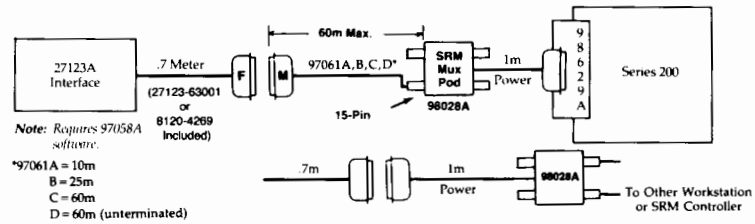
HP 27123A SRM Interface Cable Connections

HP 27128A ASI Interface

The Asynchronous Serial Interface is used for all modem connections. It can also be used for direct connections to terminals, and to serial I/O devices, though direct terminal connections are more commonly handled by an HP 27130 MUX card.

Configuration switch settings are as follows:

- For **Modem Connections**: S1, S3, and S4 UP; S2 DOWN. Set S5 UP; S6, S7, and S8 DOWN for 1200 baud rate.

- For **Direct Connections**: Set switches S1 through S4 UP. Set S5, S6, and S7 UP; S8 DOWN for 9600 baud rate.

- See interface installation and service documents for other special needs and other baud rates.
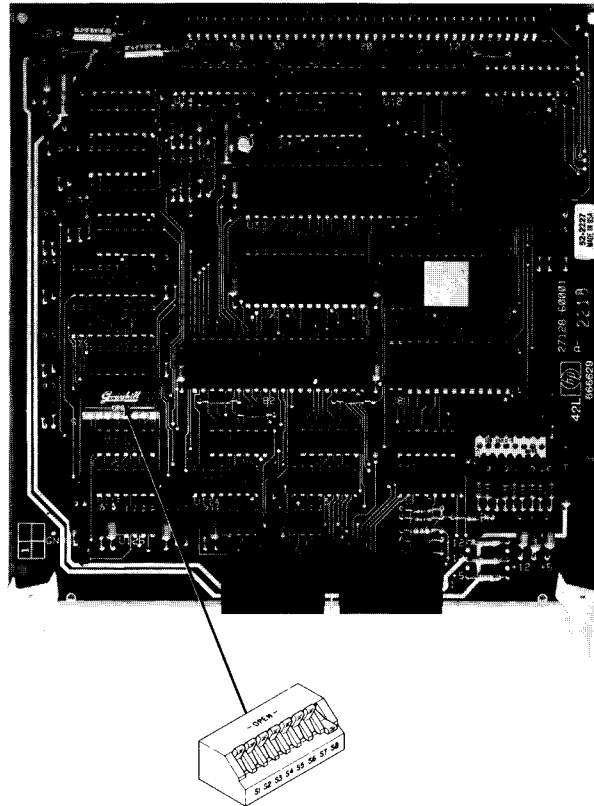
HP 27128A ASI Interface Card

Cable Information
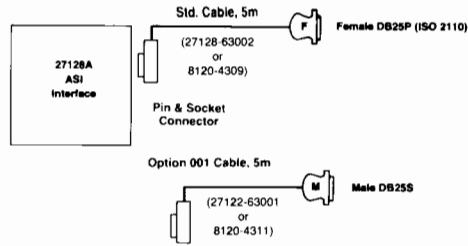
Terminal Cabling

Any of these . . .   are compatible with any of these.

ASI Interface Cables
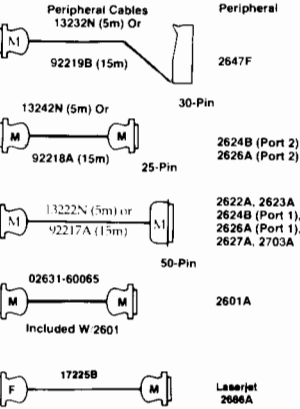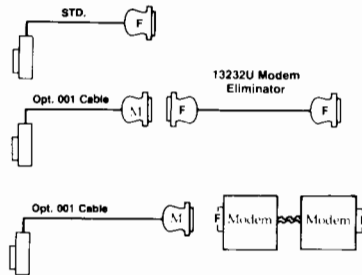
HP 27128A ASI Interface Cabling

HP 27130A/B Multiplexer

The eight-channel multiplexer card is used for direct connections to terminals **only**. It does not support modems or RS-232C printers.

No configuration is required. 28658-63001 (updated version of 8120-4076) connects interface to 28658-60005 (updated 21826-60001) 8-port connector panel. Cabling is as follows:
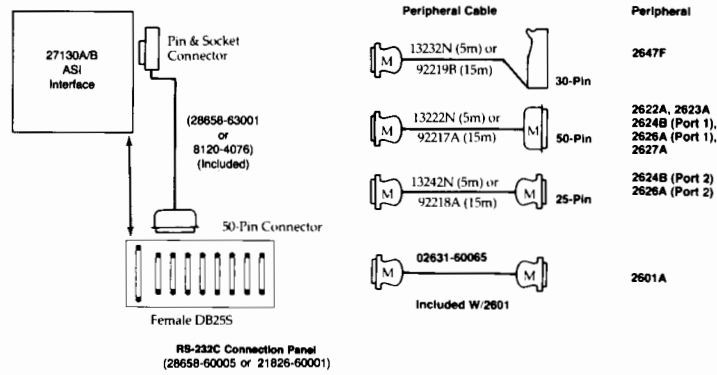
HP 27130A/B Multiplexer Cabling

HP 97062A Color Interface

Interface produces discrete RGB outputs. No configuration switches on cards. Two cards interconnect, then connect to I/O backplane through bottom card. This means two I/O slots are occupied, but only one select code is used. Therefore, the second select code is not available for other interfaces.

To install, slide assembled card pair into two slots, and seat lower card into its backplane connection. Attach interface cable to interface, then connect BNC cable ends to the respective R, G, and B medium-resolution color display inputs.

2m

97062A
RGB
Interface
Card Set

(97062-61601)
(included)

Color   Monitor
Such As HP 13279B
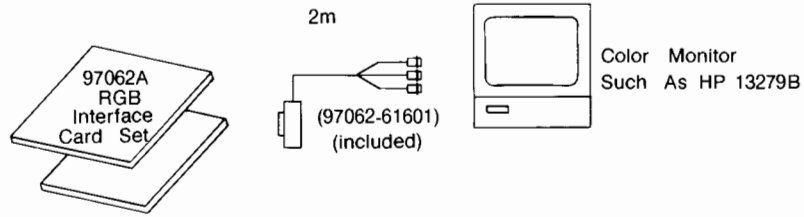
HP 98072A Color Interface Cabling

HP 97060A Graphics Processor

Used with HP 27112A GPIO to drive high-resolution color monitor. Set switches as shown in interface description earlier. Use 27112-63003 cable between processor and interface. 27112-63003 has grounding strain relief, required for Model 550 (27112-63005 cable was used on earlier models). Three 75-Ω BNC cables connect the graphics processor to the CRT monitor.

5-wire Modem Elimination Adapter

This adapter is used in direct connections between HP-UX computers. Use two female RS-232C connectors wired together back-to-back as indicated. Use appropriate hardware to physically support the two connectors and the cables that connect to them.

RS-232C to Modem Cable #1 (female connector)				RS-232C to Modem Cable #2 (female connector)
Signal Name	Pin Number		Pin Number	Signal Name
Shield	1		1	Shield
Data Out (BA)	2		3	Data In (BB)
Data In (BB)	3		2	Data Out (BA)
Signal Ground (AB)	7		7	Signal Ground (AB)
Data Carrier Detect (CF)	8		20	Data Terminal Ready (CD)
Data Terminal Ready (CD)	20		8	Data Carrier Detect (CF)

Chapter 2B
Software Installation

This section describes software installation on a new system. Updating software on an existing system is discussed later in this chapter.

Software Distribution Media
Series 500 HP-UX Release 4.0

Series 500 HP-UX System software is supplied on an HP 88140L/S cartridge tape for installation from a CS/80 cartridge tape drive. Each tape is marked with a model number that is interpreted as follows:

- 97070A Single-user HP-UX for HP 9000 Model 520
- 97079A Single-user HP-UX for HP 9000 Models 530, 540, and 550
- 97080A Multi-user HP-UX for HP 9000 Model 520
- 97089A Multi-user HP-UX for HP 9000 Models 530, 540, and 550

Hardware Power-up

Before installing software, the system hardware must be powered and prepared for use as follows:

1. Be sure the computer is unpowered, then power up all system devices except the computer. When any HP-IB device is used, all HP-IB devices connected to the same interface must also be powered to ensure correct bus signal levels and loading.

2. Set the write protect screw on the software tape cartridge to *write enabled* (arrow pointing away from SAFE), then insert it into the source drive. (BUSY light ON, PROTECT light OFF). After about 2 minutes BUSY light goes out.

3. When the tape drive finishes conditioning the tape (BUSY light goes out), apply power to the computer. The computer performs its power-up self-tests, then the Loader ROM message is displayed as the loader discovers the installation HP-UX system and begins moving it into memory:

   ```
   Loader Rev <x>
   HP-UX Model <yyyy> Release <x.x> (970zzA)
   ```

   where <x> identifies the loader ROM revision code, <yyyy> is the computer model (520, 530, 540, or 550) for which the software is intended, <x.x> is the HP-UX release version, and 970zzA is the model number of the HP-UX software.

   If loader errors are displayed, or the display remains blank, refer to CE handbook section for the computer being used for troubleshooting techniques. See also Chapter 4 of this manual.

4. When installation HP-UX system is in memory, the HP-UX system displays:

    Load done.

    This message appears only briefly on Model 520.

5. Some initial chores are performed by the system that require about 10 minutes to complete. When finished, the super-user prompt, #, is displayed. Proceed with installation.

Installation Procedure

During system installation, make all responses to installation prompts from the system console keyboard. Be sure you have responded correctly before pressing RETURN. To correct errors, use BACK SPACE. To cancel an entry prior to RETURN, press CTRL U. Once RETURN is pressed, no recovery from an entry error is possible.

NOTE

When asked for numeric responses (such as select code), do not use leading zeros. For example, to specify 5, use only 5; not 05 or 005. Use of leading zeros causes unpredictable results.

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1. To install **HP-UX only**, type

    coreinstall RETURN

    To install **HP-UX and all other software on the tape** (such as Fortran and Pascal, if present), type

    sysinstall RETURN

2. The install utility then identifies itself on the console screen, and displays a message indicating that it is installing only HP-UX (*coreinstall* option) or installing all products on the source media (*sysinstall* option). It then displays the default values for installation parameters:

    ```
    Here are the default parameters for this installation:

    * Source Device:        88140 Cartridge Tape Drive
                            select code    = 5
                            bus address    = 0
                            unit number    = 1

    * Destination Device:   CS/80 Disc Drive
                            select code    = 5
                            bus address    = 0

    * Initialization Operation: WILL be done on destination disc.
                            bootsize       = 1100000 (bytes)

    Are these values satisfactory for your system?
    If they are not, you will be instructed to supply responses
    for each parameter, interactively.
    (Enter y or n, then RETURN; default is 'yes')
    ```

    Type Y RETURN to continue with default values. Type N RETURN to use other values. Respond to requests for information as appropriate, if changing parameters.

3. When installation parameters are correct, respond "yes" to

`Are you sure you are ready. . .`

prompt by typing [Y] [RETURN]. If you respond with "no", HP-UX aborts, terminates, and you must reload the system to continue.

4. HP-UX now begins initializing the installation disc. Do not disturb the system or interrupt power until the initialization is complete. Depending on disc capacity, initialization can require up to an hour to complete. A power failure during initialization can corrupt the disc. To recover, use standard recovery procedures documented in the CS/80 CE Handbook and other CS/80 service documents.

