

ULTRIX-11™
Installation Guide

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Preface

The ULTRIX-11 Installation Guide tells you how to install your ULTRIX-11 operating system on a PDP-11 system. It also explains some of the basic administrative tasks and refers you to other documents for further details.

This guide is written for the person installing the ULTRIX-11 system. This person is usually the owner of the system or the system manager.

The ULTRIX-11 Installation Guide assumes that you are familiar with your PDP-11 system and with the operation of the peripheral devices. It also assumes you have a basic familiarity with the UNIX† operating system. See Section 3, Related Documents, for a list of introductory documents on the operating system.

1. Organization of this Guide

The ULTRIX-11 Installation Guide has six chapters:

Chapter 1 Introduction

This chapter provides background information you should know before you install your ULTRIX-11 system. It also provides details about some of the steps you will be taking when you perform the installation.

The introduction also provides an overview of the entire installation procedure and then tells you where to begin.

Chapter 2 Installing ULTRIX-11 Software from Magnetic Tape

This chapter describes how to install the ULTRIX-11 operating system from the magnetic

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tape distribution.

Chapter 3 Installing ULTRIX-11 Software from RL02 Disk

This chapter describes how to install the ULTRIX-11 operating system from the RL02 disk distribution.

Chapter 4 Installing ULTRIX-11 Software from RC25 Disk

This chapter describes how to install the ULTRIX-11 operating system from the RC25 disk distribution.

Chapter 5 Installing ULTRIX-11 Software from RX50 Diskette

This chapter describes how to install the ULTRIX-11 operating system from the RX50 diskette distribution.

Chapter 6 Completing the Installation

This chapter describes how to bring the installed system up to multiuser mode, how to log in and out of the system, and how to set up account passwords. It pertains to all the distribution media.

You need to read three of these chapters: 1) Chapter 1, Introduction, 2) Chapter 2,3,4, or 5, depending on your distribution media; and 3) Chapter 6, Completing the Installation.

The appendixes provide additional installation information and detailed examples. The appendixes are:

- Appendix A Magnetic Tape Boot Programs**
- Appendix B Disk Media Qualification (bads, rabads, dskinit)**
- Appendix C System Generation Examples**
- Appendix D Stand-alone Copy Program**
- Appendix E Loading the Games, Manuals, and Documentation Files**
- Appendix F Stand-alone Programs (icheck, mkfs, restor)**
- Appendix G Configuration Work Sheet**
- Appendix H The ed Command Summary Sheet**
- Appendix I Multiple MASSBUS/MSCP Disk Controllers**

2. How to Use This Guide

First, read Chapter 1, Introduction. Follow any directions given.

Then, proceed directly to the chapter that pertains to your distribution media. For example, if your distribution media is RX50 diskettes, then follow the installation procedure

outlined in Chapter 5, Installing ULTRIX-11 Software from RX50 Diskette.

Last, follow the instructions outlined in Chapter 6, Completing the Installation.

Before you begin the installation procedure, complete the work sheet in Appendix G. Refer to the other appendixes as necessary.

3. Related Documents

These documents can add to your understanding of the ULTRIX-11 operating system:

ULTRIX-11 Software Technical Description

ULTRIX-11 System Management Guide

ULTRIX-11 Programmer's Manual, Volume 1

For additional reading, refer to these articles in the ULTRIX-11 Programmer's Manual, Volume 2A:

UNIX for Beginners

The UNIX Time-Sharing System

4. Document Conventions

This installation guide uses these conventions:

color Examples are printed in color. Examples represent command sequences or information that you enter.

command(n) The manual section number containing the applicable description (n) is enclosed in parentheses after the command name. For example, cat(1) refers to the description of the cat command in Section 1 of the ULTRIX-11 Programmer's Manual.

comments Comments are enclosed in parentheses to the right of commands.

<CTRL/x> This symbol indicates that you are to press the CTRL key and the x key simultaneously. For example, <CTRL/D> means that you are to press the CTRL key and the D key simultaneously.

<DELETE> The DELETE key is represented by <DELETE>. Use <DELETE> to erase the last character typed.

underscore Substitutable parameters are underscored.

<RETURN> The RETURN key is represented by <RETURN>. Always press <RETURN> at the end of each command line.

Always enter commands in lowercase and end each command line with <RETURN>. If you make a typing mistake, press <DELETE> to erase a single character or <CTRL/U> to erase the entire line.

Chapter 1

Introduction

Stand-alone programs bootstrapped from the distribution media load the ULTRIX-11 software. The ULTRIX-11 software is distributed on four types of media: magnetic tape, RL02 disk, RC25 disk, and RX50 5-inch diskette.

1.1. Contents of Distribution Media

Each of the distribution kits contain the ULTRIX-11 documentation set.

The magnetic tape distribution contains one distribution tape.

The RL02 distribution kit contains two RL02 distribution disk packs. One is labeled ROOT AND /USR, which contains the root and /usr file systems and is required for your ULTRIX-11 system to operate. The second disk is labeled OPTIONAL FILES, and contains games, on-line manuals and documents.

The RC25 distribution kit contains one RC25 cartridge.

The RX50 diskette distribution kit contains 30 distribution diskettes. The first 13 diskettes are required to install your base ULTRIX-11 system. Included in these are three sysgen diskettes. You will use two of the three. The remaining 17 diskettes contain optional software.

1.2. Prepare for the Installation

This section lists the information you should know before you begin the installation and alerts you to information the installation requires from you.

1.2.1. Know Your Hardware

Before installing the ULTRIX-11 software, you must be familiar with your system hardware and the operation of its

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peripheral devices. The PDP-11 system can be equipped with any of several different hardware bootstraps, depending on the type of processor. You must know how to operate your bootstrap.

If you are not familiar with your system or do not know how to bootstrap it, read your system hardware documentation before beginning the installation.

1.2.2. System Hardware Configuration

Before installing the ULTRIX-11 software, you must have information about your system's hardware configuration in order to answer questions during the automatic installation and system generation procedures:

- Current and target processor types

The current processor is the CPU used to install the ULTRIX-11 software. The target processor is the CPU on which the ULTRIX-11 system will run when it is available to users.

For RX50, RL02, and RC25 distributions, the current processor must also be the target processor.

For the magnetic tape distribution, you can install the software on one processor and then move the system disk to the target processor. This allows you to install ULTRIX-11 software on a system that does not have a magnetic tape drive. In this case, the system disk media must be a removable disk such as an RK06, RK07, or an RL02.

The automatic installation procedure determines the current processor type and asks you to confirm it. It is possible that this processor type does not exactly match your processor type. For example, the ULTRIX-11 software displays a processor type of 45 for the PDP-11/55, and 40 for the PDP-11/35. This is because these processors are functionally equivalent. If the processor types do not match enter the correct processor type.

- Hardware device addresses and vectors

The ULTRIX-11 system generation program asks questions about the hardware CSR (control and status register) and interrupt vector addresses of each device on your system. A device's CSR address is the input/output (I/O) address that the operating system uses to access the device. The device uses the vector address to interrupt the processor if the device requires service.

Use the configuration work sheet in Appendix G to record

the hardware CSR and vector addresses of each hardware device.

At various points during the installation there are references to disks connected to the first, second, or third RH11/RH70 MASSBUS disk controller. Assigning MASSBUS controller numbers is arbitrary except if the system disk is on the MASSBUS. In this case, the system disk must be connected to the first RH11/RH70 controller. The CSR and interrupt vector address assignments are also arbitrary, and you can change them during system generation if they do not match the hardware.

Here are the conventional RH11/RH70 controller assignments:

<u>RH Number</u>	<u>Name</u>	<u>CSR</u>	<u>Vector</u>
first	HP	176700	254
second	HM	176300	150
third	HJ	176400	204

- Load device type

At one point during the installation, the automatic installation procedure displays the load device type and asks you to confirm it. This is an installation verification check. If the load device does not match, you must enter the correct device. You can then continue the installation.

For the RL02 distribution the load device must be RL02 unit 0. For the RC25 distribution the load device must be RC25 unit 0.

- System disk type

The automatic installation procedure asks for the type of your system disk. Table 1.1 lists the possible system disk types for each distribution media.

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Table 1.1 System Disks for Each Distribution Medium

<u>Distribution</u>	<u>System Disk Types</u>			
magnetic tape	RL01	RL02	RK06	RK07
	RA60	RA80	RA81	RM02
	RM03	RM05	RP02	RP03
	RP04	RP05	RP06	RC25
RL02 disk	RL02			
RC25 disk	RC25			
RX50 diskette	RD51 RD52			

If you have an RL02 system drive, you should use an RL02-EF error-free disk pack.

If you are using an RL01 as your system disk, you need two RL01 disks: one for the root file system, and one for the /usr file system.

If you have a Micro/PDP-11 system, you may have a second RD51 or RD52 Winchester disk. The automatic installation procedure determines the presence and type of disk if a second Winchester disk exists. It then asks you to confirm its findings.

1.2.3. Disk Media Qualification

You should verify your disk or disks. The following sections explain disk qualification for each distribution medium.

1.2.3.1. Magnetic Tape Distribution

The automatic installation procedure asks if you want to verify the system disk or disks. You must answer yes to this question if your system disk is an RP04, RP05, or RP06. You should answer yes for all other system disk types.

Media qualification involves scanning the disk for bad blocks or running a disk verification test, depending on the type of disk. Some disks require formatting before they can be used with ULTRIX-11 software. You can run the stand-alone *bads* program to check the first 1,000 blocks. If the check succeeds, the disk is formatted correctly. Appendix B, Disk Media Qualification, explains how to run the *bads* program.

For RL01 disks, the system disks are on drives 0 and 1. For RC25 disks, the system disk is on drive 1 (the fixed media). For all other disk types, the system disk is on drive 0. If

you have additional disks to qualify, follow the procedure outlined in Appendix B, Disk Media Qualification.

System Disk Serial Number

The bad sector file contains the serial number of your system disk. If you answered yes to the initialization question and you have one of the system disks listed below, the disk media qualification asks you for the serial number:

```
RK06 RK07  
RM02 RM03 RM05  
RP04 RP05 RP06
```

In anticipation of this question, you should locate and record your system disk pack serial number before beginning the installation.

To locate the serial number, remove the bottom cover from the disk pack. The serial number is on the bottom of the disk pack.

If you cannot locate the serial number, you can still continue with the installation. In this case, respond to the serial number question with <RETURN>. The automatic installation procedure then tries to retrieve the serial number from the bad sector file. If it can not retrieve the serial number, it invents one. A fictitious serial number does not interfere with the ULTRIX-11 system's operation, but the bad sector file would contain an erroneous serial number for the system disk.

1.2.3.2. RL02 Distribution

Copy the ROOT AND /USR distribution pack onto the blank disk. The copy becomes your system disk. Then, qualify the blank (scratch) disk with the bad block scan program bads.

If you are using the files on the OPTIONAL FILES pack, first scan another blank disk for bad blocks and then copy the OPTIONAL FILES pack onto the blank disk.

If you have additional disks to qualify, follow the procedure outlined in Appendix B, Disk Media Qualification.

1.2.3.3. RC25 Cartridge Distribution

Initialize the system disk (unit 1) and check it for bad blocks with the rabads program. Then you copy the root and usr file systems from the distribution disk (unit 0) onto the system disk (unit 1).

You can make a backup copy of your entire distribution, including the optional files. However, you must make the

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backup copy before you begin the installation because any data on the fixed unit (unit 1) is overwritten when you make the backup copy.

Load the distribution RC25 cartridge (unit 0) and write protect it. Then copy unit 0 onto unit 1, using the stand-alone copy program as described in Appendix D.

Use a record size of 10240 and use 2540 records.

Remove the distribution cartridge from unit 0 and load a blank cartridge. Release the write protect switch on unit 0, then copy the fixed disk (unit 1) onto unit 0 using the stand-alone copy program.

Remove the copy from unit 0 and store it in a safe place for backup purposes. Load the distribution cartridge and write protect it.

For further information see Section 4.2.4, Preparing for RC25 File System Backups, in the ULTRIX-11 System Management Guide.

1.2.3.4. RX50 Diskette Distribution

The automatic installation procedure asks if you want to verify the system disk or disks. Answer yes to this question.

Media qualification involves scanning the system disk for bad blocks or running a disk verification test, depending on the type of disk.

If you have a second Winchester disk or additional disks to qualify, follow the procedure outlined in Appendix B, Disk Media Qualification.

Here are the disk media qualification requirements:

- RX50 diskettes

There is no bad block replacement strategy for RX50 diskettes. Diskettes must be free of errors.

- RD51 and RD52 Winchester disks

The RQDX1 disk controller automatically replaces bad blocks on the Winchester disks. The replacement is not complete until the bad block is rewritten, so you must answer yes to the bad block scan question for Winchester disks. The bad block scan forces the replacement of any bad blocks by rewriting that block.

1.2.4. Initialize Additional Disks

If you have any of these disks in addition to your system disk, then you must initialize them using the dskinit program: RP04, RP05, RP06.

See Appendix B, Disk Media Qualification, for information on how to run dskinit.

1.2.5. The Automatic Installation Procedure

A large percentage of the ULTRIX-11 installation is automated. After you answer questions about your system's configuration, the automatic installation procedure initializes the operating system.

If your distribution media is on RX50 diskettes or magnetic tape, the automatic installation procedure first transfers the ULTRIX-11 software from the distribution media to the system disk before initializing the operating system.

The automatic installation procedure is straight forward. It asks you questions about your hardware configuration and whether you want to verify the system disk media or format the disk. Then, the installation begins.

1.2.5.1. Phases

The automatic installation procedure basically occurs in two phases:

- sdload

The sdload program (the system disk load program) transfers the ULTRIX-11 software from the distribution magnetic tape or RX50 diskette and bootstraps the system disk automatically. This program has on-line help. The RL02 and RC25 distributions are copied onto the system disk when you back up the distribution kit.

- setup

The setup program (the initial setup program) initializes the ULTRIX-11 system.

1.2.5.2. Automatic Installation Conventions

The automatic installation procedure uses the following prompt conventions:

<y or n> ?

Answer yes or no to the question. Type y for yes or n for no.

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<item1, item2, ... itemN> ?

Supply information about your system. The items enclosed in angle brackets (<>) are possible answers or other information to help you answer the question.

Press <RETURN> to continue:

After you have performed the requested action, signal the automatic installation procedure by pressing <RETURN>.

The automatic installation procedure informs you of its progress by printing messages in the format shown:

```
***** OPERATION STARTING *****
:
:   (messages)
.
***** OPERATION COMPLETED *****
```

You should check these messages because they may contain diagnostic information.

1.2.6. Edit Files

At various points during the installation you need to edit files. Appendix H, The ed Command Summary Sheet, provides a brief overview of how to use the ed text editor.

1.3. Overview of Installation Procedure

These are the basic steps to install the ULTRIX-11 software on your system:

1. Copy the software on the distribution media onto the system disk. For RL02 and RC25 distributions you perform this step before beginning the installation.
For magnetic tape and RX50 diskette distributions, the automatic installation procedure performs this step.
2. Boot the system disk. After the system boots, you are in the automatic installation procedure.
3. Answer the automatic installation procedure questions.
4. Create device-dependent special files.
5. Generate the system using the sysgen program. It asks you questions and then generates the system for you.
6. Install the new ULTRIX-11 operating system. Basically, halt and then reboot the new system.

7. Check the ULTRIX-11 file system and verify the installation. Run the fsck and usat programs to check and verify the system.
8. Make the new system available to users. This involves setting up the system to have and recognize user accounts.
9. Complete the installation. This includes bringing the system up to multiuser mode, logging in and out of the system, and setting up user passwords.

1.4. Where to Go From Here

Proceed directly to the chapter that pertains to your distribution media. For example, if your distribution is on RX50 diskettes, go to Chapter 5, Installing ULTRIX-11 Software from Diskette.

Chapter 2

Installing ULTRIX-11 Software from Magnetic Tape

This chapter describes the installation procedure for the ULTRIX-11 operating system from the magnetic tape distribution kit.

NOTE

If you have any disks in addition to the system disk or disks, you must qualify them before you install the system. See Appendix B, Disk Media Qualification, for information on how to qualify additional disks.

2.1. Magnetic Tape Installation Overview

This section of the magnetic tape installation procedure consists of these steps:

- Executing the automatic installation procedure
- Generating the ULTRIX-11 operating system
- Verifying the installation
- Making the ULTRIX-11 system available to users

First, you transfer the ULTRIX-11 software from the distribution magnetic tape to the system disk or disks and then bootstrap and initialize the operating system. The automatic installation procedure helps you do this.

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NOTE

The automatic installation does not load the following subdirectories of the /usr file system because of space limitations:

/usr/games, games programs
/usr/man, on-line manuals
/usr/doc, ULTRIX-11 documents

These files are not required for ULTRIX-11 system operation. If you want to load these optional files, refer to Appendix E, Loading the Games, Manuals, and Document Files.

Second, you generate and install an ULTRIX-11 kernel that supports your system processor and all the system devices. This kernel is the basic memory-resident portion of the operating system that supports system calls, maintains the file system, and deals directly with the processor and peripheral devices.

After verifying that the installation was successful, you perform various administrative tasks to make the system available for other users.

NOTE

If your system disk is an RL01, then you need two disks. One disk is for the root file system; the other disk is for the /usr file system. Both file systems reside on drive 1 for an RC25 system disk, and on drive 0 for all other disk types.

2.2. The Automatic Installation Procedure

After the magnetic tape boots, you are in the automatic installation procedure.

Follow these steps:

1. Mount the distribution magnetic tape and the system disk or disks.

Make sure the write enable ring is removed from the tape and then mount the tape on drive 0. Be sure the tape drive is ON LINE and READY, and the tape is rewound to load point (BOT).

Make sure the system disk drive is ON LINE and READY. This may require mounting a disk pack in drive 0. (Remember to mount a second disk in drive 1 if you are using RL01 disks.) If your system disk is an RC25, then you must mount a blank cartridge in unit 0.

2. Boot the tape.

Boot the distribution magnetic tape. Refer to your hardware manual for information on how to bootstrap your tape.

If your system has no hardware boot ROM for magnetic tape, refer to Appendix A, Magnetic Tape Boot Programs.

After successfully booting, the system displays this prompt:

Sizing Memory...

To list options, type help then press <RETURN>

Boot:

If any of your system devices are not at the standard Control and Status Register (CSR) addresses, use the help option and then the csr option in response to the boot prompt. For further information on the csr option, see Section 3.7.3, CSR Address Option, in the ULTRIX-11 System Management Guide.

3. Load the sdload program.

Load the system disk load program (sdload) by specifying your tape controller type and distribution tape density. Refer to the list below for a description of controller types and responses.

Consult your hardware documentation for the name of your controller. The TU10 and TE10 tape drives use the TM11 controller, the TU16 and TE16 use the TM02/3 controller, and the TU77 uses the TM03 controller.

<u>Controller Type</u>	<u>Response</u>
TM11 controller at 800 bits/in	tm(0,0)sdload
TM02/3 controller at 800 bits/in	ht(0,0)sdload
TM02/3 controller at 1600 bits/in	ht(4,0)sdload
TS11 controller at 1600 bits/in	ts(0,0)sdload
TSV05 controller at 1600 bits/in	ts(0,0)sdload
TU80 controller at 1600 bits/in	ts(0,0)sdload

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For example, to specify an 800 bits/in tape on a TM11 controller, type:

```
Boot: tm(0,0)sdload
```

Once loaded, sdload starts running automatically.

4. Answer the automatic installation procedure questions.

The sdload program prints some initial messages and asks questions about your system.

After you have answered the questions, the sdload phase of the automatic installation procedure begins.

At the beginning of the setup phase, you are asked to type the current date and time and confirm information. Other than this, the setup phase is completely automatic.

If an error occurs, the automatic installation procedure prints instructions describing how to recover from the error or where to get help if you cannot recover.

When the system prints the message shown below, the automatic installation portion is complete.

```
***** ULTRIX-11 INITIAL SETUP COMPLETED *****
```

Remove the distribution tape from the tape drive and store it in a safe place.

2.3. Creating the Device-Dependent Special Files

In order to be accessible by the ULTRIX-11 operating system, each device must have special files in the /dev directory. Use the make special files command msf to create the device special files. The generic command sequence is:

```
# cd /dev  
# msf device n  
# cd /  
# sync
```

device is the generic device name, such as r102, rk07, ra60, ts11, or tm03.

n is the unit number of the device.

The following sections on creating device special files all refer to this command sequence format.

NOTE

If you have one or more MASSBUS disk controllers (RH11/RH70) and/or one or more MSCP disk controllers (UDA50, KLESI, RQDX1, RUX1), omit this section, and follow the instructions given in Appendix I, Multiple MASSBUS/MSCP Disk Controllers.

NOTE

If you create a special file for an ML11 device, two special files are automatically created for each unit:

/dev/mln
/dev/rmln

n is the unit number of the ML11 device.

See Section 2.6.1, Support Files for Disks, in the ULTRIX-11 System Management Guide for further information.

2.3.1. Creating Disk and Tape Special Files

The setup program already created the special files for your system disk or disks (drive 0 or drives 0 and 1 for RL01 and RC25 system disks) during the automatic installation.

Use the msf command to create the special files for all disk and tape drives other than the system disk or disks.

Here is a sample command sequence to create the disk and tape special files for a large PDP-11 system. Modify this sequence to correspond with your system:

```
# cd /dev
# msf tu77 0          (first tape drive, unit 0)
# msf te16 1          (second tape drive, unit 1)
# msf rp06 0          (RP06 on first RH controller, unit 0)
# msf rm03 1          (RM03 on first RH controller, unit 1)
# msf ml11 2          (ML11 on first RH controller, unit 2)
# msf ra60 0          (RA60 disk on 1st MSCP controller, unit 0)
# msf ra81 1          (RA81 disk on 1st MSCP controller, unit 1)
# msf r102 0          (first RL02 disk, unit 0)
# msf r102 1          (second RL02 disk, unit 1)
# cd /
# sync
```

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If you have an RQDX1 controller with an RX50, RD51, or RD52 drive, see Section 5.1.1, RD51, RD52 & RX50 Unit Numbering.

2.3.2. Creating Special Files for Communications Devices

Communications special files let you use other terminals in addition to the console terminal. The terminals have names in the form /dev/ttynn, where nn is the unique number assigned to each line.

To set up the special files for your system configuration, you must know what type of communications controllers you have, how many of each type, and how many lines each controller can handle.

Table 2.1 describes the various communications controllers supported by the ULTRIX-11 system, how many lines each can handle, and the ULTRIX-11 name of each type.

Table 2.1 ULTRIX-11 Supported Communications Controllers

<u>Controller</u>	<u>Lines/Unit</u>	<u>ULTRIX-11 Name</u>
DLV11-A/B	1	k111
DLV11-F	1	k111
DLV11-E	1	d111
DLV11-J	4	k111
DZV11	4	dzv11
DZQ11	4	dzq11
DHV11	8	dhv11
DL11-A/B	1	k111
DL11-C/D/E	1	d111
DL11-W	1	k111
DZ11	8	dz11
DH11	16	dh11
DHU11	16	dhu11

NOTES

The DZ11-E and DZ11-F models consist of two DZ11s (a total of 16 lines) and should be viewed as two DZ11 units.

The DLV11-J is the equivalent of four DLV11s and should be viewed as four DLV11s.

Although the console terminal is on a DL11/DLV11-type line, its special file (/dev/console) already exists. Do not include it in your count of DL11/DLV11-type controllers. For example, if the last line of your DLV11-J is used as the console, you would count the DLV11-J as three DLV11-type controllers instead of four.

The second single line unit (SLU) built in to some PDP-11 processors should be counted as a DL11/DLV11-type controller. The PDP-11/23+, PDP-11/24, PDP-11/44, and the PDP-11/23+ version of the Micro/PDP-11 have this extra line.

During system generation, you need to differentiate between a KL11 and a DL11. At this point, however, group all KL11s and DL11s together and specify them as DL11s.

You reference terminals on an ULTRIX-11 system by special file names, such as tty00 or tty23. To assign these names to the lines of your communications controllers you must specify the type of controller, the controller's unit number, and the first line number to use for that controller.

Type this command sequence to remove any existing communications device special files:

```
# cd /dev  
# make ttypclean  
:  
: (make prints several messages)  
:
```

Use a variation of the msf command format shown previously to create the communications device special files. The format is:

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```
# msf device n ttynn
```

device is the communications device's ULTRIX-11 name, such as kl11, dz11, or dhv11.

n is the number of units for DL11 or KL11 controllers. It is the unit number for all other communications controllers.

ttynn is the first tty line to be assigned to that controller.

Assign the line for the first communications controller on your system tty00. For subsequent controllers, assign lines at the next available tty number.

For example, to create the special files for a system with one DH11, one DZ11, and three DL11 communications controllers, type:

```
# cd /dev  
# msf dh11 0 tty00  
# msf dz11 0 tty16  
# msf dl11 3 tty24  
# cd /  
# sync
```

In this example the first msf command assigns the 16 lines on DH11, unit 0 (DH11 lines 00-15) to tty00-tty15.

The second msf command assigns the eight lines on DZ11, unit 0 (DZ11 lines 0-7) to the next available tty lines (tty16-tty23).

The last msf command assigns the three DL11 single line units to the next available tty lines (tty24-tty26).

NOTE

All KL11 and DL11 type controllers must be grouped together and assigned to contiguous tty lines by a single execution of the msf command.

If the only single line unit you have is the console, continue with Section 2.3.3, Creating Line Printer Special Files. If your communications controller configuration consists of any single line units other than the console, however, you need to determine exactly

what types these are.

The same device driver handles all models of the DL11 single line unit. In order for the ULTRIX-11 operating system to handle the various models properly, you need to specify your system's DL11 types during the system generation process. All DL11s are of two possible types, based upon the addresses to which they are assigned. Refer to Table 2.2 for the various DL11 models and types.

Table 2.2 ULTRIX-11 Device Names, Types, and First Unit Addresses

ULTRIX-11		<u>Type</u>	<u>1st Unit Address</u>
<u>Name</u>			
k111	DL11-A/B	776500	
d111	DL11-C/D/E	775610	
k111	DL11-W	776500	
k111	DLV11-A/B	776500	
k111	DLV11-F	776500	
k111	DLV11-J	776500	
d111	DLV11-E	775610	

NOTE

The second single line unit built in to the PDP-11/23+, PDP-11/24, PDP-11/44, and some Micro/PDP-11 systems is a KL11 type.

If you have a mixture of KL11s and DL11s, then the lowest tty line numbers you assign to the DL11 units represent the KL11s. The highest tty line numbers represent the DL11 types.

In the previous example containing the line "msf d111 3 tty24," let us assume that one of the three specified DL11 units is a KL11 and the other two are DL11s. In this case, line tty24 represents the KL11 and lines tty25 and tty26 represent the DL11s.

During system generation, you indicate that you have one KL11 communications controller and two DL11 communications controllers.

2.3.3. Creating Line Printer Special Files

If your system has a line printer controlled by a parallel line printer interface, such as an LP11, then create its

special file with this command sequence:

```
# cd /dev
# msf lp11 0
# cd /
# sync
```

2.3.4. Creating Communications Lines as Printer Ports

You can use communications lines as printer ports for adding printers to your system. To set up a communications line as a printer port, type:

```
# cd /
# chmod 700 /dev/ttynn
# chog daemon /dev/ttynn
# /etc/mount -a
# mkdir /usr/spool/lpdx
# chmod 755 /usr/spool/lpdx
# chog daemon /usr/spool/lpdx
# ln /usr/lib/ulf /usr/lib/lpx
# sync
# /etc/umount -a
```

ttynn is the terminal number assigned to the printer port. Once assigned to a printer port, this terminal line is dedicated to the printer and can no longer be used to log in to the system.

You must change the mode of the entry for this terminal line in the /etc/ttys file to nologins. You do this in Section 2.9.2, Modifying the /etc/ttys File.

x can be any number, but by convention it represents the number of the printer. For example, if you are configuring a second printer into your system, you should define x as 2.

For each printer port you add to your system, the names for its spooling directory, output filter, and printer must all have the same value for x.

lpd_x is the name of the spooling directory for the printer. Each printer maintains its own separate spooling directory. The directory /usr/spool/lpd is the spooling directory for the main line printer, generally accessible through /dev/lp. You name all other spooling directories after the number of the printer.

For example, the spooling directory for printer P2 is /usr/spool/lpd2. The jobs for printer P2 are queued in this spooling directory.

lpx is the output filter name linked to /usr/lib/ulf. For example, printer P2 uses the output filter /usr/lib/lp2. The filter program /usr/lib/ulf checks to see by what name it was called, and then looks for the appropriate printer entry in /etc/printcap.

If the number of the printer does not match the output filter name, errors result. For example, specifying the output filter /usr/lib/lp2 for the third printer incorrectly sets up printer P3 according to the specifications given for printer P2. In addition, directly invoking the filter /usr/lib/ulf causes an error because the filter program mistakenly searches for the nonexistent entry "ulf" in the printer description file (/etc/printcap).

Now edit the printer description file /etc/printcap to include an entry for the printer. The /etc/printcap file must contain a printer type entry for each printer connected to the system. It already contains an entry for lp, the default printer.

Here is a sample of various printcap entries:

```
lp0|lp|0>Main printer - LP11 type interface:\n  :lp=/dev/lp:du#1:sd=/usr/spool/lpd:mx#5000:\n  :lf=/usr/adm/lp.err:\nlp1|1|LA100 printer:\n  :dn=/usr/lib/lpd:lp=/dev/tty00:\n  :sd=/usr/spool/lpd1:sh:br#4800:fc#077777:\n  :fs#06020:of=/usr/lib/lp1:\nlp2|2|LA50 printer:\n  :dn=/usr/lib/lpd:lp=/dev/tty05:\n  :sd=/usr/spool/lpd2:br#4800:fc#077777:\n  :fs#016620:of=/usr/lib/lp2:lf=/usr/adm/lp2.err:\nlp3|3|LA180 DECWRITER III:\n  :lp=/dev/ttyh0:br#1200:fc#077777:fs#06320:\n  :of=/usr/lib/lp3:sd=/usr/spool/lpd3:
```

For example, to add a second printer to a system, replacing tty05 and known as printer P2, type:

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```
# cd /
# chmod 700 /dev/tty05
# chog daemon /dev/tty05
# /etc/mount -a
# mkdir /usr/spool/lpd2
# chmod 755 /usr/spool/lpd2
# chog daemon /usr/spool/lpd2
# ln /usr/lib/ulf /usr/lib/lp2
# sync
# /etc/umount -a
```

In this example, the terminal line is `tty05 (ttynn)`. The print jobs for the second printer are queued in the `/usr/spool/lpd2` spooling directory.

You need to add an appropriate `printcap` entry for printer P2 to the `/etc/printcap` file.

In our example, this command prints files on printer P2 once the system is running in multiuser mode:

```
# lpr -P2 file
```

Refer to `printcap` in Section 5 of the ULTRIX-11 Programmer's Manual, Volume 1 for a complete description of the printer capability data base.

In addition to editing the `/etc/printcap` file, you need to set the terminal's mode in the `/etc/ttys` file to nologins. You do this in Section 2.9.2, Modifying the `/etc/ttys` File.

2.4. Naming the System

To name your system, edit the `/etc/rc` file with the `ed` text editor. Choose a site name and substitute it for "noname" in the last line of the `/etc/rc` file.

As distributed, the last line in the `/etc/rc` file reads:

```
hostname noname
```

If you want to name your system site `mypdp11`, modify the last line of the `/etc/rc` file so it reads:

```
hostname mypdp11
```

The name you choose must be made up of no more than 32 lowercase alphanumeric characters.