Approximate initialization times are:

HP 7908:	9 minutes	HP 7914:	14 minutes
HP 7911:	4 minutes	HP 7933:	49 minutes
HP 7912:	10 minutes	HP 7935:	49 minutes

HP-UX cannot be directly installed on an HP 7933/7935 from supplied cartridge tapes.

CAUTION

Do not interrupt power to computer or disc during disc initialization. Terminated initialization in this manner may seriously corrupt the disc medium.

---

5. When initialization is complete, the HP-UX kernel is copied to the destination disc boot area. HP-UX files are then copied to areas outside the reserved boot space. As each file is copied, the file name is displayed on the console. Up to an hour may be required to complete the copy operation.

If other HP-UX-based products such as Fortran are being installed, these files are also copied and listed after the HP-UX system has been copied successfully. When the first tape has been copied and unloaded by the drive, replace it with the second tape and continue the copy operation.

6. When the copy operation is complete, HP-UX rewinds and unloads the source tape. Remove the tape from the drive, restore the write enable screw to its SAFE position, and store the tape in a safe place (a determined individual, if armed with a source tape, can defeat the security of an installed system).

7. Cycle the computer power switch OFF for a few seconds, then re-power. The loader ROM should now locate the installed HP-UX system and load it (unless another system is found first in the initial system look-up routine). When loading is complete, HP-UX performs several set-up operations that can require several minutes to complete. When finished, the login prompt is displayed.

HP-UX is now installed and ready for use.

Before Continuing

1. Run *fsck* to verify file system integrity before continuing. To run the test, type:

   /etc/fsck [RETURN]

   You should encounter no errors at this stage of installation. **NEVER** leave a new installation without running *fsck*. Otherwise, if the system does not work correctly later, you may never know what went wrong.

   When the # prompt appears on the system console display, *fsck* is complete. You should not encounter any *fsck* errors when installing a new system.

Hardware and software installation is now complete.

After System Is Installed

Peripheral Tests

Run System Functional Tests (see Chapter 5) to verify correct system peripherals operation.

Operating System Protection

This is normally done by the System Administrator, but the procedure is included here for reference if needed.

1. Log in as user root, then type passwd [RETURN] (skip this step if already logged in).

2. Type in at least 7 characters (control characters are not recommended because they are hard to remember), then [RETURN] (password is not displayed).

3. When prompted, type the password and [RETURN] again to verify. If entries do not match, you are prompted again for two new entries.

4. Write down password in a secure place. If lost or forgotten, no one can log on as user root (super-user). The system takes about 15 seconds to install a new password.

System Clock

1. Type date [RETURN] to set clock.

2. Enter time zones and hours from Greenwich Mean Time (GMT) as follows:

   TZ=<sss><H><ddd> [RETURN]   then
   export TZ

   <sss> and <ddd> are three-letter abbreviations of standard and daylight savings time zones, and <H> is the number of hours from GMT. For example, if you are in Denver, the entry is TZ=MST7MDT. In Phoenix, Arizona, enter TZ=MST7 because Arizona does not use daylight saving time.

   Once the TZ variable is set up in file */etc/profile*, there is no need to reenter TZ each time the computer is powered up.

3. To set the date and time, type:

    date MMddhhmmyy RETURN

    Where MM is two-digit integer representing month, dd is day of month, hh is hour in day (24-hour clock, values from 00 thru 23), mm is minutes past the hour, and yy is year. Year is necessary only if it is not already entered correctly. All entries must be 2 digits.

4. Type exit RETURN or press CTRL- D to exit.

Before continuing with system back-up and other activities, configure the device files and other system entries that are required for the system to communicate with user terminals, remote computers, and peripheral devices. Procedures are described in Chapter 3.

System Shutdown

If you need to shut down the system for any reason, follow this procedure to ensure no data losses. You must be logged on as user root (super-user). See **After Installing HP-UX** in the *HP-UX System Administrator Manual* for cautions.

1. Type /etc/shutdown RETURN to terminate all processes, close down the file system, and perform other system maintenance operations. See *shutdown (8)* in *HP-UX Reference* for details.

2. Type /etc/fsck RETURN to perform file system integrity tests before power down.

3. Type exit RETURN to logoff.

4. The system can now be safely shut down.

System Back-up

Two backup methods using archival and incremental backups are available. Both methods involve making archive (complete) backups periodicaly and supplementing this with daily incremental backups.

This allows you to restore the system to the condition it had at the last incremental backup before a hardware failure or a system "crash". See the **Backing Up and Restoring the File System** section in the *HP-UX System Administrator Manual* for details.

Here is a step by step backup method:

1. Log on as the super-user root.

2. Type /etc/shutdown RETURN to do a system shut down.

3. Run /etc/fsck to check for the file systems integrity.

4. To create a complete (archive) file backup type /etc/backup -archive RETURN. Now go to step 6.

5. To create an incremental backup, do steps 1 through 3 above. Then type /etc/backup RETURN.

6. When the back-up has finished, remove the backup medium.

7. Determine if errors occurred during backup. If */etc/backup* is not modified, errors will be written to */etc/backuplog*.

NOTE

If you are recovering from a total loss of the file system, be careful when restoring the most recent backups. Because the backup is a copy of the system, it may contain the same error that caused the system to "crash" in the first place.

Series 500 computers support both *cpio* (copy in and out) and *tar* (tape archive). Both are standard UNIX commands. They serve to transport data between Series 200 and 500 computers as well as between HP-UX and standard UNIX systems. The command, *tcio* (tape copy in and out), was created by HP to be used together with *cpio* and *tar* to write/read data to/from HP 88140 cartridge tapes.

Updating Software

This section describes how to install update software in an existing system.

The software update package includes:

- Updated software supplied on CS/80 cartridge tape,
- Additional files describing update changes,
- Updated manual pages to be inserted into existing manual set.

Installing the Update

Shell scripts used for updates are included in the update software. Ramifications of updating the HP-UX software are discussed in the next section.

1. Log on as user *root* and be sure you are in the / (*root*) directory. Type cd/ RETURN to move to root directory.

2. Shut down the system as previously discussed, confirm that the system is in state 1 (single-user), then run */etc/fsck*. See **Using the FSCK Command** in the *HP-UX System Administrator Manual* and *fsck(8)* in the *HP-UX Reference* for details.

3. Install initialized CS/80 cartridge tape.

4. Use /etc/backup -archive to archive existing system onto the initialized CS/80 cartridge tape before installing new software. After archive is finished, remove CS/80 cartridge.

5. Type ls /etc RETURN to list files in the */etc* directory, and look for a file named *sysupdate*. If the file exists, skip to next step. If not, type:

   lifcp -b /dev/rct:SYSUPDATE - | cpio -idv RETURN

   to copy *sysupdate* script from tape to */etc* directory.

6. Execute update script by typing /etc/sysupdate RETURN

   When *sysupdate* prompts Device to load files from?, respond with /dev/rct RETURN

   to identify the special (device) file of the cartridge tape drive. *Sysupdate* confirms the presence of the special file */dev/rct*, then prompts Insert update medium and press RE-TURN.

7. Insert Update tape and press RETURN .

8. *Sysupdate* copies *sysupdate1* script from tape to file system, then executes it. *Sysupdate1* then displays `Loading files` and proceeds to update system files.

   As update files are loaded and linked, the file name and related messages are displayed on the System Console. If any libraries are loaded, *ranlib(1)* is executed to update them. Upon completion, *sysupdate1* builds the script */etc/sysupdate.end* and terminates with the message:

   `Please reboot`

9. Cycle computer power to reboot. New HP-UX system is loaded. Log on as *root* user and type

   `/etc/sysupdate.end` RETURN

   Sysupdate.end removes temporary files used during updatiug, and executes *sync* commands to gracefully terminate the process. System update is now complete.

Changes to */etc* and */dev*

Updating does not alter existing special (device) files in */dev* directory, but may add files that support new peripherals.

While the files that existed in */etc* before updating (that were used to customize the original system) remain unchanged, the update script copies any new commands to */etc* and new "configuration" files to the */etc/newconfig* directory. */etc/newconfig* files may or may not be different from configuration files shipped in */etc* with the original system. The file */etc/newconfig/README* contains a brief description of the contents of */etc/newconfig*.

The file */etc/newconfig/Update_info* is also copied to the system during updatiug. This file documents all changes between the current and previous revisions of the HP-UX Operating System. Read this file to determine what critical changes have been made in the configuration files. For example, one update release of HP-UX contained new *passwd*, *group*, and *rc* files with new entries required for the LP (line printer) spooler to work correctly.

After reviewing the changes included in the update, incorporate the changes in the existing */etc* files. Examine the files in */etc* and */etc/newconfig* and incorporate useful changes into customized configuration files in */etc*.

An update document describing changes between revisions is also included in the update package.

Changes to uucp Configuration Files

Another important directory, */usr/lib/uucp/newconfig*, is added to the system when you update it. This directory contains the same kind of information for the uucp(1) facilities that */etc/newconfig* contains for the rest of the system. Examine the files in */usr/lib/uucp/newconfig* as you did with */etc/newconfig*. You may want to use the *diff(1)* command to compare your existing configuration files with the *newconfig* versions, then incorporate any useful changes from the newer files into the existing ones.

Preventive Maintenance

System preventive maintenance consists of periodically backing up the operating system and running *fsck(8)* to ensure the integrity of the HP-UX file system. See **Backing up and Restoring the File System** in the *HP-UX System Administrator Manual* for procedures and recommendations.

In addition, equipment should be checked weekly, biweekly or monthly to be sure that cooling fan filters are clean and that adequate cooling air is available. Some additional preventive maintenance may be required for disc drives and line printers. For recommendations, refer to the CE handbook for devices of interest.

Chapter 3
Configuration

Configuration activities discussed in this chapter include:

- Loading drivers and setting up special (device) files during system installation so the operating system can communicate with peripheral devices and user terminals.

- Removing special files when peripherals or terminals are removed from the system or moved to a different interface or bus address.

- Adding new drivers and special files when the system is expanded or when a device or terminal is moved from a previous interface or bus address.

Terminology

The term "special files" is a UNIX convention that identifies files whose sole purpose is to provide interaction between the operating system and peripheral devices. It is synonymous with the term "device files" when those files serve the same exclusively I/O-related functions. The terms, when related to HP-UX, are used interchangeably, although "special files" is technically more correct, though less descriptive.

Linking Operating System
to Peripherals and Datacomm Ports

Special files contain and/or access driver software and related elements. A file must be created for each peripheral device, terminal, or remote computer before HP-UX can communicate with the device. Files are loaded and created by executing *osck*, *oscp*, and *mknod* commands from the console keyboard.

Prerequisites

- Install the hardware,

- Set device HP-IB bus address when applicable, and

- Match terminal/serial device baud rate and other settings to system expectations.

All of the drivers and I/O support facilities supported on HP-UX were transferred to the system disc during installation. However, only those special files used in nearly all normal applications were configured to be loaded during HP-UX power-up or restart. Optional files that may or may not be needed were not.

Series 500 HP-UX identifies drivers by number. The following drivers are set up for system use during initial installation:

Default Drivers Loaded During Installation of HP-UX 4.0

Driver Number	Function
1	CS/80 Disc/Tape Driver
12	General HP-IB Driver (except CS/80 and CIPER devices)
15	NULL Device Driver (output device used to discard data)
20	Special driver used only by /dev/tty
22	Driver for formatted output to non-CIPER printers, both external HP-IB and internal (Model 520)
26	Raw driver for Model 520 internal printer
29	System Console driver for Model 520 keyboard and display
31	Terminal driver for terminals connected to ASI or Multiplexer Interfaces

The following files are not set up for use during initial installation:

Driver Number	Driver File Name	Function
6	HPIB_FLEX.opt	HP 9895 Flexible Disc Driver
8	HPIB_FLEX.opt	HP 8290x 5$\frac{1}{4}$-inch Flexible Disc Driver
9	HP9885.opt	HP 9885M/S 8-inch Flexible Disc Driver
10	MEMORY_VOL.opt	"Memory Disc" Driver. Treats memory as a disc device (see sdfinit(8)
11	HP7970.opt	HP 7971A/7970E 9-track Tape Driver
14	CIPERLP.opt	CIPER Printer Driver
18	HP27112A.opt	GPIO Driver for 27112 GPIO Interface (except HP 9885 — use Driver 9 instead)
19	SERIAL.opt	Raw (character) Driver for ASI and Multiplexer cards. Used by aterm. For terminals, use Driver 31.
28	HP98770_GR.opt	Special driver for Model 520 monochrome and high-performance color displays (used only by HP GRAPHICS software)
32	HP97062_GR.opt	Driver for Model 520 Standard Color Display and HP 97062 Color Output (RGB) Interface
34		Network Interface driver for LAN 9000
35	HP268X.opt	Laser Printer Driver (such printers as HP 2680A and HP 2688A)
36	HP7974.opt	HP 7974/7978 9-track Tape Driver

Planning and Preparation

1. Make a list of interface select codes and bus addresses (where applicable) for each peripheral device in the system. Verify settings (do not change hardware connections or bus addresses unless the system is shut down).

2. Log on as user root (only *root* can use *mknod* command).

3. Get a CRT listing of currently installed special files by typing

   `ll /dev` RETURN.

   Notice the files that were created automatically during system loading.

   On a typical new installation, for all models except Model 520, the following special files are loaded:

   ```
   Special File Name  |   Function
   -------------------------------------------------------------------
       /dev/console   |   System Console Special File
       /dev/tty       |   Special File for certain system needs
       /dev/null      |   NULL Device Special File
       /dev/hd        |   CS/80 Block-mode Root Disc Special File
       /dev/rhd       |   CS/80 Raw-mode Root Disc Special File
   ```

   Model 520 HP-UX configures the following additional special files during installation:

   ```
   Special File Name  |   Function
   -------------------------------------------------------------------
       /dev/lp        |   Formatted Output Internal Printer Special File
       /dev/rlp       |   Raw-mode Internal Printer Special File
   ```

The following is a sample of the **default special files** that are listed by the *ll /dev* command following a **new system installation**. The actual listing obtained will vary somewhat, depending on what model computer is in the system. Files not included in the list, if needed, must be added by using the procedures discussed in this chapter. This list is typical for Model 520 installations:

```
                        --File Owner
                  /          --Owner's group
                  /       /       --Major (driver) Number
                  /       /       /      --Minor Number
    total 0       /       /       /      /
    crw--w--w-  1 root    system   31 0x000000 Apr  1 13:28 console
    brw-r-----  1 root    system    1 0x050001 Nov 26 10:29 ct
    br--r--r--  1 root    system    1 0x050000 Jan 14 11:04 hd
    crw-rw-rw-  1 root    system   22 0x020200 Mar 28 11:05 lp
    crw-rw-rw-  1 root    system   15 0x000000 Apr  1 14:00 null
    crw-rw-rw-  1 root    system    1 0x050001 Jan 14 12:05 rct
    cr--r--r--  1 root    system    1 0x050000 Jan 14 11:04 rhd
    crw--w--w-  1 root    system   12 0x020200 Nov 15 10:15 rlp
    crw-rw-rw-  1 root    system   20 0x010000 Mar 13 11:17 tty
    \ \ \ \     \                                          /
     \ \ \ \    --Number of links into file               /
      \ \ \ \  --Other users' access                --File name
       \ \ \ --Owner's group access
        \ \ --Owner's access
         --b = Block mode
           c = Character (raw) mode
```

Sample Listing of HP-UX 4.0 Special File Directory */dev*

Interpretation of Listing

Left-most character (b or c) indicates block-mode or character-mode file. Rest of field shows read/write access availability to file owner, owner's group, and other users.

Columns 2, 3, and 4 show number of links into file, file owner, and owner's group.

Column 5 (Major Number) indicates which driver is used with the special file.

Column 6 (Minor Number) contains eight characters.

- The first two characters are always 0x.
- Digits 3 and 4 are hexadecimal select code.
- Digits 5 and 6 are hexadecimal bus address or multiplexer port number (00 if not MUX or HP-IB).
- Digit 7 is the unit number, if applicable, or zero.
- Digit 8 is the mass storage volume number or zero for non-mass-storage devices.

File name follows file creation date and time.

Special files can be placed in any directory, but */dev* is preferred because it was created for that purpose and is readily accessible to all system users.

Using mknod

to Set Up Special Files

Special files are created by the *mknod* command:

mknod /dev/ <device file name> b <major number> <minor number>

for block-mode files, or

mknod /dev/ <device file name> c <major number> <minor number>

for character-mode files.

Terminal and Remote-computer Special Files

Create special files in the */dev* directory for all data communication ports first. Up to three *mknod* commands are used for each datacomm port. A *tty* file is required for each port that supports incoming (dial-in) datacomm connections. A *cua* (autodial) file and a *cul* (datacomm link) file must be created for each port that can initiate connections to a remote terminal or computer. *cua* and *cul* files must always be created in pairs for each port, when used. File requirements are the same for both modem and direct-connect links. **Do not set up special files for the System Console.**

Commands are as follows (see example on next page):

```
/etc/mknod /dev/tty<nn> c 31 0x<ssaauv>
/etc/mknod /dev/cua<nn> c 31 0x<ssaauv>
/etc/mknod /dev/cul<nn> c 31 0x<ssaauv>
```

All datacomm devices use the major number: 31. To determine the minor number, combine the hexadecimal values for select code (<ss>), port address (<aa> – use 00 for ASI card), and unit and volume numbers (<uv> – normally 00). The minor number is identical for *tty, cua,* and *cul* files for each given device.

Omit the System Console from consideration, then assign file names in some reasonable sequence. Suggestion: begin with the lowest select code, then proceed to higher select codes, if present. If the interface at a given select code is a multiplexer, assign the ports on that interface before continuing to the next. Assign the names *tty00, cua00,* and *cul00* to the lowest datacomm interface select code. Assign *tty01, cua01,* and *cul01* to the next higher select code. Continue with *tty02, cua02,* and *cul02* ..., until all interfaces are accounted for. Do not create *tty* files for dial-out only, or *cua/cul* files for dial-in only ports (see example).

Single-user HP-UX allows only one *tty/cua/cul* entry set. Multi-user HP-UX accepts entries up to the maximum licensed for that installation (16 ports for HP-UX 4.0).

Datacomm ports also require *inittab* entries for each port. Procedures are explained later in this chapter.

Example of Multi-user System

Consider a multi-user installation with an HP 27130 multiplexer at select code 0 (port 00 is System Console), and an HP 27128 ASI card at Select code 01. Four terminals besides the console are connected to the MUX card; the terminal at MUX port 04 is set up for user-originate only so no *cua/cul* entry is included. *mknod* file entries are as follows (terminate each line with RETURN):

```
/etc/mknod /dev/tty00 c 31 0x000100
/etc/mknod /dev/cua00 c 31 0x000100
/etc/mknod /dev/cul00 c 31 0x000100
/etc/mknod /dev/tty01 c 31 0x000200
/etc/mknod /dev/cua01 c 31 0x000200
/etc/mknod /dev/cul01 c 31 0x000200
/etc/mknod /dev/tty02 c 31 0x000300
/etc/mknod /dev/cua02 c 31 0x000300
/etc/mknod /dev/cul02 c 31 0x000300
/etc/mknod /dev/tty03 c 31 0x000400
/etc/mknod /dev/tty04 c 31 0x010000
/etc/mknod /dev/cua04 c 31 0x010000
/etc/mknod /dev/cul04 c 31 0x010000
```

Note that if the HP-UX computer can initiate connections to the remote computer or terminal (dial-out only or dial-in/dial-out), both the */dev/cua* and */dev/cul* entries are required whether the datacomm link is a direct, leased modem, or switched modem connection.

File Naming Conventions

Naming of special files is arbitrary, but to minimize confusion, names should be chosen to represent a logical mental relationship for users between the operating system and peripheral device. *Intro (4)* of the *HP-UX Reference* shows the recommended naming convention. File names in this chapter use that convention when practical.

The suggested special file name convention usually identifies the device type and HP model number of the device. In cases where two identical devices reside in the system, the file name must be unique for each device. A convenient way to solve the problem is to add *.1*, *.2*, ... to each file name for successive same-model devices. For example, if you have two HP 7908 disc drives in the system (besides the root drive), the block-mode file for each could be */dev/hd7908* and */dev/hd7908.1* respectively (on the other hand, files could be named *rose* and *carnation* if the System Administrator prefers). In any case, it is helpful to consult with the System Administrator before naming files, to determine any special preferences.

Default Special Files

Several default special files are created automatically during system installation. They usually include the following:

List of HP-UX 4.0 Default Special Files

```
ct    rct     CS/80 Cartridge Tape Drive at System HP-IB Address 00
hd    rhd     CS/80 Disc Drive at System HP-IB Address 00
      lp      Line printer at Printer HP-IB Address 01
      rlp     Graphics printer at Printer HP-IB Address 01
```

Other default special files not listed here refer to internal devices (such as internal disc drives) in Series 500 computers and to special files used by the HP-UX operating system for maintaining system operation.

Special file */dev/lp* is used by the line printer spooler. Redirected I/O to the line printer is sent to the **spooler** special file */dev/lpr* by all normal users. Super-users can redirect I/O to the */dev/lp* file, thus overriding the spooler, but this practice should generally be avoided unless necessary.

Disc and Tape Drive Special Files

Set up files for disc and tape drives next. A block-mode **and** a character-mode file should be created for each disc device or device segment. For block-mode files, the file name consists of the device type abbreviatiou (such as hd for hard disc or fd for flexible disc) and the model number (a suffix is added to differentiate segments in a multi-segmeut drive). Character-mode file names are identical to block-mode names except for the prefix r (raw- or character-mode). Block-mode files are not recommended for tape drives.

CS/80 Drives

The System Administrator's toolbox chapter of the *HP-UX System Administrator Manual* lists recommended special file names, plus major and minor numbers for supported CS/80 devices. Use *mknod* syntax; set up a block-mode and character-mode file for each drive or drive segment as indicated.

For example, to set up files for au HP 7912 ou the System Bus at select code 05, address 06, use the following commands. The first sets up the block-mode file; the second the character mode file. The *hd* prefix in the file name indicates a hard disc drive (to identify CS/80 cartridge tape drives iustalled in a disc drive enclosure, the prefix, *ct*, is used instead).

```
/etc/mknod /dev/hd7912 b 1 0x050600
/etc/mknod /dev/rhd7912 c 1 0x050600
```

Note that the root drive special file names are *hd* and *rhd* respectively, and do not include the drive model number. To set up files for a cartridge tape drive in an integrated disc/tape drive with shared controller, the following commands would be used (tape drive is unit 1, volume 0):

```
/etc/mknod /dev/ct7912 b 1 0x050610
/etc/mknod /dev/rct7912 c 1 0x050610
```

Other Devices

Refer to the *HP-UX System Administrator Manual* for other filename recommendations.