If your system is connecting to a uucp network, then the first six characters of your site name must be different

from other site name on the network. To verify if your name is unique, ask the site through which you are connecting for a list of existing site names.

2.5. Generating the ULTRIX-11 System

The preconfigured ULTRIX-11 operating system supports the system disk and console terminal and no other devices.

The system generation program sysgen produces an ULTRIX-11 operating system configured to support your exact system configuration.

To generate the system, you:

1. Complete the work sheet in Appendix G
2. Run the sysgen program
3. Respond to the sysgen prompts
4. Create the new ULTRIX-11 operating system
5. Install and boot the new ULTRIX-11 operating system

The system generation program (sysgen) is outlined in the steps below. If you would like more detailed information about the system generation program, read Chapter 2, ULTRIX-11 System Generation, in the ULTRIX-11 System Management Guide.

To aid you during the system generation process, sysgen provides extensive on-line help.

For a sample system generation, refer to the second example in Appendix C, System Generation Examples.

To begin, complete the work sheet in Appendix G. This places all the information required for the installation in one easily accessible place. After completing the work sheet, follow these steps to generate the system:

1. To mount the /usr file system, type:

```
# cd /
# /etc/mount -a
```

2. To go to the configuration directory, type:

```
# cd /sys/conf
```

3. To run the sysgen program, type:

```
# sysgen
```

The sysgen program responds by printing these messages:

```
ULTRIX-11 System Generation Program
```

```
For help, type h then press <RETURN>
```

```
sysgen>
```

The sysgen program is ready to accept commands.

4. To familiarize yourself with sysgen, type h and read the general help message:

```
sysgen> h
```

5. To print a list of all the ULTRIX-11 supported devices, type:

```
sysgen> d
```

6. To create the ULTRIX-11 configuration file, first use the help command for create:

```
sysgen> h c
```

Next, start the system generation dialogue by typing:

```
sysgen> c
```

Answer each sysgen prompt, using the second system generation example in Appendix C as a guide. If you are unsure of a response, type a question mark (?) for on-line help.

If you want to change an answer, press <CTRL/D> to move back to the previous major question.

The sysgen program displays the default response to each question in angle brackets (<>). Press <RETURN> to accept the default. When sysgen displays more than one response in angle brackets or parentheses (), it is giving you possible responses to the question.

When sysgen returns this message, you have finished creating the configuration file:

ULTRIX-11 System Generation Program

For help, type h then press <RETURN>

sysgen>

7. To review your answers, type:

sysgen> p

The sysgen program prompts you for the name of your kernel configuration. Type the configuration name and press <RETURN>. The sysgen program then prints all of your responses.

Verify your answers. If you need to change a response, recreate the system generation using the c command as described in step 6.

8. Make the new ULTRIX-11 operating system kernel.

Up to this point, you have entered responses into the configuration file. The kernel does not yet exist. Create the kernel with the make command by typing:

sysgen> m

The sysgen program prompts you for the name of your kernel configuration file. Type the configuration name and press <RETURN>. The sysgen program starts building the new ULTRIX-11 operating system. The m command generates many messages. Ignore all messages except the last one, which tells you that the system generation was successful.

See Example 2 in Appendix C, System Generation Examples, for a sample dialog.

9. Exit the sysgen program.

Complete the system generation phase by pressing <CTRL/D>.

sysgen> <CTRL/D>

#

The # prompt displays again, and the system generation is complete.

2.6. Installing the New ULTRIX-11 Operating System

To install the new ULTRIX-11 operating system, follow these steps:

1. Save the preconfigured ULTRIX-11 system.

To save the preconfigured ULTRIX-11 system for backup purposes, type:

```
#      ps/conf  
#      unix /ounix
```

2. Move the new operating system to the root directory.

To move the new operating system into the root directory and name the new operating system unix, type:

```
#      kernel.os /unix
```

kernel is the configuration name that you assigned your kernel when you generated the system. For example, if you named your configuration testunix, type:

```
#      testunix.os /unix
```

The default value for kernel.os is unix.os.

3. Change the mode of /unix.

To change the mode of /unix, type:

```
#      chmod 644 /unix
```

4. Shut down the system.

Type these commands:

```
#  
#      umount -a  
#
```

Then halt your processor.

NOTE

These commands for shutting down the system are for the installation procedure only. Do not use them to shut down the ULTRIX-11 system during normal multiuser operation. Refer to Chapter 5, ULTRIX-11 Operator Services, in the ULTRIX-11 System Management Guide for the proper shutdown procedure.

5. Boot the new ULTRIX-11 operating system.

Be sure your processor's HALT switch is released. Then bootstrap the system disk (drive 1 for RC25, drive 0 for all other system disks).

The boot program prints these messages while loading the operating system:

Sizing Memory...

Boot: xx(0,0)unix (<CTRL/C> aborts auto-boot)

NOTE

The xx represents the 2-character ULTRIX-11 name for the system disk (hk, hp, ra, rc, rd, rl, or rp).

Once loaded, the operating system starts running in single-user mode and prints the following start-up messages:

ULTRIX-11 Kernel V2.0

```
realmem = xxxxx
buffers = yyyyy
usermem = zzzzz
erase = delete, kill = ^U, intr = ^C
#
```

The realmem message (xxxxx) displays the entire size of memory in bytes. The buffers message (yyyyy) displays the total amount of memory occupied by the system's I/O buffer cache. The usermem message (zzzzz) displays the amount of free memory in bytes; that is, the realmem minus the number of bytes used by the buffer cache in the ULTRIX-11 operating system.

Erase deletes individual characters, kill removes an entire line of input, and intr (interrupt) interrupts a program. The system reminds you that it has changed these control characters from the standard UNIX V7 characters (where erase = #, kill = @, intr = delete).

is the ULTRIX-11 superuser prompt, indicating that the operating system is up and running in single-user mode.

6. Set the date and time.

Type the date and time in this format:

date yyymmddhhmm.ss

yy equals the last two digits of the year (00-99)

mm equals the number of the month of the year (01-12)

dd equals the number of the day of the month (01-31)

hh equals the hour of the day based on 24 hours (00-23)

mm equals the minutes of the hour (00-59)

ss equals the seconds of the minute (00-59)

The entry of seconds is optional.

For example, to set the date and time to 6:30 PM on August 28, 1984, type:

```
# date 8408281830
```

2.7. Checking the ULTRIX-11 File System

To make sure all the ULTRIX-11 files are properly loaded on the system disk, run the file consistency check program fsck:

```
# cd /
# sync
# fsck
```

The fsck program checks the file systems and prints the number of files, the number of blocks used, and the number of free blocks on each of the file systems.

If an error occurs, fsck prints a message describing the error and asks if it should make the necessary repairs. If you answer yes to the repair prompt, fsck attempts to fix the problem. If fsck makes any repairs, it prints the

message:

```
***** FILE SYSTEM WAS MODIFIED *****
```

The fsck program must run without errors. If an error does occur, the system disk media may be defective, you may have made an error in loading ULTRIX-11, or there may be a hardware fault that does not allow ULTRIX-11 to be loaded properly. For media faults, read Section 1.2.3, Disk Media Qualification.

2.8. ULTRIX-11 Installation Verification

You should now verify the installation with the ULTRIX-11 system acceptance test (usat) facility.

The /usr file system must be mounted before you run any tests with usat. To mount the /usr file system, type:

```
# cd /
# /etc/mount -a
```

To obtain a list of the ULTRIX-11 commands that usat can test, type:

```
# usat help
```

To test all commands and features, type:

```
# usat all          (this takes from 7 to 25
                     minutes, depending on
                     the processor)
```

You can redirect the usat program's output to a log file by typing:

```
# usat all >usat.log
```

During usat testing you will see a number of messages on the terminal. The usat installation verification was successful if the last message is:

```
NO ERRORS DETECTED
```

When you have finished the usat installation verification, unmount the /usr file system by typing:

```
# cd /
# /etc/umount -a
```

If the installation verification fails, follow these steps:

1. Run usat again on the file that failed.

2. If the verification fails again, review your installation procedure. Be sure you followed each step correctly.
3. If you installed the system correctly and the error persists, call the Digital Telephone Support Center.

2.9. Making the ULTRIX-11 System Available to Users

The ULTRIX-11 operating system installation is complete, but you must perform some administrative tasks before you make the system available to users.

Except for modifying user terminal entries in the /etc/ttys file, all of these administrative tasks require you to edit text files using the basic ULTRIX-11 text editor ed. See Appendix H, The ed Command Summary Sheet, for information on this editor.

These sections cover the basic approach to setting up your system:

- Storing User Files
- Modifying the /etc/ttys File
- Creating the User Accounts
- Connecting to Remote Systems

2.9.1. Storing User Files

Allocating user file storage depends on the number and type of disks on your system.

If your system has only two RL01 disks or a single RL02 or RK06 disk, then user files must be stored in the root or /usr file systems. In this case, omit this step and continue with Section 2.9.2, Modifying the /etc/ttys File.

The ULTRIX-11 operating system partitions each physical disk unit into logical subunits, a number of which the operating system uses. The remaining subunits are available for user file storage.

To allocate disk space for user file storage follow these steps:

1. Select an available disk partition (subunit).
2. Create a file system on the disk subunit.
3. Create a user file directory.

4. Edit the file system table (/etc/fstab).

Use the example below as a guide to create your user file systems. The example assumes that you are installing the ULTRIX-11 system on a single RP06 disk. The actual procedure varies, depending on the number and type of disks on your system.

1. Select available disk partitions.

The operating system uses the disk partitions shown in Table 2.3. NEVER attempt to create user file systems on these partitions.

Table 2.3 Partitions Used by the Operating System

<u>Disk Type</u>	<u>System Partitions</u>
RL01	all partitions on units 0 and 1
RL02	all partitions on unit 0
RK06/7	unit 0 - partitions 0, 1 & 2
RP02/3	unit 0 - partitions 0, 1 & 2
RP04/5/6	unit 0 - partitions 0, 1 & 2
RM02/3/5	unit 0 - partitions 0, 1 & 2
RA60	unit 0 - partitions 0, 1 & 2
RA80/81	unit 0 - partitions 0, 1 & 2
RC25	unit 1 - partitions 0, 1 & 2

Refer to Appendix D, Disk Logical Partition Sizes, in the ULTRIX-11 System Management Guide for the RP06 disk partition layout. The operating system occupies partitions 0, 1, and 2. Partitions 3, 4, and 5 are available for user file systems. For this example, partition 4 is used to create a single-user file system covering the remainder of the RP06 disk.

You cannot use partitions 3 and 5 because they overlap partition 4. You cannot use partition 6 and 7 because they overlay the system and user partitions.

If a second RP06 disk drive were present, you could use partition 7 to create a single-user file system covering the entire second RP06 disk or you could use a combination of the available partitions, watching out for overlap. See Appendix D, Disk Logical Partition Sizes, in the ULTRIX-11 System Management Guide for information on disk partitions.

2. Create an empty file system on the disk partition.

If you are using a separate disk pack to store user files, be sure that disk is loaded in the drive and

ready.

You create the empty file system with the make file system command **mkfs**:

```
# /etc/mkfs /dev/rnameUn size disk cpu fsname volname
```

name is the ULTRIX-11 2-character logical disk name as shown:

<u>Generic Name</u>	<u>ULTRIX-11 Name</u>
KLESI-RC25	
1st RH11/RH70-RM02/3/5, RP04/5/6, ML11	rc
2nd RH11/RH70-RM02/3/5, RP04/5/6, ML11	hp
3rd RH11/RH70-RM02/3/5, RP04/5/6, ML11	hm
RH11/RH70-RS03/4	hj
RK11-RK05	hs
RK611-RK06/7	rk
RL11-RL01/2	hk
RP11-RP02/3	rl
RQDX1-RD51/RD52	rp
RQDX1/RUX1-RX50	rd
RX211-RX02	rx
UDA50-RA60/RA80/RA81	hx
	ra

U is the disk unit number.

n is the disk partition number.

size is the size of the partition in blocks. Refer to Appendix D, Disk Logical Partition Sizes, in the ULTRIX-11 System Management Guide for partition sizes.

disk is the generic name of the disk, such as r102, rk07, and so forth.

cpu is the last two digits of the processor type, such as 23, 24, 34, 40, 44, 45, 55, 60, 70 or 73.

fsname is the file system name recorded in the super block. It can be no more than six characters in length.

volname is the volume name label recorded in the super block. It can be no more than six characters in length.

For example, to create a file system on RP06 drive 0 partition 4 on a PDP-11/70 processor, type:

```
# /etc/mkfs /dev/rhp04 313082 rp06 70 user system
```

3. Create a user file directory.

The commands below create the user file directory. In this example, the directory name is user. You may use any name that does not already exist:

```
# cd /
# mkdir user
# chmod 755 user
```

If you have more than one user file system, you must create a directory for each.

NOTE

The user file system must be logically mounted on the user directory before you can actually store files in the file system. Do not mount the user file system at this time. However, the command sequence is:

```
# cd /
# /etc/mount /dev/hp04 /user
```

The user file system is mounted when you install the user accounts.

4. Edit the file system table (/etc/fstab).

Use the ed text editor to append this line to the end of the /etc/fstab file:

```
/dev/hp04:/user:rw
```

Adding the hp04 entry to the table makes it known to all system commands that deal with file systems.

This entry also causes the hp04 file system to be mounted on /user automatically each time the system enters multiuser mode.

The hp04 (user) file system is available for user file storage when the system goes to multiuser mode.

For further details on user file storage, see Section 4.6, Setting Up User File Systems, in the ULTRIX-11

System Management Guide.

2.9.2. Modifying the /etc/ttys File
(Enabling User Terminals)

Each terminal entry in the /etc/ttys file controls the characteristics of a specific terminal. The /etc/ttys file entry also controls the mode for each terminal.

A terminal can be in one of four modes:

disabled	Disables a terminal
remote	Enables a remote (dial-up) terminal
local	Enables a local terminal
nologins	Enables a local terminal but does not allow users to log in

As distributed, all terminal entries are in the disabled mode. You should modify all entries for active hardwired terminals so they are in local mode. You should modify all entries for dial-up terminals so they are in remote mode. You should also modify all entries for printer (lpr) ports, and tip and uucp dial-out lines so they are in nologins mode.

Finally, you should remove all entries for terminals that your system does not have.

You modify a terminal's characteristics by modifying its entry in the /etc/ttys file, using the terminal enabling editor, ted.

To modify the /etc/ttys file, type:

```
# ted
```

The ted program has an on-line help facility to help you modify the entries.

In single-user mode, ted modifies only the entries in the /etc/ttys file. The terminal characteristics are not changed until the system enters multiuser mode.

In multiuser mode, ted modifies the terminal characteristics interactively.

See Section 4.7.5, Editing the /etc/ttys File, in the ULTRIX-11 System Management Guide for further information on modifying user terminal characteristics.

2.9.3. Editing the Terminal Type File

The terminal type file /etc/ttytype identifies the terminal type to system programs, such as vi. Entries in this file have this format:

type ttynn

type is the type of terminal you have, for example:

vt100 tty00

To see a listing of the existing terminal type file, type:

```
# cat /etc/ttytype
```

Use the ed text editor to modify entries in the /etc/ttytype file.

If your system console is a CRT (video terminal) then you must modify the first line of the /etc/ttytype file so it correctly identifies your console. For example, if your system console is a VT100, edit the first line of the /etc/ttytype file so it reads:

vt100 console

For more information about editing the /etc/ttytype file, see Section 4.7.4, Editing the /etc/ttytype File, in the ULTRIX-11 System Management Guide.

2.9.4. Creating the User Accounts

To create new user accounts, edit the /etc/passwd file. Each line in this file describes one user account, in the form:

name:passwd:user-ID:group-ID:real-name:directory:shell

name is the user's login name. It can have a maximum of eight lowercase characters.

passwd is the user's encrypted password. When you create the user's entry in the /etc/passwd file, leave this field blank.

user-ID is a unique user-identification number.

group-ID is a common group-identification number. This groups together several users who are working on a common project so they can share files.

real-name is the user's real name, such as Jane Doe.