Additional Entries for Datacomm Ports

For datacomm ports, in addition to setting up special files, entries in the files */etc/ttytype* and */etc/inittab* must be updated for each terminal and remote computer link.

Updating */etc/ttytype*

To list the contents of */etc/ttytype*, type:

```
more /etc/ttytype RETURN.
```

To reconfigure the file to match the installed system, use any system editor. Add an entry for each log-in terminal to file */etc/ttytype* (or change existing entries instead, if appropriate), and delete unneeded entries to keep the system clean. For each entry,

1. Specify terminal model number followed by a blank, then

2. Add the special file name for that terminal (such as tty04) to complete the entry.

Here is an example of the contents of */etc/ttytype* for a small, newly installed, multi-user system (note that special files *tty00*, *tty01*, and *tty02* may not yet exist in directory */dev* when this file is created):

```
9020 console
2622 tty00
2623 tty01
2624 tty02
```

When setting up entries for computers running terminal emulator software, use the HP model number of the terminal being emulated.

Updating */etc/inittab*

For each entry in */etc/ttytype*, place two entries in */etc/inittab*; one for each system state.

- Set up entries **only** for terminals in system.

- Set up entries for **all** system states (1= single-user; 2=multi-user).

- Do not set up any entries for terminals that do not exist.

Examples are shown later.

Single-user System

Supports System Console and one *uucp* port; no other terminals.

1. Set */etc/inittab* System Console entry to correct baud rate (if applicable), then

2. Set *uucp* port for remote computer. Here is an example showing both operations with tty01 for the *uucp* port (5=9600 baud, 0= no delay):

```
1:co:c:/etc/getty console 5 0
2:co:c:/etc/getty console 5 0
1:01:k:
2:01:c:/etc/getty tty01 5
```

Entry Options: (See Multi-user for definitions) /etc/getty name [<type>[<delay>]]

Multi-user System

1. Set */etc/inittab* System Console entries as in single-user example (baud rate may need to be changed).

2. Set all */etc/getty* entries as shown previously for all tty ports. Do not set up entries for datacomm ports that do not exist. Only the last digit (baud rate) and optional type and delay should be changed or added.

<type> defines baud rate and dial-up sequence for a given port as follows:

0 300/150/110/1200 baud; normal dial-up sequence starting at 300 baud
1 150 baud; no sequence
2 2400 baud; no sequence
3 1200/300/150/110 baud; normal dial-up sequence starting at 1200 baud
4 300 baud for console DECwriter
5 9600 baud; no sequence
H HP terminal using direct connection

<delay> defines the time in seconds before a dial-up port is disconnected if there is no response to login request. Set to zero or omit for direct connections.

Multi-user Example

Using the multi-user example earlier in this chapter, here is what the finished file should resemble (comment lines in the supplied file have been omitted):

Single user state: Kill all user processes except console.

```
1:co:c:/etc/getty console 5
1:00:k
1:01:k
1:02:k
1:04:k
```

Multi-user state: Enable all users with continuous process availability.

```
2:00:c:/etc/getty tty00 5
2:01:c:/etc/getty tty01 5
2:02:c:/etc/getty tty02 5
2:03:c:/etc/getty tty03 5
2:04:c:/etc/getty tty04 5
```

The number following the first colon on each line represents the port number, and can be any value from 00 through 99. *tty00* through *tty04* could be named *george, Charles*, etc., if preferred; The numerical correspondence with port numbers is purely coincidental, and has no system significance.

Baud rate/dial-up sequence parameters may vary from the example shown, but otherwise the *inittab* file should be very similar.

Changing Peripheral Devices
To Move or Delete Devices:

1. If the system is running, do not remove power from any system devices until the shutdown command and related tasks have been completed. See Chapter 2 and the *HP-UX System Administrator Manual* for procedures and necessary precautions.

2. Power down system before changing interfaces, interface cables, or disconnecting (or connecting) any hardware items in the system.

3. Make required hardware changes then re-power system.

4. Boot HP-UX and log in as user root.

5. Remove special file for old device location using the command:

    rm <*special file descriptor*> RETURN

   File descriptor must include entire directory path description.

6. If datacomm port, delete the */etc/inittab* entry for both states 1 and 2, and delete the terminal entry from file */etc/ttytype*.

7. If moving devices, create a new special file using *mknod* as explained earlier in this chapter.

Adding Users

After peripherals, terminals, and remote computer ports have been installed and linked to the operating system, the system administrator should add user and password directory entries for each system user, and create the support files that are appropriate for each user's needs. Procedures are described in the *HP-UX System Administrator Manual.*

Chapter 4
Troubleshooting

This chapter contains troubleshooting procedures and flowcharts for Series 500 HP-UX from an overall system perspective. When the procedure indicates that a hardware device or assembly is defective, refer to the appropriate hardware CE Handbook for further repair procedures.

Available Tools

The following troubleshooting software and tools are inherent in all up-to-date Series 500 HP-UX hardware/software systems:

- Loader ROM self-test program. Loader ROM tests check the processor and other internal assemblies, and perform various tests on installed I/O cards. The overall test provides a high confidence that there are no non-intermittent failures in most of the internal hardware.

- HP-UX System Functional Tests included in the HP-UX operating system (see Chapter 5). These tests verify communication between the computer and HP-UX-supported peripherals. These tests are not comprehensive diagnostics.

In addition, the CS/80 Exerciser Utility Program (available separately) can be used as a stand-alone test program, or it can be added to the HP-UX file system for use at any time. This program provides extensive disc diagnostics including hard and soft error checking. It can be used to test any supported CS/80 disc or tape drive connected to the HP-UX system.

Minimum Requirements

Before troubleshooting, verify that the system meets minimum hardware configuration requirements listed at the beginning of Chapter 2. In addition, check the following details:

System Console:

- Model 520 uses built-in keyboard and CRT. Internal printer can be used for hardcopy listing of test results.

- Other models require external termiual connected to ASI or MUX card at select code 00 (MUX port 00, if applicable).

Installation Disc

Installation disc must be a single-controller CS/80 drive connected through an HP 27110 HP-IB Interface set for high-speed operation.

If these devices are not present, the system cannot be installed.
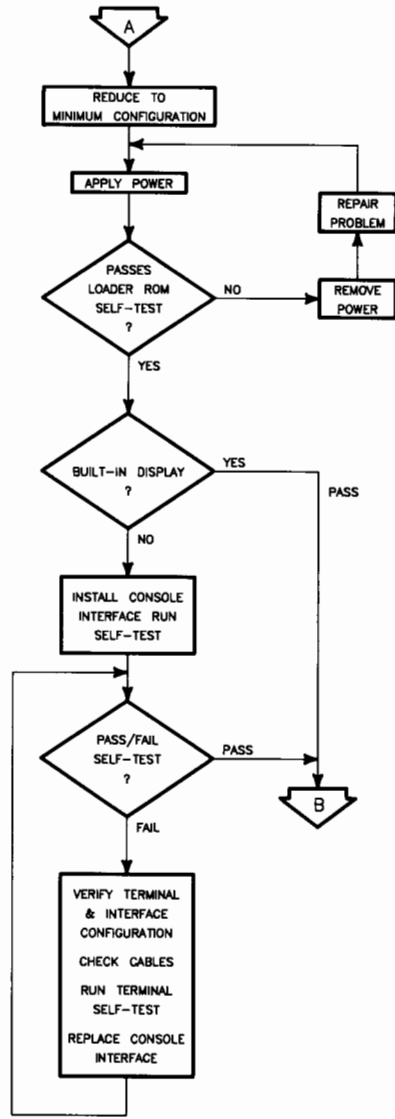
Preliminary Troubleshooting Flow Chart

New Installations

Most new installations perform correctly without difficulty "as delivered". If problems are encountered during installation, the techniques and philosophies described here should be helpful.

General Approach

The following procedure outline is structured for the case where the system is totally non-functional at the start of the troubleshooting process. When troubleshooting a new but only partly operational system, some steps can be omitted, but following the procedure anyway ensures that no function escapes proper testing due to a missed step. Troubleshooting existing systems that were once operating correctly is treated later in this chapter.

I: Get minimum-configuration computer working

Before other system devices can be tested, the computer (and built-in display, if present) must be operating correctly.

1. Remove **all** interfaces, and disconnect all external peripherals. If a possible memory defect is suspected, remove all memory cards but one before running self-test.

2. Apply power to the computer and allow sufficient time for self-test to finish. Check loader ROM messages (if computer has built-in display) or CPU LED display (all other models) for self-test errors.

3. If computer passes self-test (no loader ROM self-test errors), skip to Step II.

4. If errors occur (computer fails self-test), refer to computer CE handbook diagnostic and troubleshooting chapters for troubleshooting and repair procedures.

II: Get minimum-configuration computer and display working

These instructions apply only to computers using an external terminal for the system console. At this point, the LEDs on the processor card show no self-test errors. No terminal is connected to the computer at this time.

1. If the **system console is a terminal**, remove power then install the console interface. **Be sure the card is configured correctly.** Connect the terminal to the interface and apply power; first to the terminal, then to the computer. Allow self-test to complete, then verify loader ROM messages. If no errors are listed, and other messages are displayed correctly, go to step III.

2. If the **system console terminal** is not working correctly:

   a. If loader ROM messages on the terminal display appear to be scrambled, verify terminal and interface configurations to be sure baud rate, handshaking and other factors are properly matched (see Chapter 7 for configuration information).

   b. If no information is displayed on the terminal, place terminal in LOCAL, and run the terminal self-test. If the self-test works, check cabling and computer/terminal interfaces. Be sure the computer interface is set to match terminal operating characteristics. Refer to interface installation document and terminal operating manual for further information.

III: Get full-memory computer working

Minimum-configuration computer and display are now working, and loader ROM messages are being displayed correctly on the system console.

1. Remove computer power and install any remaining memory cards.

2. Apply power to computer and wait for self-test to complete.

3. Verify memory self-test. If any failures occur correct the problem before continuing.

Memory testing is now complete for entire memory. Correct any errors before continuing.

```
                    ┌───┐
                  ▽─┤ B ├─▽
                    └───┘
                      │
                      ▼
        ┌──────────────────────────┐
        │ MINIMUM—CONFIGURATION     │
        │ MAINFRAME  &  DISPLAY     │
        │ NOW  WORK.  LOADER        │           ┌──────────────────┐
        │ ROM  MESSAGES  CORRECT    │           │  RUN  SELF—TEST   │
        └──────────────────────────┘           └──────────────────┘
                      │                                  ▲
                      ▼                                  │
        ┌──────────────────────────┐          ┌──────────────────┐
        │   REMOVE   POWER          │          │ IDENTIFY  &  REPLACE │
        │ INSTALL  FULL  MEMORY     │          │  FAULTY  MEMORY   │
        │  APPLY  POWER             │          └──────────────────┘
        │ LET  SELF—TEST  RUN       │                   ▲
        └──────────────────────────┘                   │
                      │                                 │
                      ▼                                 │
                 ╱─────────╲      NO        ┌──────────────────┐
                ╱ SELF—TEST  ╲──────────────▶│  REMOVE   POWER  │
                ╲   PASS  ?  ╱               └──────────────────┘
                 ╲─────────╱
                      │
                     YES
                      ▼
        ┌──────────────────────────┐
        │ COMPUTER  &  FULL         │
        │ MEMORY  ARE  NOW          │
        │    WORKING                │
        └──────────────────────────┘
                      │
                      ▼
                    ┌───┐
                  ▽─┤ C ├─▽
                    └───┘
```
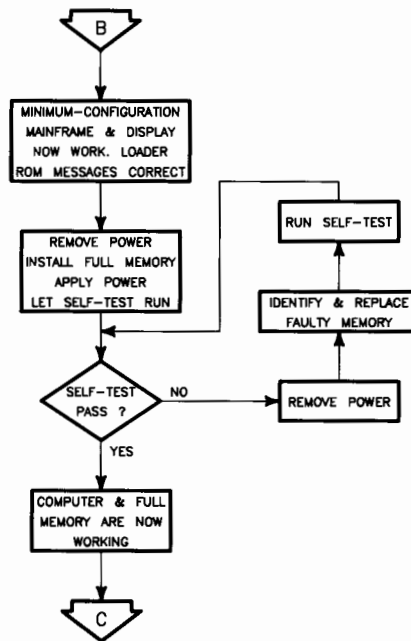
Minimum Configuration to Full Memory

IV: Get computer and installation disc working together

The computer, keyboard, display, and memory are now working (keyboard has not been tested but probably works at least partially unless evidence shows otherwise).