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directory is the pathname of the user's home directory
This is where the user account resides.

shell specifies the user's shell program. If this entry is blank, the Bourne shell is the default.

Here are the steps to create a demonstration account and two user accounts:

1. Edit the /etc/passwd file.

Using ed, add an appropriate line for each user to the /etc/passwd file. Make sure that the new entries do not conflict with any existing entries.

Here is an example of how to add a demo account and two user accounts for fictitious people. Modify these lines to match your users:

```
demo::10:20:demonstration account:/usr/demo:  
jad::20:30:Jane Anne Doe:/user/jad:/bin/csh  
smith::21:30:John W. Smith:/user smith:/bin/csh
```

Note that the demo account is in a separate home directory and uses the Bourne shell, and that the jad and smith accounts have the same parent directory and use the C shell.

2. Mount the user file systems.

Mount the file systems where the user's home directories will be located:

```
# cd /  
# /etc/mount -a
```

The -a option to the mount command specifies that all file systems in the /etc/fstab file be mounted.

3. Set up the home directories.

Create the home directories and change the owners to the new users:

```
# cd /usr  
# mkdir demo  
# chog demo demo  
# cd /user  
# mkdir jad smith  
# chog jad jad  
# chog smith smith  
# cd /
```

4. Unmount the user file systems.

Type:

```
# cd /
# /etc/umount -a
```

5. Create start-up files for each account.

Refer to Chapter 6, Completing the Installation, for information on multiuser mode, logging in and out, and passwords.

After you create the new accounts, bring the ULTRIX-11 system up to multiuser mode.

Then log in to each account and create the user's start-up files. If the user has the Bourne shell (/bin/sh), then create a .profile file in the home directory. If the user has the C shell (/bin/csh), create a .login and .cshrc file in the home directory.

These files contain a list of commands that the shell program executes each time the user logs in the system. For further information about these start-up files, read the Introduction to the C Shell and Introduction to the UNIX Shell, in the ULTRIX-11 Programmer's Manual, Volume 2A and refer to csh and sh in Section 1 of the ULTRIX-11 Programmer's Manual, Volume 1.

Enter each new user's password into the /etc/passwd file by executing the passwd command.

2.9.5. Connecting to Remote Systems

You can access remote systems with the ULTRIX-11 tip facility. Refer to Section 4.9, Setting Up tip Connections, in the ULTRIX-11 System Management Guide for instructions.

If your system is participating in the UNIX users network (sometimes called USENET), refer to the UUCP Installation and Administration Guide in the ULTRIX-11 Programmer's Manual, Volume 2B for instructions on how to set up uucp.

Chapter 3

Installing ULTRIX-11 Software from RL02 Disk

This chapter describes the installation procedure for the ULTRIX-11 operating system from the RL02 distribution kit.

3.1. RL02 Disk Installation Overview

This section of the RL02 disk installation consists of these steps:

- Backing up the RL02 distribution media
- Executing the automatic installation procedure
- Generating the ULTRIX-11 operating system
- Verifying the installation
- Making the ULTRIX-11 system available to users

You must make a backup copy of your first distribution pack (labeled ROOT AND /USR). If you will use the optional software and if you have the facilities, you should copy the OPTIONAL SOFTWARE pack. Then you can begin the installation.

First, bootstrap your system disk (a copy of the ROOT AND /USR distribution disk) and initialize the operating system. The automatic installation procedure helps you with this.

Second, generate and install an ULTRIX-11 kernel that supports your system processor and all the system devices. This kernel is the basic memory-resident portion of the operating system that supports system calls, maintains the file system, and deals directly with the processor and peripheral devices.

After verifying that the installation was successful, you perform various administrative tasks to make the system

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available for other users.

The rest of this chapter explains how to perform these steps.

3.2. Backing Up the RL02 Distribution

This section explains how to copy your distribution media. The copy becomes your system disk. The original distribution media becomes your backup copy.

You need the backup copy in case something happens to the system disk. In that event, you can copy the backup copy (the original distribution) of the root and /usr file systems and use them to install your ULTRIX-11 system again.

Copying the distribution disk packs requires a system with one RL02 disk drive and one or more other mass storage devices. The second mass storage device must be at least as large as an RL02 or magnetic tape. If your system does not meet this requirement, you can copy the distribution disks on another system that has the required mass storage devices. The processor type need not match your own; it can be any of the supported PDP-11 processors.

Use the procedure below to copy the distribution disks. The instructions assume you are using RL02 drive 1 as the second mass storage device. You must modify the instructions when using a different device for the copy operation. Refer to Appendix D, Stand-alone Copy Program, for instructions on using the stand-alone copy program with alternate mass storage devices.

NOTE

You can only boot off of an RL02 disk. Therefore, you must copy your distribution onto an RL02 disk.

If you only have one RL02 drive, copy the distribution RL02 to any blank disk or tape. Then copy the disk or tape to a blank RL02, which then becomes the system disk. Save the original distribution RL02 disk as a backup.

3.2.1. Copying the ROOT AND /USR Distribution Disk

To copy the root and /usr file systems, follow these steps:

1. Mount the disk media.

Mount the ROOT AND /USR distribution disk pack in RL02

drive 0. Write protect drive 0 by pressing the WRITE PROT switch. Press the LOAD switch and wait for the READY indicator to light.

Mount your system disk pack (a blank RL02) in drive 1. Do not write protect drive 1. Press the LOAD switch and wait for the READY indicator to light.

2. Bootstrap RL02 drive 0. Read all of the instructions in this step before continuing.

Use your hardware bootstrap to boot RL02 drive 0.

The boot program prints these messages on the terminal:

Sizing Memory...

Boot: r1(0,0)unix (<CTRL/C> will abort auto-boot)

As soon as this message appears, interrupt the automatic boot by pressing <CTRL/C>.

The boot program cancels the automatic boot and prints:

To list options, type help then press <RETURN>

Boot:

There may be a delay of several seconds between the time you press <CTRL/C> and the appearance of the Boot: prompt.

NOTE

If you wait too long to press <CTRL/C>, the operating system loads into memory and begins printing several messages. In this case, halt the processor and repeat this step from the beginning.

3. Load the stand-alone copy program.

To load the stand-alone copy program, type:

Boot: r1(0,0)/sas/copy

After successfully loading, the copy program prints this message:

ULTRIX-11 Stand-alone Copy Program

Input File:

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4. Copy the ROOT AND /USR disk pack.

Copy the ROOT AND /USR distribution disk onto your system disk by entering these commands to the stand-alone copy program:

```
Input File: rl(0,0)
Output File: rl(1,0)
Record Size <16384 MAX> : 10240
Number of Records: 1024
Ready to copy rl(0,0) to rl(1,0) <y or n> ? y
.
.
.
(this takes a few minutes)
.
Copy Complete
More files to copy <y or n> ? n
Exit called
Boot:
```

5. Load the bad block scan program (bads).

To load the stand-alone bad block scan program, type:

```
Boot: rl(0,0)/sas/bads
```

After successfully loading, the bads program prints this message:

```
Quick Bad Block Scan Program
Disk type <cr to exit, ? for list of disks>:
```

6. Scan the copied RL02 disk (system disk) for bad blocks.

To use the bads program to scan your system disk for bad blocks, type:

```
Disk type <cr to exit, ? for list of disks>: rl02
Unit number: 1
Scan disk pack for bad blocks <[y] or n> ? y
Block offset: 0
# of blocks <cr for full pack>: <RETURN>
```

READING (this takes a few minutes)

20480 blocks checked
0 bad blocks found

Disk type <cr to exit, ? for list of disks>: <RETURN>
Exit called

Boot:

The final bards program message must be "0 bad blocks found." If it is not, then you cannot use that disk to back up the ROOT AND /USR distribution pack. Get another RL02 disk pack and repeat the procedure.

Repeated failures may indicate a problem with your system disk hardware.

7. Use the copy as your system disk.

Halt your processor. Then remove the ROOT AND /USR distribution disk pack from drive 0 and store it in a safe place for backup purposes.

Remove the newly copied pack from drive 1, label it "Root and /usr (copy)" and then mount it in drive 0. Release the WRITE PROT switch.

If you are not going to use the optional files or you cannot back up the OPTIONAL FILES distribution disk pack, proceed directly to Section 3.3, The Automatic Installation Procedure.

3.2.2. Copying the OPTIONAL FILES Distribution Disk

It is not mandatory that you copy the OPTIONAL FILES disk for normal operation of the ULTRIX-11 system. If you do install the software on this pack, however, you should, if possible, make a backup copy first.

Follow these steps to copy the OPTIONAL FILES distribution pack:

1. Mount the disk media.

Be sure that your new root and /usr system disk is mounted in drive 0 (step 7 above) and write protected. If the drive is not already on-line, press the LOAD switch and wait for the READY indicator to light.

Mount a blank RL02 disk pack in drive 1. Do not write protect drive 1. Press the LOAD switch and wait for the READY indicator to light.

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2. Bootstrap RL02 drive 0.

Use your hardware bootstrap to boot RL02 drive 0. Read all of this step before continuing.

The boot program prints these messages on the terminal:

Sizing Memory...

Boot: rl(0,0)unix (<CTRL/C> will abort auto-boot)

As soon as this message appears, interrupt the automatic boot by pressing <CTRL/C>.

The boot program cancels the automatic boot and prints:

To list options, type help then press <RETURN>

Boot:

There may be a delay of several seconds between the time you press <CTRL/C> and the appearance of the Boot: prompt.

NOTE

If you wait too long to press <CTRL/C>, the operating system loads into memory and begins printing several messages. In this case, halt the processor and repeat this step from the beginning.

3. Load the bad block scan program (bads).

To load the stand-alone bad block scan program, type:

Boot: rl(0,0)/sas/bads

After successfully loading, the bads program prints this message:

Quick Bad Block Scan Program

Disk type <cr to exit, ? for list of disks>:

4. Scan the blank RL02 disk for bad blocks.

To use the bads program to scan your blank disk for bad blocks, type:

Disk type <cr to exit, ? for list of disks>: rl02

```
Unit number: 1
Scan disk pack for bad blocks <[y] or n> ? y
Block offset: 0
# of blocks <cr for full pack>: <RETURN>
READING           (this takes a few minutes)
20480 blocks checked 0 bad blocks found
Disk type <cr to exit, ? for list of disks>: <RETURN>
Exit called
```

Boot:

The final bads program message must be "0 bad blocks found." If it is not, then you cannot use that pack as the optional files backup disk. Get another RL02 disk pack and repeat the procedure.

Repeated failures may indicate a problem with your system disk hardware.

5. Load the stand-alone copy program.

To load the stand-alone copy program, type:

Boot: rl(0,0)/sas/copy

After successfully loading, the copy program prints this message:

ULTRIX-11 Stand-alone Copy Program

Input File:

Release the LOAD switch on drive 0 and wait for the LOAD indicator to light. Remove your copy of the root and /usr system disk from drive 0.

6. Mount the OPTIONAL FILES disk pack.

Mount the OPTIONAL FILES distribution disk in RL02 drive 0. Press the LOAD switch and wait for the READY indicator to light. Be sure drive 0 is write protected.

7. Copy the OPTIONAL FILES disk pack.

Copy the OPTIONAL FILES disk pack by typing these commands to the stand-alone copy program:

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```
Input File: rl(0,0)
Output File: rl(1,0)
Record Size <16384 MAX> : 10240
Number of Records: 1024
Ready to copy rl(0,0) to rl(1,0) <y or n> ? y
.
.
.
(this takes a few minutes)
.
Copy Complete

More files to copy <y or n> ? n
Exit called
```

Boot:

Halt your processor. Then release the LOAD switch on drive 0 and wait for the LOAD indicator to light. Remove the OPTIONAL FILES distribution disk and save it as a backup.

Remove the newly copied optional files pack from drive 1 and label it "Optional Files Backup."

You are now ready to begin the installation.

3.3. The Automatic Installation Procedure

After the RL02 disk boots, you are in the automatic installation procedure.

Follow these steps:

1. Mount the system disk.

Mount your copy of the distribution RL02 disk labeled "Root and /usr (copy)" into drive 0. Press the LOAD switch and wait for the READY indicator to light. Make sure the WRITE PROT switch is released.

2. Boot the disk.

Be sure the processor is halted, then bootstrap the system disk. Refer to your hardware manual for information on how to bootstrap your disk.

The boot program prints these messages while loading the operating system:

Sizing Memory...

```
Boot: rl(0,0)unix (<CTRL/C> will abort auto-boot)
```

Once loaded, the operating system starts running in single-user mode and prints these start-up messages:

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```
realmem = xxxxx
buffers = yyyyy
usermem = zzzzz
erase = delete, kill = ^U, intr = ^C
```

The realmem message (xxxxx) displays the entire size of memory in bytes. The buffers message (yyyyy) displays the total amount of memory occupied by the system's I/O buffer cache. The usermem message (zzzzz) displays the amount of free memory in bytes; that is, the realmem minus the number of bytes used by the buffer cache in the ULTRIX-11 operating system.

Erase deletes individual characters, kill removes an entire line of input, and intr (interrupt) interrupts a program. The system displays this message to remind you that it has changed these control characters from the standard UNIX V7 characters (where erase = #, kill = @, intr = delete).

The initial setup program (setup) starts running automatically.

3. The automatic installation procedure.

The setup program prints some initial messages and a display of your system disk and processor types. It asks you to confirm that this information is correct.

The setup program then prompts you for the date and time. After you type the current date and time, the automatic installation procedure begins.

If an error occurs, the automatic installation procedure prints instructions on how to recover from the error or where to get help if you cannot recover.

When the system prints the message shown below, the automatic installation procedure is complete.

```
***** ULTRIX-11 INITIAL SETUP COMPLETED *****
```

3.4. Creating the Device-Dependent Special Files

To be accessible by the ULTRIX-11 operating system, each device must have special files in the /dev directory. The generic command sequence is:

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```
# cd /dev  
# msf device n  
# cd /  
# sync
```

device is the generic device name, such as r102, rk07, ra60, ts11, or tm03.

n is the unit number of the device.

The following sections on creating device special files all refer to this command sequence format.

NOTE

If you have one or more MASSBUS disk controllers (RH11/RH70) and/or one or more MSCP disk controllers (UDA50, KLESI, RQDX1, RUX1), omit this section, and follow the instructions given in Appendix I, Multiple MASSBUS/MSCP Disk Controllers.

NOTE

If you create a special file for an ML11 device, two special files are automatically created for each unit:

```
/dev/mln  
/dev/rmln
```

n is the unit number of the ML11 device.

See Section 2.6.1, Support Files for Disks, in the ULTRIX-11 System Management Guide for further information.

3.4.1. Creating Disk and Tape Special Files

The setup program already created the special files for your system disk (drive 0) during the automatic installation procedure. If your system does not have any other disk or tape drives, omit this step and continue with Section 3.4.2, Creating Special Files for Communications Devices.

Use the msf command to create the special files for all disk and tape drives, other than the system disk.

Here is a sample command sequence to create the disk and

tape special files for a large PDP-11 system. Modify this sequence to correspond with your system:

```
# cd /dev
# msf tu77 0          (first tape drive, unit 0)
# msf te16 1          (second tape drive, unit 1)
# msf rp06 0          (RP06 on first RH controller, unit 0)
# msf rm03 1          (RM03 on first RH controller, unit 1)
# msf ml11 2          (ML11 on first RH controller, unit 2)
# msf ra60 0          (RA60 disk on 1st MSCP controller, unit 0)
# msf ra81 1          (RA81 disk on 1st MSCP controller, unit 1)
# cd /
# sync
```

If you have an RQDX1 controller with an RX50, RD51, or RD52 drive, see Section 5.1.1, RD51, RD52 & RX50 Unit Numbering.

3.4.2. Creating Special Files for Communications Devices

Communications special files allow you to use other terminals in addition to the console terminal. The terminals have names in the form `/dev/ttynn` where `nn` is the unique number assigned to each line.

To set up the special files for your system configuration you must know what type of communications controllers you have, how many of each type, and how many lines each controller can handle.

Table 3.1 lists the various communications controllers supported by the ULTRIX-11 system, how many lines each can handle, and the ULTRIX-11 name of each type.

Table 3.1 ULTRIX-11 Supported Communications Controllers

<u>Controller</u>	<u>Lines/Unit</u>	<u>ULTRIX-11 Name</u>
DLV11-A/B	1	k111
DLV11-F	1	k111
DLV11-E	1	d111
DLV11-J	4	k111
DZV11	4	dzv11
DZQ11	4	dzq11
DHV11	8	dhv11
DL11-A/B	1	k111
DL11-C/D/E	1	d111
DL11-W	1	k111
DZ11	8	dz11
DH11	16	dh11
DHU11	16	dhu11

NOTES

The DZ11-E and DZ11-F models consist of two DZ11s (a total of 16 lines), and should be viewed as two DZ11 units.

The DLV11-J is the equivalent of four DLV11s and should be viewed as four DLV11s.

Although the console terminal is on a DL11/DLV11-type line, its special file (/dev/console) already exists. Do not include it in your count of DL11/DLV11-type controllers. For example, if the last line of your DLV11-J is used as the console you would count the DLV11-J as three DLV11-type controllers instead of four.

The second single line unit (SLU) built into some PDP-11 processors should be counted as a DL11/DLV11-type controller. The PDP11/23+, PDP11/24, PDP11/44, and the PDP11/23+ version of the Micro/PDP-11 have this extra line.

During system generation, you need to differentiate between a KL11 and a DL11. At this point, however, group all KL11s and DL11s together and specify them as DL11s.

You reference terminals on an ULTRIX-11 system by special file names, such as tty00 or tty23. To assign these names to the lines of your communications controllers you must specify the type of controller, the controller's unit number, and the first line number to use for that controller.

Type this command sequence to remove any existing communications device special files:

```
# cd /dev  
# make ttypclean  
.  
.: (make prints several messages)  
.
```

Use a variation of the msf command format shown previously to create the communications device special files. The format is:

```
# msf device n ttynn
```

device is the communications device's ULTRIX-11 name,
 such as KL11, DZ11, or DHV11.

n is the number of units for DL11 or KL11 com-
 munications controllers. It is the unit
 number for all other communications controllers.

ttynn is the first tty line to be assigned to that
 controller.

Assign the line for the first communications controller
on your system tty00. For subsequent controllers,
assign lines at the next available tty number.

For example, to create the special files for a system
with one DH11, one DZ11, and three DL11 communications
controllers, type:

```
# cd /dev  
# msf dh11 0 tty00  
# msf dz11 0 tty16  
# msf dl11 3 tty24  
# cd /  
# sync
```

In this example the first msf command assigns the 16
lines on DH11, unit 0 (DH11 lines 0-15) to tty00-tty15.

The second msf command assigns the eight lines on DZ11,
unit 0 (DZ11 lines 0-7) to the next available tty lines
(tty16-tty23).

The last msf command assigns the three DL11 single line
units to the next available tty lines (tty24-tty26).

NOTE

All KL11 and DL11 type controllers
must be grouped together and as-
signed to contiguous tty lines by a
single execution of the msf com-
mand.

If your communications controller configuration con-
sists of any single line units other than the console,
you need to determine exactly what types these are. If
the only single line unit you have is the console, con-
tinue with Section 3.4.3, Creating Line Printer Special

Files.

The same device driver handles all models of the DL11 single line unit. In order for the ULTRIX-11 operating system to properly handle the various models, you need to specify your system's DL11 types during the system generation process. All DL11s are of two possible types, based upon the addresses to which they are assigned. Refer Table 3.2 for the various DL11 models and types.

Table 3.2 Device Names, Types and First Unit Addresses

ULTRIX-11			
Name	Type	1st	Unit Address
k111	DL11-A/B	776500	
dl11	DL11-C/D/E	775610	
k111	DL11-W	776500	
k111	DLV11-A/B	776500	
k111	DLV11-F	776500	
k111	DLV11-J	776500	
dl11	DLV11-E	775610	

NOTE

The second single line unit built into the PDP11/23+, PDP11/24, PDP11/44 and some Micro/PDP-11 systems is a KL11 type.

If you have a mixture of KL11s and DL11s, then the lowest tty line numbers you assign to the DL11 units represents the KL11s. The highest tty line numbers represent the DL11 types.

In the previous example containing the line "msf dl11 3 tty24," let us assume that one of the three specified DL11 units is a KL11 and the other two are DL11s. In this case, line tty24 represents the KL11 and lines tty25 and tty26 represent the DL11s.

During system generation, you indicate that you have one KL11 communications controller and two DL11 communications controllers.

3.4.3. Creating Line Printer Special Files

If your system has a line printer controlled by a parallel line printer interface, such as an LP11, create its special file with this command sequence:

```
# cd /dev
# msf lp11 0
# cd /
# sync
```

3.4.4. Creating Communications Lines as Printer Ports

You can use communications lines as printer ports for adding printers to your system. To set up a communications line as a printer port, type:

```
# cd /
# chmod 700 /dev/ttynn
# chog daemon /dev/ttynn
# /etc/mount -a
# mkdir /usr/spool/lpdx
# chmod 755 /usr/spool/lpdx
# chog daemon /usr/spool/lpdx
# ln /usr/lib/ulf /usr/lib/lpx
# sync
# /etc/umount -a
```

ttynn is the terminal number assigned to the printer port. Once assigned to a printer port, this terminal line is dedicated to the printer and can no longer be used to log in to the system.

You must change the mode of the entry for this terminal line in the /etc/ttys file to nologins. You do this later in Section 3.10.2, Modifying the /etc/ttys File.

x can be any number, but by convention it represents the number of the printer. For example, if you are configuring a second printer into your system, you should define x as 2.

For each printer port you add to your system, the names for its spooling directory, output filter, and printer must all have the same value for x.

lpd_x is the name of the spooling directory for the printer. Each printer maintains its own separate spooling directory. The directory /usr/spool/lpd is the spooling directory for the main line printer, generally accessible through /dev/lp. You name all other spooling directories after the number of the printer. For example, the spooling directory for printer

P2 is /usr/spool/lpd2. The jobs for printer P2 are queued in this spooling directory.

lpx is the output filter name linked to /usr/lib/ulf. For example, printer P2 uses the output filter /usr/lib/lp2. The filter program /usr/lib/ulf checks to see by what name it was called, and then looks for the appropriate printer entry in /etc/printcap.

If the number of the printer does not match the output filter name, errors result. For example, specifying the output filter /usr/lib/lp2 for the third printer incorrectly sets up printer P3 according to the specifications given for printer P2. In addition, directly invoking the filter /usr/lib/ulf causes an error because the filter program mistakenly searches for the non-existent entry "ulf" in the printer description file (/etc/printcap).

Now edit the printer description file /etc/printcap to include an entry for the printer. The /etc/printcap file must contain a printer type entry for each printer connected to the system. It already contains an entry for lp, the default printer.

Here is a sample of various printcap entries:

```
lp0|lp|0>Main printer - LP11 type interface:\n  :lp=/dev/lp:du#1:sd=/usr/spool/lpd:mx#5000:\n  :lf=/usr/adm/lp.err:\nlp1|1|LA100 printer:\n  :dn=/usr/lib/lpd:lp=/dev/tty00:\n  :sd=/usr/spool/lpd1:sh:br#4800:fc#077777:\n  :fs#06020:of=/usr/lib/lp1:\nlp2|2|LA50 printer:\n  :dn=/usr/lib/lpd:lp=/dev/tty05:\n  :sd=/usr/spool/lpd2:br#4800:fc#077777:\n  :fs#016620:of=/usr/lib/lp2:lf=/usr/adm/lp2.err:\nlp3|3|LA180 DECWRITER III:\n  :lp=/dev/ttyh0:br#1200:fc#077777:fs#06320:\n  :of=/usr/lib/lp3:sd=/usr/spool/lpd3:
```

For example, to add a second printer to a system that replaces tty05 and is known as printer P2, type:

```

# cd /
# chmod 700 /dev/tty05
# chog daemon /dev/tty05
# /etc/mount -a
# mkdir /usr/spool/lpd2
# chmod 755 /usr/spool/lpd2
# chog daemon /usr/spool/lpd2
# ln /usr/lib/ulf /usr/lib/lp2
# sync
# /etc/umount -a

```

In this example, the terminal line is tty05 (ttynn). The print jobs for the second printer are queued in the /usr/spool/lpd2 spooling directory.

You need to add an appropriate printcap entry for printer P2 to the /etc/printcap file.

In our example, this command prints files on printer P2 once the system is running in multiuser mode:

```
# lpr -P2 file
```

Refer to printcap in Section 5 of the ULTRIX-11 Programmer's Manual, Volume 1 for a complete description of the printer capability data base.

In addition to editing the /etc/printcap file, you need to set the terminal's mode in the /etc/ttys file to nologins. You do this later in Section 3.10.2, Modifying the /etc/ttys File.

3.5. Naming the System

To name your system, edit the /etc/rc file with the ed text editor. Choose a site name and substitute it for "noname" in the last line of the /etc/rc file.

For example, as distributed the last line in the /etc/rc file reads:

```
hostname noname
```

If you want to name your system site mypdp11, modify the last line of the /etc/rc file so it reads:

```
hostname mypdp11
```

The name you choose must be made up of no more than 32 lowercase alphanumeric characters.

If your system is connecting to a uucp network, then the

first six characters of your site name must be different than any other site name on the network. To verify if your name is unique, ask the site through which you are connecting for a list of existing site names.

3.6. Generating the ULTRIX-11 System

The preconfigured ULTRIX-11 operating system supports only the system disk and console terminal, and no other devices.

The system generation program (sysgen) produces an ULTRIX-11 operating system configured to support your exact system configuration.

To generate the system, you:

1. Complete the work sheet in Appendix G
2. Run the sysgen program
3. Respond to the sysgen prompts
4. Create the new ULTRIX-11 operating system
5. Install and boot the new ULTRIX-11 operating system

The steps below outline the system generation program (sysgen). If you would like more detailed information about the system generation program, read Chapter 2, ULTRIX-11 System Generation, in the ULTRIX-11 System Management Guide.

To aid you during the system generation process, sysgen provides extensive on-line help.

For a sample system generation, refer to the second example in Appendix C, System Generation Examples.

To begin, complete the work sheet in Appendix G. This places all the information required for the installation in one easily accessible place. After completing the worksheet, follow these steps to generate the system:

1. To mount the /usr file system, type:

```
# cd /
# /etc/mount -a
```

2. To go to the configuration directory type:

```
# cd /sys/conf
```

3. To run the sysgen program, type:

```
# sysgen
```

The sysgen program responds by printing these messages:

```
ULTRIX-11 System Generation Program
```

```
For help, type h then press <RETURN>
```

```
sysgen>
```

The sysgen is ready to accept commands.

4. To familiarize yourself with sysgen, type h and read the general help message:

```
sysgen> h
```

5. To print a list of all the ULTRIX-11 supported devices type:

```
sysgen> d
```

6. To create the ULTRIX-11 configuration file, type the help command for create:

```
sysgen> h c
```

Next, start the system generation dialogue by typing:

```
sysgen> c
```

Answer each sysgen prompt, using the system generation example in Appendix C as a guide. If you are unsure of the response, type a question mark (?) for on-line help.

If you want to change an answer, press <CTRL/D> to move back to the previous major question.

The sysgen program displays the default response in angle brackets (<>). Press <RETURN> to accept the default. When sysgen displays more than one response in angle brackets <> or parentheses () it is giving you possible responses to the question.

When sysgen returns this prompt, you have finished creating the configuration file:

ULTRIX-11 System Generation Program

For help, type h then press <RETURN>

sysgen>

7. To review your answers, type:

sysgen> p

The sysgen program prompts you for the name of your kernel configuration. Type the configuration name and press <RETURN>. The sysgen program then prints all of your responses.

Verify your answers. If you need to change a response, recreate the system generation using the c command as described in step 6.

8. Make the new ULTRIX-11 operating system kernel.

Up to this point you have entered responses into the configuration file. The kernel does not yet exist. Create the kernel with the make command by typing:

sysgen> m

The sysgen program prompts you for the name of your kernel configuration file. Type the configuration name and press <RETURN>. The sysgen program starts building the new ULTRIX-11 operating system. The m command generates a large number of messages. Ignore all messages except the last one, which tells you that the system generation was successful.

See Example 2 in Appendix C, System Generation Examples, for a sample dialogue.

9. Exit the sysgen program.

Complete the system generation phase by pressing <CTRL/D>:

sysgen> <CTRL/D>

#

The # prompt redisplays, and the system generation is complete.

3.7. Installing the New ULTRIX-11 Operating System

Install the new ULTRIX-11 operating system using these steps:

1. Save the preconfigured ULTRIX-11 system.

To save the preconfigured ULTRIX-11 system for backup purposes, type:

```
# cd /sys/conf  
# mv /unix /ounix
```

2. Move the new operating system to the root directory.

To move the new operating system into the root directory and name the new operating system unix, type:

```
# mv kernel.os /unix
```

kernel is the configuration name that you assigned your kernel when you generated the system. For example, if you named your kernel configuration testunix, type:

```
# mv testunix.os /unix
```

The default value for kernel.os is unix.os.

3. Change the mode of /unix.

To change the mode of /unix, type:

```
# chmod 644 /unix
```

4. Shut down the system.

Type these commands:

```
# cd /  
# /etc/umount -a  
# sync
```

Then halt your processor.

NOTE

These commands for shutting down the system are for the installation procedure only. Do not use them to shut down the ULTRIX-11 system during normal multiuser operation. Refer to Chapter 5, ULTRIX-11 Operation Services, in the ULTRIX-11 System Management Guide for the proper shutdown procedure.

5. Boot the new ULTRIX-11 operating system.

Be sure your processor's HALT switch is released. Then bootstrap the system disk (drive 0).

The boot program prints these messages while loading the operating system:

Sizing Memory...

Boot: rl(0,0)unix (<CTRL/C> will abort auto-boot)

Once loaded, the operating system starts running in single-user mode and prints these start-up messages:

ULTRIX-11 Kernel V2.0

```
realmem = xxxxx
buffers = yyyyy
usermem = zzzzz
erase = delete, kill = ^U, intr = ^C
#
```

The realmem message (xxxxx) displays the entire size of memory in bytes. The buffers message (yyyyy) displays the total amount of memory occupied by the system's I/O buffer cache. The usermem message (zzzzz) displays the amount of free memory in bytes; that is, the realmem minus the number of bytes used by the buffer cache in the ULTRIX-11 operating system.

Erase deletes individual characters, kill removes an entire line of input, and intr (interrupt) interrupts a program. The system reminds you that it has changed these control characters from the standard UNIX V7 characters (where erase = #, kill = @, intr = delete).

is the ULTRIX-11 superuser prompt, indicating that the operating system is up and running in single-user mode.

6. Set the date and time.

Type the date and time in this format:

date yyymmddhhmm.ss

yy equals the last two digits of the year (00-99)
mm equals the number of the month of the year (01-12)
dd equals the number of the day of the month (01-31)
hh equals the hour of the day based on 24 hours (00-23)
mm equals the minutes of the hour (00-59)
ss equals the seconds of the minute (00-59)
The entry of seconds is optional.

For example, to set the date and time to 6:30 PM on August 28, 1984, type:

```
# date 8408281830
```

3.8. Checking the ULTRIX-11 File System

To make sure all the ULTRIX-11 files are properly loaded on the system disk, run the file consistency check program fsck.

Type these commands:

```
# cd /  
# sync  
# fsck
```

The fsck program checks the file systems and prints the number of files, the number of blocks used, and the number of free blocks on each of the file systems.

If an error occurs, fsck prints a message describing the error and asks if it should make the necessary repairs. If you answer yes to the repair prompt, fsck attempts to fix the problem. If fsck makes any repairs, it prints this message:

```
***** FILE SYSTEM WAS MODIFIED *****
```

The fsck program must run without errors. If an error does occur, the system disk media may be defective, or you may have made an error in loading ULTRIX-11, or there may be a

hardware fault that does not allow ULTRIX-11 to be loaded properly. For media faults, read Section 1.2.3, Disk Media Qualification.

3.9. ULTRIX-11 Installation Verification

Now you can verify the installation with the ULTRIX-11 system acceptance test (usat) facility.

The /usr file system must be mounted before you run any tests with usat. To mount the /usr file system, type:

```
# cd /
# /etc/mount -a
```

To obtain a list of the ULTRIX-11 commands that usat can test, type:

```
# usat help
```

To test all commands and features, type:

```
# usat all      (this takes from 7 to 25 minutes,
                  depending on the processor)
```

You can redirect the usat program's output to a log file by typing:

```
# usat all >usat.log
```

During usat testing you will see a number of messages on the terminal. The usat installation verification was successful if the last message is:

```
NO ERRORS DETECTED
```

When you have finished the usat installation verification, unmount the /usr file system by typing:

```
# cd /
# /etc/umount -a
```

If the installation verification fails, follow these steps:

1. Run usat again on the file that failed.
2. If the verification fails again, review your installation procedure. Be sure you followed each step correctly.
3. If you installed the system correctly and the error persists, call the Digital Telephone Support Center.

3.10. Making the ULTRIX-11 System Available to Users

The ULTRIX-11 operating system installation is complete, but you must perform some administrative tasks before you make the system available to users.

Except for modifying user terminal entries in the /etc/ttys file, all of these administrative tasks require you to edit text files, using the basic ULTRIX-11 text editor ed. See Appendix H, The ed Command Summary Sheet, for information on this editor.

These sections cover the basic approach to setting up your system:

- Storing User Files
- Modifying the /etc/ttys File
- Creating the User Accounts
- Connecting to Remote Systems

3.10.1. Storing User Files

Allocating user file storage depends on the number and type of disks on your system.

If your system has only a single RL02 disk, then user files must be stored in the root or /usr file systems. In this case, omit this step and continue with Section 3.10.2, Modifying the /etc/ttys File.

The ULTRIX-11 operating system partitions each physical disk unit into logical subunits, a number of which the operating system uses. The number depends upon the type of disk. The remaining subunits are available for user file storage.

To allocate disk space for user file storage follow these steps:

1. Select an available disk partition (subunit).
2. Create a file system on the disk subunit.
3. Create a user file directory.
4. Edit the file system table (/etc/fstab).

Use the example below as a guide to create your user file systems. The example assumes that the system disk is RL02 drive 0 and that drive 1 is available for user file storage. The actual procedure varies, depending on the number and type of disks on your system.

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1. Select available disk partitions.

The operating system uses all of the partitions on RL02 drive (unit) 0. NEVER attempt to create user file systems on these partitions.

Refer to Appendix D, Disk Logical Partition Sizes, in the ULTRIX-11 System Management Guide for the RL02 disk partition layout. All of drive 1 is available for user file storage.

The RL02 disk has three partitions: 0, which covers the first half of the disk; 1, which covers the second half; and 7, which covers the entire disk. These three partitions allow you to create a single file system for the entire disk, or two smaller file systems, each covering half of the disk.

In this example, you create one user file system on the RL02 in drive 1.

2. Mount a blank RL02 pack into drive 1.
3. Create an empty file system on the disk partition.

You create the file system with the make file system command mkfs:

```
/etc/mkfs /dev/rnameUn size disk cpu fsname volname
```

name is the ULTRIX-11 2-character logical disk name as shown:

<u>Generic Name</u>	<u>ULTRIX-11 Name</u>
KLESI-RC25	rc
1st RH11/RH70-RM02/3/5, RP04/5/6, ML11	hp
2nd RH11/RH70-RM02/3/5, RP04/5/6, ML11	hm
3rd RH11/RH70-RM02/3/5, RP04/5/6, ML11	hj
RH11/RH70-RS03/4	hs
RK11-RK05	rk
RK611-RK06/7	hk
RL11-RL01/2	rl
RP11-RP02/3	rp
RQDX1-RD51/RD52	rd
RQDX1/RUX1-RX50	rx
RX211-RX02	hx
UDA50-RA60/RA80/RA81	ra

U is the disk unit number.

n is the disk partition number.

size is the size of the partition in blocks. Refer to Appendix D, Disk Logical Partition Sizes, in the ULTRIX-11 System Management Guide for partition sizes.

disk is the generic name of the disk.

cpu is the last two digits of the processor type, such as 23, 24, 34, 40, 44, 45, 55, 60, 70 or 73.

fsname is the file system name recorded in the super block. It can be no more than six characters in length.

volname is the volume name label recorded in the super block. It can be no more than six characters in length.

For example, to create a file system on RL02 drive 1 with a PDP11/23 processor, type:

```
# /etc/mkfs /dev/r1l17 20480 r102 23 user users
```

4. Create a user file directory.

The commands below create the user file directory. In this example the directory name is user. You may use any name that does not already exist.

```
# cd /
# mkdir user
# chmod 755 user
```

If you have more than one user file system, you must create a user directory for each file system.

NOTE

The user file system must be logically mounted on the user directory before you can actually store files in the file system. Do not mount the user file system at this time. However, the command sequence is:

```
# cd /
# /etc/mount /dev/r1l17 /user
```

The user file system is mounted when you install the user accounts.

5. Edit the file system table (*/etc/fstab*).

Use ed to append this line to the end of the */etc/fstab* file:

```
/dev/r117:/user:rw
```

Adding the r117 entry to the table makes it known to all system commands that deal with file systems.

This entry also causes the r117 file system to be mounted on /user automatically each time the system enters multiuser mode.

The r117 (user) file system is available for user file storage when the system goes to multiuser mode.

For further details on user file storage see Section 4.6, Setting Up User File Systems, in the ULTRIX-11 System Management Guide.

3.10.2. Modifying the */etc/ttys* File
(Enabling User Terminals)

Each terminal entry in the */etc/ttys* file controls the characteristics of a specific terminal. The */etc/ttys* file entry also controls the mode of each terminal.

A terminal can be in one of four modes:

disabled Disables the terminal

remote Enables a remote (dial-up) terminal

local Enables a local terminal

nologins Enables a local terminal but does not allow users to log in

As distributed, all terminal entries are in the disabled mode. You should modify all entries for active hardwired terminals so they are in local mode. You should modify all entries for dial-up terminals so they are in remote mode. You should also modify all entries for printer ports (lpr), and tip and uucp dial-out lines so they are in nologins mode.

Finally, you should remove all entries for terminals that your system does not have.

You modify a terminal's characteristics by modifying its entry in the */etc/ttys* file, using the terminal enabling editor, ted. To modify the */etc/ttys* file, type:

```
# ted
```

The ted program has an on-line help facility to help you modify user terminals.

In single-user mode, ted modifies only the entries in the /etc/ttys file. The terminal characteristics are not changed until the system enters multiuser mode.

In multiuser mode, ted modifies the terminal characteristics interactively.

See Section 4.7.5, Editing the /etc/ttys File, in the ULTRIX-11 System Management Guide for further information on modifying user terminal characteristics.

3.10.3. Editing the Terminal Type File

The terminal type file /etc/ttytype identifies the terminal type to system programs, such as vi. Entries in this file have this format:

```
type      ttynn
```

type is the type of terminal you have, for example:

```
vt100      tty00
```

To see a listing of the existing terminal type file, type:

```
# cat /etc/ttytype
```

Use the ed text editor to modify entries in the /etc/ttytype file.

If your system console is a CRT (video terminal) then you must modify the first line of the /etc/ttytype file so it correctly identifies your console. For example, if your system console is a VT100, edit the first line of the /etc/ttytype file so it reads:

```
vt100      console
```

For more information on editing the /etc/ttytype file see Section 4.7.4, Editing the /etc/ttytype File, in the ULTRIX-11 System Management Guide.

3.10.4. Creating the User Accounts

To create new user accounts edit the /etc/passwd file. Each line in this file describes one user account, in the form:

```
name:passwd:user-ID:group-ID:real-name:directory:shell
```

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name is the user's login name. It can have a maximum of eight lowercase characters.

passwd is the user's encrypted password. When you create the user's entry in the /etc/passwd file, leave this field blank.

user-ID is a unique user-identification number.

group-ID is a common group-identification number. It groups together several users who are working on a common project so they can share files.

real-name is the user's real name, such as Jane Doe.

directory is the pathname of the user's home directory. This is where the user resides.

shell specifies the user's shell program. If this entry is blank then the Bourne shell is the default.

Here are the steps to create a demonstration account and two user accounts:

1. Edit the /etc/passwd file.

Using ed, add these lines to the /etc/passwd file. Make sure that the new entries do not conflict with any existing entries.

```
demo::10:20:demonstration account:/usr/demo:  
jad::20:30:Jane Anne Doe:/user/jad:/bin/csh  
smith::21:30:John W. Smith:/user smith:/bin/csh
```

Note that the demo account is in a separate home directory and uses the Bourne shell, and that the jad and smith accounts have the same parent directory and use the C shell.

2. Mount the user file systems.

Mount the file systems where the user's home directories will be located:

```
# cd /  
# /etc/mount -a
```

The -a option to the mount command specifies that all file systems in the /etc/fstab file be mounted.

3. Set up the home directories.

Create the home directories and change the owners to the

new users:

```
# cd /usr
# mkdir demo
# chog demo demo
# cd /user
# mkdir jad smith
# chog jad jad
# chog smith smith
```

4. Unmount the user file systems.

To unmount the user file systems, type:

```
# cd /
# /etc/umount -a
```

5. Create start-up files for each account.

Refer to Chapter 6, Completing the Installation, for details on multiuser mode, logging in and out, and passwords.

After you create the new accounts, bring the ULTRIX-11 system up to multiuser mode.

Log in to each account and create the user's start-up files. If the user has the Bourne shell (/bin/sh), then create a .profile file in the home directory. If the user has the C shell (/bin/csh), create a .login and a .cshrc file in the home directory.

These files contain a list of commands that the shell program executes each time the user logs in to the system. For further information about these start-up files, read the Introduction to the C Shell and Introduction to the UNIX Shell, in the ULTRIX-11 Programmer's Manual, Volume 2A and refer to csh and sh in Section 1 of the ULTRIX-11 Programmer's Manual, Volume 1.

Enter each new user's password into the /etc/passwd file by executing the passwd command.

3.10.5. Connecting to Remote Systems

You can access remote systems with the ULTRIX-11 tip facility. Refer to Section 4.9, Setting Up tip Connections, in the ULTRIX-11 System Management Guide for instructions.

If your system will participate in the UNIX users network (sometimes called USENET), refer to the UUCP Installation and Administration Guide in the ULTRIX-11 Programmer's Manual, Volume 2B for instructions on how to set up uucp.

Chapter 4

Installing ULTRIX-11 Software from RC25 Disk

This chapter describes the installation procedure for the ULTRIX-11 operating system from the RC25 disk distribution kit.

4.1. RC25 Disk Installation Overview

This section of the RC25 disk installation consists of these steps:

- Initializing the system disk (RC25 fixed unit 1) and loading the /usr and root file systems from the distribution media
- Executing the automatic installation procedure
- Generating the ULTRIX-11 operating system
- Verifying the installation
- Making the ULTRIX-11 system available to users

First, you initialize the system disk (fixed RC25, unit 1), and then you load the root and /usr file systems from the distribution media onto your system disk.

Next, you bootstrap your system disk and initialize the operating system. The automatic installation procedure helps you with this.

Finally, you generate and install an ULTRIX-11 kernel that supports your system processor and all the system devices. This kernel is the basic memory resident portion of the operating system that supports system calls, maintains the file system, and deals directly with the processor and peripheral devices.

After verifying that the installation was successful, you

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perform various administrative tasks to make the system available for other users.

The rest of this chapter describes how to perform these steps.

4.2. Loading root and /usr from the RC25 Distribution Media

This section describes how to load the root and /usr file systems from the RC25 distribution cartridge onto your system disk.

The RC25 disk consists of two units driven by the same motor. Unit 0 (or the even-numbered unit, if there is more than one RC25 disk) is the removable cartridge on the top of the RC25, and unit 1 (or the odd-numbered unit, if there are more than one RC25 disks) is the fixed disk on the bottom.

Your system disk is unit 1, but you must always have a removable cartridge mounted in unit 0 before you run the ULTRIX-11 system. This is because the disk drive does not spin up without a cartridge in unit 0. Therefore, you must use the opser program to shut down the system to single-user mode before you can change the removable cartridge.

Follow these steps to initialize the system disk and then load the root and /usr file systems:

1. Mount disk media.

Mount the distribution cartridge into RC25 unit 0 (the removable cartridge), and write protect it by pressing the Write Protect Removable switch. Press the RUN switch and wait for it to stop flashing (glow steadily).

Do not write protect drive 1.

2. Bootstrap RC25 unit 0. Read all of the instructions in this step before continuing.

Use your hardware bootstrap to boot RC25 unit 0.

The boot program prints these messages on the terminal:

Sizing Memory...

Boot: rc(0,0)unix (<CTRL/C> will abort auto-boot)

As soon as this message appears, interrupt the automatic boot by pressing <CTRL/C>.

The boot program cancels the automatic boot and prints:

To list options, type help then press <RETURN>

Boot:

There may be a delay of several seconds between the time you press <CTRL/C> and the appearance of the Boot: prompt.

NOTE

If you wait too long to press <CTRL/C>, the operating system loads into memory and begins printing several messages. In this case, halt the processor and repeat this step from the beginning.

If any of your system devices are not at the standard Control and Status Register (CSR) addresses, use the help option and then the csr option in response to the boot prompt. For further information on the csr option, see Section 3.7.3, CSR Address Option, in the ULTRIX-11 System Management Guide.

3. Load the MSCP disk initialization program (rabads).

To load the stand-alone MSCP disk initialization program, type:

Boot: rc(0,0)/sas/rabads

After successfully loading, the rabads program prints this message:

ULTRIX-11 MSCP Disk Initialization Program

4. Initialize the fixed RC25 disk.

To use the rabads program to initialize your fixed RC25 disk (unit 1), type:

rabads < help exit drives status table init replace >: i

Disk type < ra60 ra80 ra81 rx50 rd51 rd52 rc25 >: rc25

Unit number < 0-7 >: 1

Starting block number < 0 >: 0

Number of blocks to check < 50902 >: 50902

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```
Rewrite blocks written with "forced error" (? for help)
< y or n > ? y
```

```
READING...           (this takes a few minutes)
```

```
50902 blocks checked
0 bad blocks found
0 bad blocks replaced
```

```
rabads < help exit drives status table init replace >: e
Exit called
```

Boot:

The number of bad blocks found must equal the number of bad blocks replaced. If it does not, then you cannot use that disk as the system disk. Repeated failures may indicate a problem with your system disk hardware. In this event, contact your Digital Equipment Corporation field service representative.

5. Load the stand-alone copy program.

To load the stand-alone copy program, type:

```
Boot: rc(0,0)/sas/copy
```

After successfully loading, the copy program prints this message:

```
ULTRIX-11 Stand-alone Copy Program
```

Input File:

6. Load the root and /usr file systems onto the system disk.

To load the root and /usr file systems from the RC25 cartridge (unit 0) to your system disk (unit 1) type these commands to the stand-alone copy program:

```
Input File: rc(0,0)
Output File: rc(1,0)
Record Size <16384 MAX> : 10240
Number of Records: 1400
Ready to copy rc(0,0) to rc(1,0) <y or n> ? y
:
        (this takes a few minutes)
.
Copy complete
More files to copy <y or n> ? n
Exit called
Boot:
```

The RC25 disk, unit 1 is your new system disk.

If you are not using the optional files, remove the distribution RC25 cartridge from unit 0 and store it in a safe place for backup purposes. Then, insert a blank RC25 cartridge into unit 0 and press the RUN switch. Write enable unit 0 (the removable cartridge) by releasing the Write Protect Removable switch.