1. Run disc drive self-test and consult disc drive CE handbook Troubleshooting and Diagnostic chapters if it fails. When drive passes self-test, continue with the next step.

2. Remove power from the computer and install the System Disc HP-IB interface. Make sure the computer passes loader ROM self-test.

3. With disc powered and running, insert the HP-UX operating system tape into the installation-disc tape drive and wait until tape "busy" light goes out. Apply power to the computer, and watch the busy light. If the light cycles on and off after the computer completes its self-test sequence, the computer is communicating with the tape drive controller, indicating that the HP-IB interface and cable are probably working correctly.

   If the busy light does not cycle when the computer is powered:

   a. The disc drive, the computer's disc interface, or the HP-IB cable may be defective. Continue with Step b.

   b. Move the HP-IB interface cable from the System Bus HP-IB card to another HP-IB interface (power OFF), then reapply power. If the busy light now responds, the original HP-IB card may be defective. Exchange with known-good card to verify. Reconnect the cable to the original disc interface and retest.

   c. If the busy light still does not respond, replace the disc drive HP-IB cable and retest on the substitute System Bus HP-IB interface. If problem disappears, cable was defective; restore original interface. If not, run CS/80 internal diagnostics, or use HP 85 disc diagnostics if available to determine whether disc drive is faulty. See CS/80 CE handbook for additional information concerning diagnostics and troubleshooting.

4. At this point, the loader ROM has accessed the tape drive controller. If HP-UX is already on the CS/80 disc, unload the tape cartridge and skip to Step V. If installing a new HP-UX system ou the disc, allow the computer to continue loading HP-UX from the tape if power is already ON, or apply power to start loading HP-UX if power is OFF.

   If you want to re-install HP-UX over a previously existing system, be sure that the System Administrator has backed up the existing system, if needed, before re-installing.

   If the loader ROM caunot locate any existing systems when no tape is present in the tape drive, 1) the disc is empty (normal for new installation), 2) the disc's boot area is corrupt (previously-installed system), or 3) the disc drive is defective (possible in either case).

   Load a system.

   a. Load the HP-UX system from the HP-UX software tape. If the system appears to load correctly , skip to Step V.

   b. If system does not load correctly, check for:

      -- Bad tape. Try another HP-UX installation tape, if available.
      -- Change CS/80 drive to a different HP-IB interface.
      -- Use HP 85 or Series 500 stand-alone CS/80 Exerciser to troubleshoot the disc drive.

5. Run CS/80 Exerciser program, if desired, to verify disc/computer iuteraction beyond that demonstrated by the loader ROM. The value of this step varies, depending on previous experience with the installation disc (installed systems only). This test should be unnecessary on a new disc unless other factors indicate the possibility of a drive malfunction or anomaly.
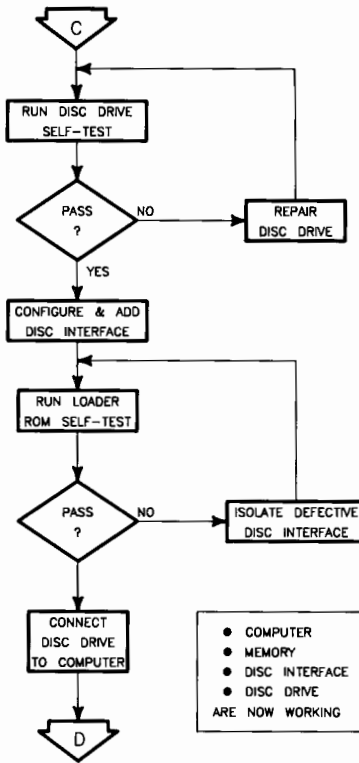
Disc Drive Check

V: Get installed HP-UX working

The computer, system console, and installation disc are now communicating.

IMPORTANT

An existing system may contain valuable data that has not been copied on back-up media and must be preserved if possible. Do not install a new operating system on a previously working disc unless authorized to do so by the System Administrator. If HP-UX must be reinstalled and the disc contains data that must be preserved, exhaust all available means for recovering the data from the disc before installing the new system. Help and guidance can be obtained through your HP Technical Support Engineer.

---

1. If you are installing a new system that failed to turn on properly or reinstalling HP-UX on a previously corrupt disc, install HP-UX as explained in Chapter 2. If the HP-UX operating system installs correctly and you can log on, continue with step VI. If errors are found during HP-UX installation, return here.

2. If HP-UX installation fails, check for bad HP-UX system installation tape or disc (caused by corrupt system code, erased or overwritten media, or damaged tape cartridge or disc). If the tape or disc is bad, repeat the procedure, using a known-good replacement.

   If the installation failure does not appear to be related to the installation tape or disc, check the computer, using procedures described in the computer CE handbook for the model of interest. Use CS/80 disc drive self-test to check for media and media drive problems, or use HP-85 CS/80 Exerciser (as appropriate), if available.

```
                    ┌──────────┐
                    ▽    D     ▽
                    └──────────┘
                         │
                         ▼ ◄─────────────────────────────────┐
               ┌─────────────────┐                           │
               │ INSERT HP-UX MEDIA │                        │
               │ USE LOADER ROM TO │      ┌──────────┐       │
               │ FIND SYSTEMS ON TAPE │   │ REPOWER  │◄──┐   │
               └─────────────────┘  ◄──── │ COMPUTER │   │   │
                         │               └──────────┘   │   │
         YES    ╱◇╲ SYSTEM                               │   │
        ┌───────  FOUND?                                 │   │
        │       ╲◇╱                                      │   │
   ┌────▽───┐      │ NO                                  │   │
   ▽   E    ▽      ▼                                     │   │
   └────────┘  ┌─────────────┐                           │   │
               │ SUBSTITUTE HP-UX │                      │   │
               │ SYSTEM MEDIA │                          │   │
               │ TRY AGAIN │                             │   │
               └─────────────┘                           │   │
                         │                               │   │
              ╱◇╲ SYSTEM      YES  ┌────────────────┐    │   │
               FOUND?  ──────────► │ BAD HP-UX TAPE │    │   │
              ╲◇╱                  │ REPLACE WITH NEW│───●   │
                         │ NO       │ OR BACK-UP COPY│        │
                         ▼          └────────────────┘        │
               ┌─────────────┐                               │
               │ MOVE CABLE FROM │                           │
               │ DISC INTERFACE TO │                         │
               │ ANOTHER HP-IB CARD │                        │
               └─────────────┘                               │
                         │                                   │
              ╱◇╲ SYSTEM      YES  ┌────────────────┐        │
               FOUND?  ──────────► │ REPLACE INTERFACE │     │
              ╲◇╱                  │ MOVE CABLE BACK │───────┘
                         │ NO       │ TO ORIGINAL POSITION │
                         ▼          └────────────────┘
               ┌─────────────┐
               │ REPLACE CABLE │
               └─────────────┘
                         │
              ╱◇╲ SYSTEM      NO   ┌────────────────┐
               FOUND?  ──────────► │ RUN FULL CS/80 │
              ╲◇╱                  │ DIAGNOSTICS AND │──────┘
                         │          │ REPAIR DRIVE │
                         ▼          └────────────────┘
                    ┌────────┐
                    ▽   E    ▽
                    └────────┘
```

Disc and Interface Troubleshooting/Verification

VI: Add remaining interfaces and peripherals

The HP-UX operating system is now installed.

1. Remove power from the computer, then add remaining interfaces and peripherals, one at a time, verifying the operation of each to isolate any device that is not functioning correctly. When repowering the computer, apply power to the peripheral before powering the computer.

   a. Verify interfaces and other accessories by using the loader ROM self-tests executed during power-up.

   b. Verify peripherals by using System Functional Tests (Chapter 5), or the quick checks provided at the end of this chapter.

   c. Use CS/80 Exerciser utility on any CS/80 disc drive in the system if you suspect it is malfunctioning or want to verify operation.
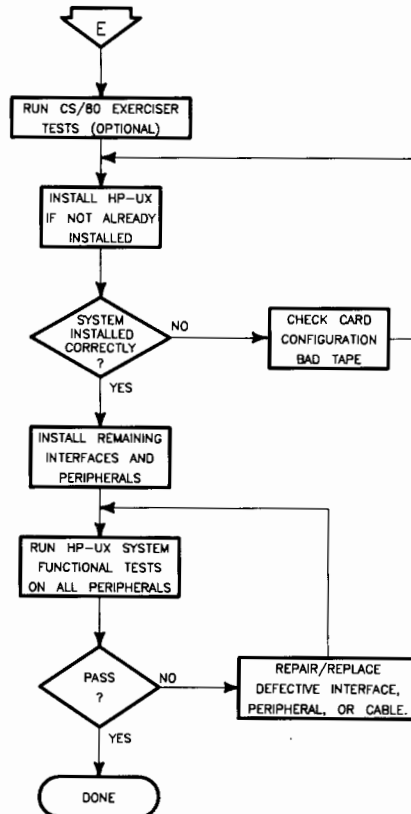
Testing Other Discs and Peripherals

VII: Final Check

Run *fsck* to verify file system integrity on the complete system so you will have a known-good reference point should a problem arise in the future.

1. Log on as *root* and run the *fsck -n /dev/hd* command. If you are installing a new system, no errors should occur.

NOTE

If *fsck* reports any problems, repair may require removal of one or more files. File maintenance is the responsibility of the System Administrator. Do not remove any files from system or attempt to repair file system defects detected by *fsck* **unless specifically authorized to to so by the System Administrator.** Contact your HP Technical Support Engineer for assistance and guidance when repairing or restoring a corrupt file system.

---

2. If you are restoring a previously-working system, the system administrator should restore files from the most recent system back-up tapes and run *fsck* again before using the system for normal operation.

3. Log off when you are finished by typing exit RETURN.

Existing Systems

An existing system is a system that was once fully operational, including peripherals and special (device) files.

IMPORTANT

An existing system may contain valuable data that has not been copied on back-up media and must be preserved if possible. Do not install a new operating system on a previously working disc unless authorized to do so by the System Administrator. If HP-UX must be reinstalled and the disc contains data that must be preserved, exhaust all available means for recovering the data from the disc before installing the new system. Contact your HP Technical Support Engineer for assistance if needed.

Troubleshooting procedures for an existing system are similar to those for a new system, except that you know the existing system once worked correctly. To find the problem, determine to what extent the system is operational, then follow the procedure for a new system, entering the process at the appropriate point.

I: Determine to What Extent the System is Operational

If system is shut down and the computer is not powered, skip to Step II. If the computer and its peripherals are powered, continue here.