Because you always write protect unit 0 whenever you mount the distribution cartridge, there is no need to copy the optional files onto another disk. To load the optional files onto the system, however, refer to Appendix E, Loading Optional Software.

You are now ready to install the ULTRIX-11 system.

4.3. The Automatic Installation Procedure

After the RC25 disk boots, you are in the automatic installation procedure, and you should have the Boot: prompt from the previous step. If you do not have the Boot: prompt, repeat step 2 in Section 4.2, Loading root and /usr from the RC25 Distribution Media, except boot unit 1.

Follow these steps:

1. Boot the system disk.

Bootstrap the system disk (RC25, unit 1):

Boot: rc(1,0)unix (<CTRL/C> aborts auto-boot)

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Once loaded, the operating system runs in single-user mode and prints these messages:

```
ULTRIX-11 Kernel V2.0

realmem = xxxxx
buffers = yyyyy
usermem = zzzzz
erase = delete, kill = ^U, intr = ^C
```

The realmem message (xxxxx) displays the entire size of memory in bytes. The buffers message (yyyyy) displays the total amount of memory occupied by the system's I/O buffer cache. The usermem message (zzzzz) displays the amount of free memory in bytes; that is, the realmem minus the number of bytes used by the buffer cache in the ULTRIX-11 operating system.

Erase deletes individual characters, kill removes an entire line of input, and intr (interrupt) interrupts a program. The system displays this message to remind you that it has changed these control characters from the standard UNIX V7 characters (where erase = #, kill = @, intr = delete).

The initial setup program (setup) starts running automatically.

2. The automatic installation procedure.

The setup program prints some initial messages and a display of your system disk and processor types. It asks you to confirm that this information is correct.

The setup program then prompts you for the date and time. After you type the current date and time, the automatic installation procedure begins.

If an error occurs, the automatic installation prints instructions on how to recover from the error or where to get help if you cannot recover.

When the system prints the message shown below, the automatic installation portion is complete.

```
***** ULTRIX-11 INITIAL SETUP COMPLETED *****
```

4.4. Creating the Device-Dependent Special Files

To be accessible by the ULTRIX-11 operating system, each device must have special files in the /dev directory. Use the make special files command (msf) to create the device special files. The generic command sequence is:

```
# cd /dev  
# msf device n  
# cd /  
# sync
```

device is the generic device name, such as r102, rk07, ra60, ts11 or tm03.

n is the unit number of the device.

The following sections on creating device special files all refer to this command sequence format.

NOTE

If you have one or more MASSBUS disk controllers (RH11/RH70) and/or one or more MSCP disk controllers (UDA50, KLESI, RQDX1, RUX1), omit this section and follow the instructions given in Appendix I, Multiple MASSBUS/MSCP Disk Controllers.

NOTE

If you create a special file for an ML11 device, two special files are automatically created for each unit:

/dev/mln
/dev/rmln

n is the unit number of the ML11 device.

See Section 2.6.1, Support Files for Disks, in the ULTRIX-11 System Management Guide for further information.

4.4.1. Creating Disk and Tape Special Files

The setup program already created the special files for your system disk (RC25 drive, units 0 and 1) during the automatic installation procedure. If your system does not have any other disk or tape drives, omit this step and continue with Section 4.4.2, Creating Special Files for Communications Devices.

Use the msf command to create the special files for all disk and tape drives other than the system disk.

Here is a sample command sequence to create the disk and tape special files for a large PDP-11 system. Modify this sequence to correspond with your system:

```
# cd /dev
# msf tu77 0      (first tape drive, unit 0)
# msf te16 1      (second tape drive, unit 1)
# msf rp06 0      (RP06 on first RH controller, unit 0)
# msf rm03 1      (RM03 on first RH controller, unit 1)
# msf ml11 2      (ML11 on first RH controller, unit 2)
# msf ra60 0      (RA60 disk on 1st MSCP controller, unit 0)
# msf ra81 1      (RA81 disk on 1st MSCP controller, unit 1)
# msf rl02 0      (first RL02 disk, unit 0)
# msf rl02 1      (second RL02 disk, unit 1)
# cd /
# sync
```

If you have an RQDX1 controller with an RX50, RD51, or RD52 drive, see Section 5.1.1, RD51, RD52 & RX50 Unit Numbering.

4.4.2. Creating Special Files for Communications Devices

Communications special files let you use other terminals in addition to the console terminal. The terminals have names in the form `/dev/ttynn`, where `nn` is the unique number assigned to each line.

To set up the special files for your system configuration, you must know what type of communications controllers you have, how many of each type, and how many lines each controller can handle.

Table 4.1 describes the various communications controllers supported by the ULTRIX-11 system, how many lines each can handle, and the ULTRIX-11 name of each type.

Table 4.1 ULTRIX-11 Supported Communications Controllers

<u>Controller</u>	<u>Lines/Unit</u>	<u>ULTRIX-11 Name</u>
DLV11-A/B	1	k111
DLV11-F	1	k111
DLV11-E	1	d111
DLV11-J	4	k111
DZV11	4	dzv11
DZQ11	4	dzq11
DHV11	8	dhv11
DL11-A/B	1	k111
DL11-C/D/E	1	d111
DL11-W	1	k111
DZ11	8	dz11
DH11	16	dh11
DHU11	16	dhu11

NOTES

The DZ11-E and DZ11-F models consist of two DZ11s (a total of 16 lines), and should be viewed as two DZ11 units.

The DLV11-J is the equivalent of four DLV11s and should be viewed as four DLV11s.

Although the console terminal is on a DL11/DLV11-type line, its special file (/dev/console) already exists. Do not include it in your count of DL11/DLV11-type controllers. For example, if the last line of your DLV11-J is used as the console you would count the DLV11-J as three DLV11-type controllers instead of four.

The second single line unit (SLU) built into some PDP-11 processors should be counted as a DL11/DLV11-type controller. The PDP-11/23+, PDP-11/24, PDP-11/44, and the PDP-11/23+ version of the Micro/PDP-11 have this extra line.

During system generation, you need to differentiate between a k111 and a d111. At this point, however, group all k111s and d111s together and specify them as d111s.

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file names, such as tty00 or tty23. To assign these names to the lines of your communications controllers, you must specify the type of controller, the controller's unit number, and the first line number to use for that controller.

To remove any existing communications device special files, type this command sequence:

```
# cd /dev  
# make ttyclean  
.  
.: (make prints several messages)  
. 
```

Use a variation of the msf command to create the communications device special files. The format is:

```
# msf device n ttynn
```

device is the communications device's ULTRIX-11 name, such as kl11, dz11, or dhv11.

n is the number of units for dl11 or kl11 controllers. It is the unit number for all other communications controllers.

ttynn is the first tty line to be assigned to that controller.

Assign tty00 as the line for the first communications controller on your system. For subsequent controllers, assign lines at the next available tty number.

For example, to create the special files for a system with one DH11, one DZ11, and three DL11 communications controllers, type:

```
# cd /dev  
# msf dh11 0 tty00  
# msf dz11 0 tty16  
# msf dl11 3 tty24  
# cd /  
# sync
```

In this example, the first msf command assigns the 16 lines on DH11, unit 0 (DH11 lines 0-15) to tty00-tty15.

The second msf command assigns the eight lines on DZ11, unit 0 (DZ11 lines 0-7) to the next available tty lines (tty16-tty23).

The last msf command assigns the three dl11 single line

units to the next available tty lines (tty24-tty26).

NOTE

All KL11 and DL11 type controllers must be grouped together and assigned to contiguous tty lines by a single execution of the msf command.

If your communications controller configuration consists of any single line units other than the console, you need to determine exactly what types these are. If the only single line unit you have is the console, continue with Section 4.4.3, Creating Line Printer Special Files.

The same device driver handles all models of the DL11 single line unit. For the ULTRIX-11 operating system to handle the various models properly, you need to specify your system's DL11 types during the system generation process. All DL11s are of two possible types, based upon the addresses to which they are assigned. Refer to Table 4.2 for the various DL11 models and types.

Table 4.2 Device Names, Types and First Unit Addresses

ULTRIX-11			
<u>Name</u>	<u>Type</u>	<u>1st</u>	<u>Unit Address</u>
kl11	DL11-A/B	776500	
dl11	DL11-C/D/E	775610	
kl11	DL11-W	776500	
kl11	DLV11-A/B	776500	
kl11	DLV11-F	776500	
kl11	DLV11-J	776500	
dl11	DLV11-E	775610	

NOTE

The second single line unit built into the PDP-11/23+, PDP-11/24, PDP-11/44 and some Micro/PDP-11 systems is a KL11 type.

If you have a mixture of KL11s and DL11s, then the lowest tty line numbers you assign to the DL11 units represents the KL11s. The highest tty line numbers represent the DL11 types.

In the previous example containing the line "msf dl11 3 tty24," let us assume that one of the three specified DL11 units is a KL11 and the other two are DL11s. In this case, line tty24 represents the KL11 and lines tty25 and tty26 represent the DL11s.

During system generation, you indicate that you have one KL11 communications controller and two DL11 communications controllers.

4.4.3. Creating Line Printer Special Files

If your system has a line printer controlled by a parallel line printer interface, such as an LP11, then create its special file with this command sequence:

```
# cd /dev
# msf lp11 0
# cd /
# sync
```

4.4.4. Creating Communications Lines as Printer Ports

You can use communications lines as printer ports for adding printers to your system. To set up a communication line as a printer port, type:

```
# cd /
# chmod 700 /dev/ttynn
# chog daemon /dev/ttynn
# /etc/mount -a
# mkdir /usr/spool/lpd
# chmod 755 /usr/spool/lpd
# chog daemon /usr/spool/lpd
# ln /usr/lib/ulf /usr/lib/lpx
# sync
# /etc/umount -a
```

ttynn is the terminal number assigned to the printer port. Once assigned to a printer port, this terminal line is dedicated to the printer and can no longer be used to log in to the system.

You must change the mode of the entry for this terminal line in the /etc/ttys file to nologins. You do this in Section 4.10.2, Modifying the /etc/ttys File.

x can be any number, but by convention it represents the number of the printer. For example, if you are configuring a second printer into your system, you should define x

as 2.

For each printer port you add to your system, the names for its spooling directory, output filter, and printer must all have the same value for x.

lpdx is the name of the spooling directory for the printer. Each printer maintains its own separate spooling directory. The directory /usr/spool/lpd is the spooling directory for the main line printer, generally accessible through /dev/lp. You name all other spooling directories after the number of the printer. For example, the spooling directory for printer P2 is /usr/spool/lpd2. The jobs for printer P2 are queued in this spooling directory.

lpx is the output filter name linked to /usr/lib/ulf. For example, printer P2 uses the output filter /usr/lib/lp2. The filter program /usr/lib/ulf checks to see by what name it was called, and then looks for the appropriate printer entry in /etc/printcap.

If the number of the printer does not match the output filter name, errors result. For example, specifying the output filter /usr/lib/lp2 for the third printer incorrectly sets up printer P3 according to the specifications given for printer P2. In addition, directly invoking the filter /usr/lib/ulf causes an error because the filter program mistakenly searches for the nonexistent entry "ulf" in the printer description file (/etc/printcap).

Now edit the printer description file /etc/printcap to include an entry for the printer. The /etc/printcap file must contain a printer type entry for each printer connected to the system. It already contains an entry for lp, the default printer.

Here is a sample of various printcap entries:

```
lp0|lp|0>Main printer - LP11 type interface:\n  :lp=/dev/lp:du#1:sd=/usr/spool/lpd:mx#5000:\n  :lf=/usr/adm/lp.err:\nlp1|1|LA100 printer:\n  :dn=/usr/lib/lpd:lp=/dev/tty00:\n  :sd=/usr/spool/lpd1:sh:br#4800:fc#077777:\n  :fs#06020:of=/usr/lib/lp1:\nlp2|2|LA50 printer:\n  :dn=/usr/lib/lpd:lp=/dev/tty05:\n  :sd=/usr/spool/lpd2:br#4800:fc#077777:\n
```

```
:fs#016620:of=/usr/lib/lp2:lf=/usr/adm/lp2.err:
lp3|3|LA180 DECWRITER III:\ 
:lp=/dev/ttyh0:br#1200:fc#077777:fs#06320:\ 
:of=/usr/lib/lp3:sd=/usr/spool/lpd3:
```

For example, to add a second printer to a system, replacing tty05 and known as printer P2, type:

```
# cd /
# chmod 700 /dev/tty05
# chog daemon /dev/tty05
# /etc/mount -a
# mkdir /usr/spool/lpd2
# chmod 755 /usr/spool/lpd2
# chog daemon /usr/spool/lpd2
# ln /usr/lib/ulf /usr/lib/lp2
# sync
# /etc/umount -a
```

In this example, the terminal line is tty05 (ttynn). The print jobs for the second printer are queued in the /usr/spool/lpd2 spooling directory.

You need to add an appropriate printcap entry for printer P2 to the /etc/printcap file.

In our example, this command prints files on printer P2 once the system is running in multiuser mode:

```
# lpr -P2 file
```

Refer to printcap in Section 5 of the ULTRIX-11 Programmer's Manual Volume 1 for a complete description of the printer capability data base.

In addition to editing the /etc/printcap file, you need to set the terminal's mode in the /etc/ttys file to nologins. You do this later in Section 4.10.2, Modifying the /etc/ttys File.

4.5. Naming the System

To name your system, edit the /etc/rc file with the ed text editor. Choose a site name and substitute it for "noname" in the third line of the /etc/rc file.

As distributed, the last line in the /etc/rc file reads:

```
hostname noname
```

If you want to name your system site mypdp11, modify the last line of the /etc/rc file so it reads:

```
hostname mypdp11
```

The name you choose must be made up of no more than 32 lowercase alphanumeric characters.

If your system is connecting to a uucp network, then the first six characters of your site name must be different than any other site name on the network. To verify if your name is unique, ask the site through which you are connecting for a list of existing site names.

4.6. Generating the ULTRIX-11 System

The preconfigured ULTRIX-11 operating system supports the system disk and console terminal and no other devices.

The system generation program (sysgen) produces an ULTRIX-11 operating system configured to support your exact system configuration.

To generate the system, you:

1. Complete the work sheet in Appendix G
2. Run the sysgen program
3. Respond to the sysgen prompts
4. Create the new ULTRIX-11 operating system
5. Install and boot the new ULTRIX-11 operating system

The steps below outline the system generation program (sysgen). If you would like more detailed information about the system generation program, read Chapter 2, ULTRIX-11 System Generation, in the ULTRIX-11 System Management Guide.

To aid you during the system generation process, sysgen provides extensive on-line help.

For a sample system generation, refer to the second example in Appendix C, System Generation Examples.

To begin, complete the work sheet in Appendix G. This places all the information required for the installation in one easily accessible place. After completing the work sheet, follow these steps to generate the system:

1. To mount the /usr file system, type:

```
# cd /
# /etc/mount -a
```

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2. To go to the configuration directory, type:

```
# cd /sys/conf
```

3. To run the sysgen program, type:

```
# sysgen
```

The sysgen program responds by printing these messages:

```
ULTRIX-11 System Generation Program
```

```
For help, type h then press <RETURN>
```

```
sysgen>
```

The sysgen program is ready to accept commands.

4. To familiarize yourself with sysgen, type h and read the general help message:

```
sysgen> h
```

5. To print a list of all the ULTRIX-11 supported devices type:

```
sysgen> d
```

6. To create the ULTRIX-11 configuration file first type the help command for create:

```
sysgen> h c
```

Next, start the system generation dialogue by typing:

```
sysgen> c
```

Answer each sysgen prompt, using the second example in Appendix C as a guide. If you are unsure of the response, type a question mark (?) for on-line help.

If you want to change an answer, press <CTRL/D> to move back to the previous major question.

The sysgen program displays the default response to each question in angle brackets (<>). Press <RETURN> to accept the default. When sysgen displays more than one response in angle brackets or parentheses (), it is giving you possible responses to the question.