Isolate the problem to the core system (computer, system console, and main system disc) or to peripherals (user terminals, printers, and other peripheral devices and their related special files).

1. Log onto system as user *root*. If you cannot log on, core system is defective; skip to Step II.

2. If log-on is successful, problem is likely related to peripheral devices. To determine cause,

   a. Check interface select code and device HP-IB address and compare with the special file for that device to see that they match.

   b. Run System Functional Tests (Chapter 5) or Quick Checks later in this chapter to see if computer can communicate with the device(s). If the test works, the problem is related to operator error or ignorance.

   c. Disconnect inoperative peripheral from system and run self-test or external exerciser. If a problem is found, fix it, then reconnect to the system.

   d. Exchange interface cable to inoperative peripheral with a known-good cable, then retry.

   e. Does another peripheral work on the same I/O card? If not, replace the card with a known-good card and retest.

II: Bring Up the System

If the system is shut down (computer power switch OFF), or if you are unable to log on, follow this procedure:

System Power-up

1. Set all power switches in the system to their OFF positions. If the computer uses an external terminal and serial interface for the system console, verify interconnections between the console devices and their respective interfaces before continning.

2. Apply power to peripheral devices first.

3. Apply power to computer and watch display for loader ROM messages that indicate the computer is functioning correctly.

   a. If no messages appear, start with Step I of the New Systems troubleshooting procedure.

   b. If a terminal is used as system console, and loader ROM messages are scrambled, check baud rate and other datacomm link settings including handshake. If incorrect, fix, then cycle computer power switch and repeat step 3.

   c. If loader ROM messages indicate that the computer is looking for a system (but can't find one), be sure the system root disc is powered and operating correctly. If the disc is powered and connected, go to Step IV of new-system troubleshooting procedure.

   d. If loader ROM messages indicate that a system is being loaded, wait for loader completion, then continue to step 4.

Verify HP-UX Operation

4. When `login` message appears, log in as user *root* (system administrator may have to do this to preserve password security).

    a. If you cannot log in, the software is defective, and the operating system will have to be reinstalled (files can be restored from back-up tapes, if available). Go to step V of new-system troubleshooting procedure.

    b. If login is successful, continue with step 5.

5. Use System Functional Tests (use updated version for HP-UX 4.0) to verify peripheral operation. See Chapter 5 for procedures.

6. Run *fsck* to verify file system integrity.

Quick Checks

Printers

1. Create a new special (device) file.
2. Use *cat* command to send something to that file.
3. Remove file when finished.

Plotters

1. Create a new special (device) file
2. Create a file containing valid HPGL commands.
3. Use *cat* command to send file to the plotter.
4. Remove the files when finished.

Flexible Disc Drives

1. Create a new character-mode special (device) file.
2. Use *tar* command (`tar -tf`) to check the disc "table of contents". If the disc has not been initialized with a tar format, the drive access indicator will still flash on then off, indicating that the drive was accessed.
3. Use *tar* command to copy something to a tar-format initialized scratch disc.
4. Use *tar* command to check that the file was copied correctly.
5. Remove the files when finished.

Tape Drives

Using a tar-format initialized scratch tape, follow the same procedure as for flexible disc drives.

Terminals

1. Verify terminal connections, baud rate and character format configuration settings and interface/terminal handshake definitions. Be sure hardware is correctly interconnected.
2. Swap inoperative terminal with a known-good terminal.
3. Check the *inittab* file for correct entries.
4. Check the */dev* directory for correct entries.

Chapter 5
Diagnostics

The following Series 500 HP-UX diagnostic software and tools are available:

- HP-UX System Functional Tests included in *CE.utilities* directory of HP-UX operating system. These tests are used primarily to verify that data can be transferred between the computer and selected peripherals, thus verifying that the peripherals, interfaces, and interface cables are connected and working correctly.

- Device self-test capabilities. Self-tests vary, depending on the peripheral and design philosophy behind the test. Most self-tests are not comprehensive, but establish a high confidence that the tested peripheral is operating correctly.

- Limited computer self-test included in the Loader ROM. These tests establish a high confidence that the computer CPU, memory, and interface cards are working correctly.

- CS/80 Exerciser available separately (two versions, one for Model 520; the second for all other Series 500 models). When used in conjunction with disc drive self-test, a high confidence in drive and interface integrity is established. This program includes the ability to examine tape and disc error logs stored by the drive controller. The exerciser program can be operated as a stand-alone system program, or it can be added to the standard HP-UX file system so that it can be run at any time without shutting down then restarting HP-UX.

System Functional Tests are an expanded successor to *ptests* that was used with HP-UX 1.0/2.0/3.0; upgraded to meet the needs of newer, more extensive HP-UX operating systems. *ptests* is obsolete; no longer supported, and operating manuals are no longer available. This Chapter describes System Functional Tests as updated since release of the original HP-UX 4.0 *CE.utilities* directory and files. If you are using earlier versions of *CE.utilities*, results may differ from the descriptions given in this chapter. Several notes in this chapter explain various situations that may produce unexpected results when earlier versions are used.

Directory Description

The *CE.utilities* directory contains two or more subdirectories:

- *Sft* contains programs that verify connections to peripheral devices.

- *Crtadjust* provides alignment patterns for graphics terminals and monitors.

- *CS80* contains the CS/80 Exerciser program (if it has been installed on the system disc) that is used to test and retrieve error logs from any CS/80 mass storage device connected to the system.

Several programs and files in the *CE.utilities* directory were changed following the release of HP-UX 4.0. The changes support additional peripherals, and fixed several bugs that existed in the original HP-UX 4.0 version of *CE.utilities*. A revision code was also added to the tests at that time to clearly identify which version is being used. This chapter describes the updated tests.

The original tests are easily identified by their lack of any revision message when *Sft* and *Crtadjust* opening menus are displayed. Subsequent revisions display revision numbers as follows:

System Functional Tests Revision Codes

```
Software Version                      Test Program Revision
                                       Sft       Crtadjust
------------------------------------------------------------

HP-UX 4.0 Intermediate Release        26.3        26.3
```

Updated current software is available through the HP TSO (Technical Support Organization). It can be installed on current HP-UX 4.0 systems, replacing the original version.

HP-UX System Functional Tests

These tests are peripheral exercisers used to verify that the computer can successfully transfer data to and/or from selected peripheral devices.

Procedure

Log on as user *root* (System Administrator may need to provide password access). To access tests, change directory to *CE.utilities*:

```
cd /usr/CE.utilities RETURN
```

. Tests are organized by directory. To select a given test, the current directory is changed to specify which test is to be used. When specifying a file within a given current directory, precede the file name by ./ so HP-UX knows that the current directory should be used. To display the user instructions for the currently selected test (current directory), type:

```
./help RETURN
```

at any time when the super-user prompt (#) is present.

To activate System Functional Tests, type:

`cd Sft` RETURN after super-user prompt (note upper- and lowercase),

then type

`./sft` RETURN

to start the tests. The following menu appears:

Opening Menu

```
          Series 500 SYSTEM FUNCTIONAL TESTS    Rev 26.3

   0)  exit system functional tests

   1)  PRINTERS

   2)  CS-80 DISC DRIVES

   3)  non CS-80 DISC DRIVES

   4)  GRAPHICS DEVICES

   5)  DIGITIZERS

   6)  TERMINALS

   7)  TAPE DRIVES

   Enter the number of the test you would like to run, then press RETURN.
```

Opening Menu Display

To select a test, type the test number, then press RETURN .

Test 1:   Printers

The following menu is displayed when the Printer Test option is selected[1]:

```
Enter the number corresponding to the device you would like to test,
then press RETURN.

0) go back to main menu

1) HP-IB PRINTERS: 2602A, 2631, 293xA, 9876A, 9020 - internal (0600),
2) CIPER PRINTERS: 2563A, 2608S
3) LASER PRINTERS: 2680, 2688
4) RS232 PRINTERS: 2601A, 2686
```

Type ⌈ 0 ⌉ ⌈RETURN⌉ to abort, or test number then ⌈RETURN⌉ to test. When test requests printer select code and device address of the printer to be tested, respond with a four-digit code as follows:

```
ssaa  RETURN
```

where <ss> is the two-digit hexadecimal select code (use lowercase hexadecimal 4-digit address and leading zero if necessary), and <aa> is the two-digit hexadecimal device address (again, use lowercase hexadecimal 4-digit address and leading zero if necessary). For HP-IB devices, <aa> is the HP-IB Primary Address. For RS-232C printers, <aa> is the multiplexer port address, or 00 if an Asynchronous Serial Interface is being used.

NOTE

The CIPER Printer test is tailored to the special HP-IB protocol used by CIPER (intelligent peripheral) devices. CIPER data format and protocol is unlike standard HP-IB communication.

Test Output

The test prints fourteen 80-character lines of text, each successive line shifted one character to the left, then terminates the test with a form feed. Here is an example of the printout:

```
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnop
"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopq
#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqr
$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrs
%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrst
&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstu
'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuv
()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvw
)*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwx
*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxy
+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz
,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{
-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|
./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}
```

Console displays:

```
begin printer test of /dev/<printer special-file name>
End of test.  Press <RETURN> to continue.
```

When test is complete, press ⌈RETURN⌉ to restore main menu.

---

[1] The menu for earlier versions incorrectly lists the HP 2563A CIPER printer under the HP-IB printer test.

Test 2:   CS/80 Disc Drives

NOTE

CS/80 Root Device cannot be tested. If you can load and run systems
and programs from the root disc, you have exceeded the scope of tests
performed by this program on other CS/80 devices.

NOTE

The CS/80 disc must be initialized, with a file system set up. If a file
system does not already exist, use

/lbin/sdfinit /dev/<disc special-file name> RETURN

to initialize the disc and create a file system. **DO NOT INITIALIZE
THE ROOT DEVICE.** <disc special-file name> is the name of the
HP-UX block special (device) file assigned to the drive being tested[1].
Default values are assigned for block size and interleave factor, and no
boot area is created; suitable for most situations. To select other values,
refer to the *HP-UX Reference* entry for *sdfinit(8)*. From about 10
minutes up to an hour or more (HP 7933/7935) is required to complete
the process, depending on the size of the disc.

No menu is displayed for this test. When asked for select code and bus address of the drive to
be tested, respond with a 6-digit lowercase hexadecimal code as follows:

    ssaauv RETURN

where <ss> is the two-digit select code of the drive (use leading zero if necessary), <aa> is
the two-digit bus address (HP-IB primary address with leading zero if needed), <u> is the unit
number of the drive, and <v> is the volume number. To access the internal drives on the Model
520, <ss> is 07, <aa> is 00, u is 0 (Winchester drive) or 1 (flexible drive), and v is 0.

When a normal test sequence passes, the console display should have a series of four messages
similar to the following:

    begin CS/80 test of device /dev/<disc special-file name>
    testing mounted file system /usr/CE.utilties/Sft/tempdir
    test pattern read back okay
    end of test. Press <RETURN> to continue.

If the second and third lines are missing, the test did not execute properly, even though end-of-
test is indicated with no reported errors.

NOTE

Versions preceding HP-UX 4.0 Rev. 26.3 report "test pattern read
back okay" without having tested the disc.

When test is complete, press RETURN to restore main menu.

---

[1] If the <disc special-file name> does not exist in the HP-UX file system, it can be set up by using /etc/mknod. See Tool Box
section of *HP-UX System Administrator Manual* for procedures.

Test 3:   Non-CS/80 Drives

NOTE

The non-CS/80 disc must be initialized, with a file system set up. If a
file system does not already exist, use:

`/lbin/sdfinit /dev/<disc special-file name> 1024 0 4` `RETURN`

to initialize the disc and create a file system on external flexible disc
drives (use 3 instead of 4 for HP 9895). <disc special-file name> is
the name of the HP-UX block special (device) file assigned to the drive
being tested[1]. Block size, boot area, and interleave factor are optimum
or nearly so for the models listed. To select other values, refer to the
HP-UX Reference entry for *sdfinit(8)*. From about 10 minutes up to
an hour or more (HP 7933/7935) is required to complete the process,
depending on the size of the disc.

This test is for flexible disc drives. The test opens with the following menu display:

```
Enter the number corresponding to the device you would like to test,
then press RETURN.

0)  go back to main menu

1)  5 1/4" FLOPPIES: includes 82901, 82902
2)  8" FLOPPY: 9895
3)  8" FLOPPY: 9885
```

Non-CS/80 Disc Drive Test Menu

Press key corresponding to desired test number then `RETURN`. When test program requests select
code and bus address, use 4-digit lowercase hexadecimal value where the first two digits are the
select code and the last two are the bus address (use leading zeros if needed). For example, 0e04
is select code 14, bus address 4.

When a normal test sequence passes, the console display should have a series of four messages
similar to the following:

```
begin non-CS/80 test of device /dev/<disc special-file name>
testing mounted file system /usr/CE.utilties/Sft/tempdir
test pattern read back okay
End of test.  Press <RETURN> to continue.
```

If the second and third lines are missing, the test did not execute properly, even though end-of-
test is displayed without an error indication.

NOTE

Versions preceding HP-UX 4.0 Rev. 26.3 report `"test pattern read
back okay"` without having tested the disc.

When test is complete, press `RETURN` to restore main menu.

---

[1] If the <disc special-file name> does not exist in the HP-UX file system, it can be set up by using */etc/mknod*. See Tool Box
section of *HP-UX System Administrator Manual* for procedures.

Test 4: Graphics Devices

This test drives graphics output devices including internal and external displays. The test opens with the menu:

```
Enter the number corresponding to the device you would like to test,
then press RETURN.

0) go back to main menu

1) 2623A - graphics terminal
2) 2627A - color graphics terminal
3) 2647F - intelligent graphics terminal
4) 7470A - 2 pen graphics plotter
5) 7580A/B or 7585A/B - 8-pen drafting plotter
6) 9872C/T - 8 pen graphics plotter
7) 97060A - graphics processor
8) 97062A - rgb graphics processor
9) 98760A - (9020A only)
10) 98770B - (9020C only)
11) 98780B - (9020B only)
```

Graphics Test Selection Menu

Select the device to be tested, then press RETURN.

For Options 9, 10, and 11, the program begins test program execution immediately. For other tests, it requests select code and device address before proceeding. Respond to the request with

ssaa RETURN

where <ssaa> is a four-digit hexadecimal code consisting of numerals and lowercase letters. <ss> is the two-digit interface select code (use leading zero if necessary) for the device being tested. The two-digit value of <aa> varies, depending on the device and interface type:

- For HP-IB devices such as plotters, use HP-IB Primary Address (with leading zero if needed).

- To test RS-232C devices, use the muliplexer card port number for multiplexer connections, or 00 for asynchronous serial interface cards.

- For all GPIO and color interface connections (such as graphics processors), use 00.

Allow sufficient time for test program to compile graphics output program. When test is complete, press RETURN to restore main menu. Here is a sample of the output pattern:
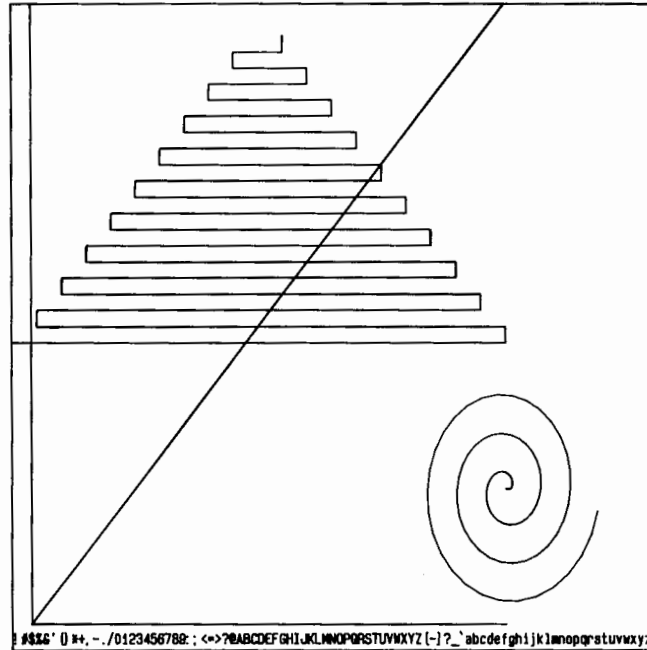
Example of Graphics Test Pattern

Test 5:   Digitizers

This test is designed to exercise the HP 9111A Graphics Input Tablet. No other devices are supported at the present time. When asked for the HP-IB select code and bus address of the digitizer to be tested, respond with a 4-digit hexadecimal code as follows:

ssaa RETURN

where <ss> is the two-digit hexadecimal select code (use lowercase letters and leading zero if needed), and <aa> is the two-digit hexadecimal device address (HP-IB primary address, again using lowercase letters and leading zero if needed).

The test takes input data from the digitizer and sends it to a graphics output device such as a CRT display or plotter. Choose a graphics output device from the menu:

```
Enter the number corresponding to the output device then press RETURN.

0)  go back to main menu

1)  2623A - graphics terminal
2)  2627A - color graphics terminal
3)  2647F - intelligent graphics terminal
4)  7470A - 2-pen graphics plotter
5)  7580A/B or 7585A/B - 8-pen drafting plotter
6)  9872C/T - 8-pen graphics plotter
7)  97060A - graphics processor
8)  97062A - rgb graphics processor
9)  98760A - (9020A only)
10)   98770B - (9020C only)
11)   98780B - (9020B only)
```

Output Device Menu for Digitizer Test

To select a graphics output device, type the number corresponding to the chosen device, then press RETURN .

For Options 9, 10, and 11, the program proceeds test program execution immediately. For other devices, it requests select code and device address before proceeding. Respond to the request with

ssaa RETURN

where <ssaa> is a fonr-digit hexadecimal code consisting of numerals and lowercase letters. <ss> is the two-digit interface select code (use leading zero if necessary) for the output device. The two-digit value of <aa> varies as follows:

- For HP-IB devices such as plotters, use HP-IB Primary Address (with leading zero if needed).

- To use an RS-232C display device, provide the muliplexer card port number for multiplexer connections, or 00 for asynchronous serial interface cards.

- All GPIO and color interface devices (such as graphics processors), require device address 00.

When the test begins, a small square appears in the upper right-hand corner of the graphics output area. If you are using a CRT display for output, the cursor should follow the position of the digitizer pen when you move it around on the tablet surface (if you are using a plotter, the pen should move as it imitates the digitizer pen location on the plotter paper. Press the pen down to freeze the first point on the display or plotter. Move the pen to the next point and press, then continue. A line should be drawn between each successive pair of points until you move the cursor inside the square. If you press the pen down while the cursor is in the square, the test terminates.

Press RETURN to restore the main menu.

NOTE

Versions preceding HP-UX 4.0 Revision 26.3 have the following defects:

- Test fails on HP 98760 (Model 520 CRT display).

- Test may fail while compiling device-specific code.

- Test prompts twice for the tablet device address; never for the address of a graphics output device.

Test 6:   Terminals

This test verifies operation of system terminals based on interfacing. When requested, identify the terminal using a 4-digit lowercase hexadecimal value then press RETURN. The first two digits are the select code of the serial interface or multiplexer card connected to the terminal, the last two digits are the port number of the multiplexer card or zero if a serial interface (use leading zeros if necessary).

The test program outputs several lines of text (same as printer-test text), then asks you to type something from the terminal keyboard. Type a line up to 80 characters in length and press RETURN. The line is displayed as it is typed, then echoed back and redisplayed on a lower line. Verify text on terminal screen and check echo against original line. Test text lines may be double-spaced on terminal display, depending on how the terminal handles end-of-line characters.

NOTE

Test versions preceding HP-UX 4.0 Revision 26.3 send terminal test output messages to the terminal being tested. However, when testing another terminal from the system console, when the test requests an input line from the terminal, the line must be typed on the console instead or the test cannot terminate correctly.

System console displays:

```
begin terminal test of device /dev/tty<nn>
End of test.  Press <RETURN> to continue.
```

When test is complete, press RETURN to restore main menu.

Test 7: Tape Drives

This test is for 9-track and CS/80 cartridge tape drives. The test opens with the following menu:

```
Enter the number corresponding to the device you would like to test,
then press RETURN.

0) go back to main menu

1) 7971 - 9 track tape drive¹
2) 7974, 7978 - 9 track tape drives
3) 7908, 7911, 7912, 7914 - cartridge tape drive on these discs
```

CAUTION

Be sure to use the correct unit number for CS/80 cartridge tape tests. Use <u> = 1 for single-controller drives, or <u> = 0 for separate-controller drives. Failure to use the correct tape drive unit number, or specifying an incorrect select code and/or bus address can destroy the boot area or other files on the incorrectly selected disc because *tar* does not check for existing files before it begins the mass-storage write operation.

Type the number corresponding to the desired test then press RETURN. Respond to the request for select code and bus address with a 4-digit lowercase hexadecimal code (first two digits are select code, use leading zero if needed; last two digits are bus address value), then press RETURN.

System console then displays:

```
begin <device type> test of device /dev/<special-file name>
Make sure that a certified tape is on the device to be tested
and that the tape drive is not busy.
WARNING: this will destroy any existing data or programs on the tape.
Okay to continue test? (y/n)
y
testpattern read back okay
Do you want the cartridge tape unloaded? (y/n)
```

Verify that tape is ready, then press lowercase y RETURN.

Cartridge tape unloading prompt appears only if device is CS/80 cartridge. Only lowercase y is accepted as "yes" response for both questions.

When test is complete, press RETURN to restore main menu.

---

[1] Versions preceding Revision 26.3 erroneously include the HP 7970 9-track tape drive in this option. The HP 7970 is not officially supported for Series 500 HP-UX.

CRT Alignment Patterns

CRT alignment pattern capability is provided as an aid in aligning and checking the performance of graphics display devices. To display graphics test patterns, change the current directory as follows:

If you are in the *Sft* directory, use

```
cd ../Crtadjust
```

If you are in another directory or want to be safe, use

```
cd /usr/CE.utilities/Crtadjust
```

to get the same result.

This test compiles a graphics program that generates and displays a test pattern on the selected video output device (you can display user instructions by using the ./help command).

After changing the directory, type the command:

```
./adjust
```

after the super-user prompt to obtain the output-device selection menu:

```
        CRT GRAPHICS ADJUSTMENT UTILTIES    Rev 26.3

  0)  exit utility

  1)  2623A - graphics terminal
  2)  2627A - color graphics terminal
  3)  2647F - intelligent graphics terminal
  4)  97060A - graphics processor
  5)  97062A - rgb graphics processor
  6)  98760A - (9020A only)
  7)  98770B - (9020C only)
  8)  98780B - (9020B only)

  If you want to display on a device other than this one, be sure no program
  is waiting for input from that device.  For example, you cannot
  test a terminal that is displaying the login prompt.

  Enter the number corresponding to the output device, then press RETURN.
```

Select the device to be tested, then press RETURN.

For Options 6, 7, and 8, the program proceeds immediately to the pattern-selection menu. For other options, it requests select code and device address before proceeding. Respond to the request with

```
ssaa  RETURN
```

where <ssaa> is a four-digit hexadecimal code consisting of numerals and lowercase letters. <ss> is the two-digit interface select code (use leading zero if necessary) for the device being aligned. The two-digit value of <aa> is the multiplexer port number for RS-232C devices connected to a multiplexer card. All other devices that connect to an asynchronous serial interface, color interface, or GPIO card require 00 for <aa>.

A new menu now appears, showing the available display pattern options:

```
0)   select different device or exit

1)   alignment pattern
2)   white raster¹
3)   color bars
```

Enter the number of the display configuration, then press RETURN.

NOTE

Test versions preceding HP-UX 4.0 Rev. 26.3 produce a syntax error while compiling the support program for the white raster option on any specific device.

Select a pattern, type the corresponding number and press RETURN. The pattern is then displayed on the selected device. To exit or select another display device, press 0 then RETURN.

Allow sufficient time for test program to compile graphics output program. When test is complete, press RETURN to restore main menu.

NOTE

Versions preceding HP-UX 4.0 Rev 26.3 do not clear the test pattern upon test completion. This may obscure typing if the console is being tested.

To exit the utility, press 0 then RETURN again.

Abnormal Terminations

Avoid using abnormal program terminations. Exit options in the various menus provide clean return paths to the HP-UX operating system. Using the BREAK key or cycling power to reboot the system should be avoided because the file system and operating environment can be corrupted if files are not properly closed by using exits.

If a catastrophic failure requires re-powering the computer to recover, the System Administrator should be consulted beforehand to ensure that proper recovery procedures are followed including use of file system checks and repairs if needed. Any temporary files created by the tests must also be manually removed.

Device Self-tests

Some disc drives, printers, terminals, and other devices are equipped with built-in self test capability. Refer to CE handbook or service manual for device of interest for self-test procedures.

---

¹ On versions preceding Revision 26.3, Option 2 reads **white out the screen**.

Chapter 6
Adjustments

There are no hardware adjustments related to HP-UX operation.

Adjustments related to set-up, maintenance, and repair of specific hardware devices are treated in manuals for the device in question.

Supported Peripherals

The list of currently supported peripherals changes constantly as new devices are introduced and others become obsolete. Thus it is impossible to maintain up-to-date listings here. If any questions arise concerning supported devices, refer to the current supported peripherals list that is distributed monthly to all HP field support offices. The following list was reasonably current as of the date this manual was published, and is provided as a field support aid for general situations. Use it with due caution.

Hard/Winchester Disc Drives

All CS/80 drives in this list that are available with built-in cartridge tape drive are also supported in the cartridge tape (CT) version.

```
Model Number          Description
-----------------------------------------------------------

HP 7908P/R            CS/80 16.5-Mbyte hard disc
HP 7911P/R            CS/80 28.1-Mbyte hard disc
HP 7912P/R            CS/80 65.6-Mbyte hard disc
HP 7914P/R            CS/80 132-Mbyte hard disc
HP 7914TD             CS/80 132-Mbyte hard disc
                      with 9-track tape drive

HP 7933H              CS/80 404-Mbyte hard disc
HP 7935H              CS/80 404-Mbyte hard disc
HP 7941A              CS/80 23.8-Mbyte hard disc
HP 7945A              CS/80 55.5-Mbyte hard disc
HP 9133A              4.6-Mbyte Micro-Winchester disc and
                      3 1/2-inch flexible disc
HP 9134A              4.6-Mbyte Micro-Winchester disc (obsolete)
HP 9134B              9.7-Mbyte Micro-Winchester disc (obsolete)
HP 9134XV             14.5-Mbyte Micro-Winchester disc
                        (Option 010 not supported)
HP 9135A              4.6-Mbyte Micro-Winchester disc and
                      5 1/4-inch flexible disc (obsolete)
HP 9135B              9.7-Mbyte Micro-Winchester disc and
                      5 1/4-inch flexible disc (obsolete)
```

Flexible Disc Drives

```
Model Number          Description
-----------------------------------------------------------

HP 82901M/S           Dual 5 1/4-inch drive
HP 82902M/S           Single 5 1/4-inch drive
HP 9885M/S            8-inch flexible disc drive (obsolete)
HP 9895A              Dual 8-inch drive (single drive optional)
HP 9121S/D            Single/dual 270-Kbyte  3 1/2-inch drive
HP 9122S/D            Single/dual 780-Kbyte  3 1/2-inch drive
HP 9125S              270-Kbyte IBM 5 1/4-inch drive
```

Magnetic Tape Drives

```
        Model                Description

        -----------------------------------------------------------

        HP 88140L/S          CS/80 Cartridge Tape Drive
        HP 7971A             9-track magnetic tape subsystem
        HP 7974A             9-track magnetic tape drive
        HP 7978A             9-track magnetic tape drive
        HP 9144A             1/4-inch magnetic tape cartridge drive
```

Printers

```
        Model                Description

        -----------------------------------------------------------

        HP 2225A/AY          150 cps dot-matrix Thinkjet(TM) printer
        HP 2563A             300 lpm dot matrix impact printer with
                             Option 290 Series 500 HP-IB CIPER interface
        HP 2565A             600 lpm dot matrix impact printer with
                             Option 290 Series 500 HP-IB CIPER interface
        HP 2566A             900 lpm dot matrix impact printer with
                             Option 290 Series 500 HP-IB CIPER interface
        HP 2601A             40 cps Daisywheel impact printer (Option 826)
        HP 2602A             25 cps Daisywheel impact printer (Option 046)
        HP 2631B/G           Serial impact printer (dot matrix)
        HP 2680A             45 Page/min Laser Printer
        HP 2686A             8 Page/min Laserjet(TM)
        HP 2688A             12 Page/min Laser (Option 850)
        HP 2932A             200 cps dot-matrix impact printer
        HP 2933A             200 cps "Factory Data Printer"
        HP 2934A             200 cps "Office Printer"
        HP 9876A             Thermal line printer (dot matrix)
```

Graphics Devices

```
        Model                Description

        -----------------------------------------------------------

        HP 7470A             Two-pen graphics plotter (media size ANSI A)
        HP 7475A             6-pen plotter (media sizes ANSI A and B)
        HP 7550A             8-pen plotter (media sizes ANSI A and B)
        HP 7580A/B           8-pen plotter (media sizes ANSI A thru D)
        HP 7585A/B           8-pen plotter (media sizes ANSI A thru E)
        HP 7586B             8-pen roll-feed plotter (media size ANSI E)
        HP 9872C/T           8-pen vector plotter
        HP 9111A             Graphics input tablet
        HP 9872B/S/C/T       8-pen Plotter (media sizes ANSI A and B)
```

Interfaces and Accessories

Model	Description
HP 27110A	HP-IB Interface
HP 27112A	GPIO Interface
HP 27122A	RJE Interface
HP 27123A	Shared Resource Management (SRM) Interface
HP 27128A	Asynchronous Serial Interface
HP 27130A/B	Multiplexer Interface
HP 97040A	256-Kbyte RAM
HP 97046A	1.02-Mbyte RAM
HP 97062A	Red-Green-Blue interface
HP 97098A	Series 500 I/O Expander

Terminals (RS-232C Serial Interfacing)

Model Number	Description
HP 2392A	Alphanumeric Terminal
HP 2622A	Alphanumeric Terminal
HP 2623A	Graphics Terminal
HP 2624B	Data Entry Station
HP 2625A	Graphics/IBM 3270 Terminal
HP 2626A	Alphanumeric Dual port Terminal
HP 2627A	Color Graphics Terminal
HP 2628A	Graphics HPWORD Terminal
HP 98790A	Series 200 Block Mode Terminal Emulator
HP 97056A	Series 500 Terminal Emulator
HP 97076A	HP-UX ATERM Terminal Emulator (Series 500)

Terminal Connections

Terminal Configuration

Set terminals to the following configuration (not all parameters are user-configurable on some models):

Datacomm Settings		Terminal Settings	
Parity	NONE	Tab=Spaces	NO
DataBits	8	RETURN Def	CR
Clk	INT	RETURN=ENTER	NO
StopBits	1	LocalEcho	OFF
EnqAck	YES	CapsLock	OFF
TR(CD)	HI	Start Col	1
Chk Parity	NO	ASCII 8 BITS	NO
RecvPace	Xon/Xoff	XmitFnctn(A)	NO
SRRXmit	NO	SPOW(B)	NO
RR(CF)Recv	NO	InhEolWrp(C)	NO
XmitPace	Xon/Xoff	InhHndShk(G)	YES
SRRInvert	NO	Inh DC2(H)	YES
CS(CB)Xmit	NO		

Match datacomm baud rate to link capabilities and computer interface settings (9600 baud for direct connections).

Interconnections

- Terminals can be connected to the computer through an HP 27128 Asynchronous Serial Interface (ASI) or one of the ports on an HP 27130 Multiplexer (MUX) card. The System Console terminal interface must be installed at Select Code 0, and the console terminal must be connected to Port 00 if a MUX card is used. If any other select code or port is used for the System Console terminal, no communication between the computer and the console is possible.

- For direct connections to terminals: Modem cable from terminal can be plugged directly into the female DCE (standard) cable from the ASI card, or into the appropriate female connector on the MUX cable assembly (System Console must connnect to port 00).

- Modem connections require a DTE cable (Option 001 with HP 27128 ASI card) from the card to the modem. The MUX cannot be connected to modems.

Direct Links Between HP-UX Computers

To link two Series 200/500 HP-UX-equipped computers through datacomm or serial interfaces, use a 5-wire modem-eliminator adapter between two DTE or modem cables (male RS-232C connectors). To make an adapter, use female RS-232C connectors wired as shown in Chapter 2.

Chapter 8
Replaceable Parts

Manuals

HP-UX manuals are listed in Chapter 1. They are available through HP Computer Supplies Operation (CSO).

Software Tapes and Discs

Cartridge tapes and discs supplied as part of the HP-UX operating system are not available separately to ensure compliance with software licensing agreements between HP and software source suppliers.

If a tape or disc is defective or fails within the normal warranty period, it can be exchanged for a new replacement. If the warranty has expired and a tape or disc fails but the customer has not maintained a back-up, a duplicate can be created. In either case, contact your responsible SE for assistance. To prevent violating license agreements, do not attempt to circumvent standard procedures.

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Chapter 9
Diagrams

Hardware Diagrams

Hardware block diagrams and other drawings are included in the CE handbook section related to the hardware of interest.

HP-UX Software Diagrams

Diagrams and other information describing memory allocation and HP-UX file system structure, are in the System Administrator manual.

Chapter 10
Reference

Handling Procedures for
Electrostatic Protection

Static sensitive components and assemblies are shipped in anti-static containers. Do not remove until ready to install.

1. When possible, use controlled-static workstation (HP 9300-0933 or equivalent). If no workstation is available, use anti-static shipping container (plastic bags are conductive on the outside).

2. Set accessory on workstation surface or on top of bag while setting switches or changing configuration jumpers. Keep one hand in contact with bag while making changes with other hand.

3. When installing accessory in computer, hold accessory in one hand, touch grounded point on computer frame, then slide accessory into support slot while maintaining contact with frame with other hand.

4. Seat accessory into connector(s), then install cover plates, if any. When all covers are in place, special precautions no longer apply.

5. Be sure computer and peripherals have power cords connected before installing interface cables. Be sure power switches are in OFF position before connecting or removing power or interface cables.

These procedures are general techniques only. Refer to installation manuals for special precautions.