When sysgen returns this prompt, you have finished

creating the configuration file:

```
ULTRIX-11 System Generation Program  
For help, type h then press <RETURN>  
sysgen>
```

7. To review your answers, type:

```
sysgen> p
```

The sysgen program prompts you for the name of your kernel configuration. Type the configuration name and press <RETURN>. The sysgen program then prints all of your responses.

Verify your answers. If you need to change a response, recreate the system generation using the c command as described in step 6.

8. Make the new ULTRIX-11 operating system kernel.

Up to this point, you have entered responses into the configuration file. The kernel does not yet exist. Create the kernel with the make command by typing:

```
sysgen> m
```

The sysgen program prompts you for the name of your kernel configuration. Type the configuration name and press <RETURN>. The sysgen program starts building the new ULTRIX-11 operating system. The m command generates a large number of messages. Ignore all messages except the last one, which tells you that the system generation was successful.

See Example 2 in Appendix C, System Generation Examples, for a sample dialog.

9. Exit the sysgen program.

Complete the system generation phase by pressing <CTRL/D>:

```
sysgen> <CTRL/D>
```

```
#
```

The # prompt displays again, and the system generation is complete.

4.7. Installing the New ULTRIX-11 Operating System

To install the new ULTRIX-11 operating system, use these steps:

1. Save the preconfigured ULTRIX-11 system.

To save the preconfigured ULTRIX-11 system for backup purposes, type:

```
# cd /sys/conf  
# mv /unix /ounix
```

2. Move the new operating system to the root directory.

To move the new operating system into the root directory and name the new operating system unix, type:

```
# mv kernel.os /unix
```

kernel is the configuration file name that you assigned to your kernel when you generated the system. For example, if you named your configuration file testunix, type:

```
# mv testunix.os /unix
```

The default value for kernel is unix.os.

3. Change the mode of /unix.

To change the mode of /unix, type:

```
# chmod 644 /unix
```

4. Shut down the system.

Type these commands:

```
# cd /  
# /etc/umount -a  
# sync
```

Then halt your processor.

NOTE

These commands for shutting down the system are for the installation procedure only. Do not use them to shut down the ULTRIX-11 system during normal multiuser operation. Refer to Chapter 5, ULTRIX-11 Operator Services, in the ULTRIX-11 System Management Guide for the proper shutdown procedure.

5. Boot the new ULTRIX-11 operating system.

Be sure that the processor's HALT switch is released. Then bootstrap the system disk (RC25, unit 1).

The boot program prints these messages while loading the operating system:

Sizing Memory...

Boot: rc(1,0)unix (<CTRL/C> aborts auto-boot)

Once loaded, the operating system starts running in single-user mode and prints these start-up messages:

ULTRIX-11 Kernel V2.0

```
realmem = xxxxx
buffers = yyyyy
usermem = zzzzz
erase = delete, kill = ^U, intr = ^C
#
```

The realmem message (xxxxx) displays the entire size of memory in bytes. The buffers message (yyyyy) displays the total amount of memory occupied by the system's I/O buffer cache. The usermem message (zzzzz) displays the amount of free memory in bytes; that is, the realmem minus the number of bytes used by buffer cache in the ULTRIX-11 operating system.

Erase deletes individual characters, kill removes an entire line of input, and intr (interrupt) interrupts a program. The system reminds you that it has changed these control characters from the standard UNIX V7 characters (where erase = #, kill = @, intr = delete).

is the ULTRIX-11 superuser prompt, indicating that the operating system is up and running in single-user mode.

6. Set the date and time.

Type the date and time in this format:

date yymmddhhmm.ss

yy equals the last two digits of the year (00-99)

mm equals the number of the month of the year (01-12)

dd equals the number of the day of the month (01-31)

hh equals the hour of the day based on 24 hours (00-23)

mm equals the minutes of the hour (00-59)

ss equals the seconds of the minute (00-59)

The entry of seconds is optional.

For example, to set the date and time to 6:30 PM on August 28, 1984, type:

```
# date 8408281830
```

4.8. Checking the ULTRIX-11 File System

To make sure all the ULTRIX-11 files are properly loaded on the system disk, run the file consistency check program fsck.

Type these commands:

```
# cd /
# sync
# fsck          (this takes a few minutes)
```

The fsck program checks the file systems and prints the number of files, the number of blocks used, and the number of free blocks on each of the file systems.

If an error occurs, fsck prints a message describing the error and asks if it should make the necessary repairs. If you answer yes to the repair prompt, fsck attempts to fix the problem. If fsck makes any repairs, it prints this message:

```
***** FILE SYSTEM WAS MODIFIED *****
```

The fsck program must run without errors. If an error does occur, the system disk media may be defective, or you may have made an error in loading ULTRIX-11, or there may be a

hardware fault that does not allow ULTRIX-11 to be loaded properly. For media faults, read Section 1.2.3, Disk Media Qualification.

4.9. ULTRIX-11 Installation Verification

Now you can verify the installation with the ULTRIX-11 system acceptance test (usat) facility.

The /usr file system must be mounted before you run any tests with usat. To mount the /usr file system, type:

```
# /etc/mount -a
```

To obtain a list of the ULTRIX-11 commands that usat can test, type:

```
# cd /
# usat help
```

To test all commands and features, type:

```
# usat all          (this takes from 7 to 25
                     minutes, depending on
                     the processor)
```

You can redirect the usat program's output to a log file by typing:

```
# usat all >usat.log
```

During usat testing you will see a number of messages on the terminal. The usat installation verification was successful if the last message is:

NO ERRORS DETECTED

When you have finished the usat installation verification, unmount the /usr file system by typing:

```
# cd /
# /etc/umount -a
```

If the installation verification fails, follow these steps:

1. Run usat again on the file that failed.
2. If the verification fails again, review your installation procedure. Be sure you followed each step correctly.
3. If you installed the system correctly and the error persists, call the Digital Telephone Support Center.

4.10. Making the ULTRIX-11 System Available to Users

The ULTRIX-11 operating system installation is complete, but you must perform some administrative tasks before you make the system available to users.

Except for modifying the /etc/ttys file, all of these administrative tasks require you to edit text files, using the basic ULTRIX-11 text editor ed. See Appendix H, The ed Command Summary Sheet, for information on this editor.

These sections cover the basic approach to setting up your system:

- Storing User Files
- Modifying the /etc/ttys File
- Creating the User Accounts
- Connecting to Remote Systems

4.10.1. Storing User Files

Allocating user file storage depends on the number and type of disks on your system.

The ULTRIX-11 operating system partitions each physical disk unit into logical subunits, a number of which the operating system uses. The remaining subunits are available for user file storage.

To allocate disk space for user file storage follow these steps:

1. Select an available disk partition (subunit).
2. Create a file system on the disk subunit.
3. Create a user file directory.
4. Edit the file system table (/etc/fstab).

Use the example below as a guide to create your user file systems. Modify this example to suit your particular system.

1. Select available disk partitions.

The operating system uses the partitions on unit 1 shown in Table 4.3.

Table 4.3 Partitions and Their Use

<u>Partition</u>	<u>Use</u>
0	root
1	swap
2	usr

NEVER attempt to create user file systems on these partitions of the system disk.

To use the rasize command to see the RC25 disk partition layouts, type:

```
# rasize
```

Note that partitions 4, 5, and 6 are not defined and cannot be used for user file storage. You cannot use partition 7 because it overlaps partitions 0,1,2, and 3.

Partition 3 is available, and we use it in this example to create one user file system.

If you have a blank RC25 cartridge (unit 0), you could use partition 7 to create one user file system covering the entire second cartridge, or you could use a combination of the available partitions, watching out for overlap. See Appendix D, Disk Logical Partition Sizes, in the ULTRIX-11 System Management Guide for information on disk partitions.

2. Create an empty file system on the disk partition.

You create the file system with the make file system command mkfs:

```
# /etc/mkfs /dev/rnameUn size disk cpu fsname volname
```

name is the 2-character ULTRIX-11 logical disk name as shown:

<u>Generic Name</u>	<u>ULTRIX-11 Name</u>
KLESI-RC25	
1st RH11/RH70-RM02/3/5, RP04/5/6, ML11	rc
2nd RH11/RH70-RM02/3/5, RP04/5/6, ML11	hp
3rd RH11/RH70-RM02/3/5, RP04/5/6, ML11	hm
RH11/RH70-RS03/4	hj
RK11-RK05	hs
RK611-RK06/7	rk
RL11-RL01/2	hk
RP11-RP02/3	r1
RQDX1-RD51/RD52	rp
RQDX1/RUX1-RX50	rd
RX211-RX02	rx
UDA50-RA60/RA80/RA81	hx
	ra

- U is the disk unit number.
- n is the disk partition number.
- size is the size of the partition in blocks. Refer to Appendix D, Disk Logical Partition Sizes, in the ULTRIX-11 System Management Guide for partition sizes.
- disk is the generic name of the disk.
- cpu is the last two digits of the processor type, such as 23, 24, 34, 40, 44, 45, 55, 60, 70 or 73.
- fsname is the file system name recorded in the super block. It can be no more than six characters in length.
- volname is the volume name label recorded in the super block. It can be no more than six characters in length.

For example, to create a file system on RC25 unit 1 with a PDP-11/73 processor, type:

```
# /etc/mkfs /dev/rrc13 23644 rc25 73 user system
```

3. Create a user file directory.

The commands below create the user file directory. In this example the directory name is user. You may use any name that does not already exist.

```
# cd /
# mkdir user
# chmod 755 user
```

If you have more than one user file system, you must create a user directory for each file system.

NOTE

The user file system must be logically mounted on the user directory before you can actually store files in the file system. Do not mount the user file system at this time. However, the command sequence is:

```
# cd /
# /etc/mount /dev/rc13 /user
```

The user file system is mounted when you install the user accounts.

4. Edit the file system table (/etc/fstab).

Use the ed editor to append this line to the end of the /etc/fstab file:

```
/dev/rc13:/user:rw
```

Adding the rc13 entry to the table makes it known to all system commands that deal with file systems.

This entry also causes the rc13 file system to be mounted on /user automatically each time the system enters multiuser mode.

The rc13 (user) file system is available for user file storage when the system goes to multiuser mode.

For further details on user file storage, see Section 4.6, Setting Up User File Systems, in the ULTRIX-11 System Management Guide.

4.10.2. Modifying the /etc/ttys File (Enabling User Terminals)

Each terminal entry in the /etc/ttys file controls the characteristics of a specific terminal. The /etc/ttys file entry also controls the mode of each terminal.

A terminal can be in one of four modes:

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disabled	Disables a terminal
remote	Enables a remote (dial-up) terminal
local	Enables a local terminal
nologins	Enables a local terminal but does not allow users to log in

As distributed, all terminal entries are in the disabled mode. You should modify all entries for active hardwired terminals so they are in local mode. You should modify all entries for dial-up terminals so they are in remote mode. You should also modify all entries for printer ports (lpr), and tip and uucp dial-out lines so they are in nologins mode.

Finally, you should remove all entries for terminals which your system does not have.

You modify a terminal's characteristics by modifying its entry in the /etc/ttys file, using the terminal enabling editor, ted.

To modify the /etc/ttys file, type:

```
# ted
```

The ted program has an on-line help facility to help you modify the entries.

In single-user mode, ted modifies only the entries in the /etc/ttys file. The terminal characteristics are not changed until the system enters multiuser mode.

In multiuser mode, ted modifies the terminal characteristics interactively.

See Section 4.7.5, Editing the /etc/ttys File, in the ULTRIX-11 System Management Guide for further information about modifying user terminal characteristics.

4.10.3. Editing the Terminal Type File

The terminal type file /etc/ttystype identifies the terminal type to system programs, such as vi. Entries in this file have this format:

<u>type</u>	<u>ttynn</u>
-------------	--------------

For example:

vt100	tty00
-------	-------

To see a listing of the existing terminal type file, type:

```
# cat /etc/ttytype
```

Use the ed text editor to modify entries in the /etc/ttytype file.

If your system console is a CRT (video terminal) then you must modify the first line of the /etc/ttytype file so it correctly identifies your console. For example, if your system console is a VT100, edit the first line of the /etc/ttytype file so it reads:

```
vt100    console
```

For more information on editing the /etc/ttytype file see Section 4.7.4, Editing the /etc/ttytype File, in the ULTRIX-11 System Management Guide.

4.10.4. Creating the User Accounts

To create new user accounts edit the /etc/passwd file. Each line in this file describes one user account, in the form:

name:passwd:user-ID:group-ID:real-name:directory:shell

name is the user's login name. It can have a maximum of eight lowercase characters.

passwd is the user's encrypted password. When you create the user's entry in the /etc/passwd file, leave this field blank.

user-ID is a unique user-identification number.

group-ID is a common group-identification number. It groups together several users who are working on a common project so they can share files.

real-name is the user's real name, such as Jane Doe.

directory is the pathname of the user's home directory. This is where the user's account resides.

shell specifies the user's shell program. If this entry is blank then the Bourne shell is the default.

These steps create a demonstration account and two user accounts:

1. Edit the /etc/passwd file.

Using ed, add these lines to the /etc/passwd file. Make sure that the new entries do not conflict with any existing entries.

```
demo:::10:20:demonstration account:/usr/demo:  
jad:::20:30:Jane Anne Doe:/user/jad:/bin/csh  
smith:::21:30:John W. Smith:/user smith:/bin/csh
```

Note that the demo account is in a separate home directory and uses the Bourne shell, and that the jad and smith accounts have the same parent directory and use the C shell.

2. Mount the user file systems.

Mount the file systems where the user's home directories will be located:

```
# cd /  
# /etc/mount -a
```

The -a option to the mount command specifies that all file systems in the /etc/fstab file be mounted.

3. Set up the home directories.

Create the home directories and change the owners to the new users:

```
# cd /usr  
# mkdir demo  
# chog demo demo  
# cd /user  
# mkdir jad smith  
# chog jad jad  
# chog smith smith
```

4. Unmount the user file systems.

To unmount the user file systems, type:

```
# cd /  
# /etc/umount -a
```

5. Create start-up files for each account.

Refer to Chapter 6, Completing the Installation, for details on multiuser mode, logging in and out, and passwords.

After you create the new accounts, bring the ULTRIX-11 system up to multiuser mode.

Log in to each account and create the user's start-up files. If the user has the Bourne shell (/bin/sh), then create a .profile file in the home directory. If the user has the C shell (/bin/csh), create a .login and .cshrc file in the home directory.

These files contain a list of commands that the shell program executes each time the user logs in to the system. For further information about these start-up files, read the Introduction to the C Shell and Introduction to the UNIX Shell, in the ULTRIX-11 Programmer's Manual, Volume 2A and refer to csh and sh in Section 1 of the ULTRIX-11 Programmer's Manual, Volume 1.

Enter each new user's password into the /etc/passwd file by executing the passwd command.

4.10.5. Connecting to Remote Systems

You can access remote systems with the ULTRIX-11 tip facility. Refer to Section 4.9, Setting Up tip Connections, in the ULTRIX-11 System Management Guide for instructions.

If your system is participating in the UNIX users network (sometimes called USENET), refer to the UUCP Installation and Administration Guide in the ULTRIX-11 Programmer's Manual, Volume 2B for instructions on how to set up uucp.

Chapter 5

Installing ULTRIX-11 Software from RX50 Diskette

This chapter describes the installation procedure for the ULTRIX-11 operating system from the RX50 diskette distribution kit.

5.1. RX50 Diskette Installation Overview

This section of the RX50 diskette installation consists of these steps:

- Executing the automatic installation procedure
- Generating the ULTRIX-11 operating system
- Loading optional software
- Verifying the installation
- Making the ULTRIX-11 system available to users

You transfer the ULTRIX-11 software from the first 13 distribution RX50 diskettes to the system disk. To do this, you need to insert and remove the diskettes from the RX50 diskette drives. Then, you bootstrap and initialize the operating system. The automatic installation procedure helps you with this.

Next, you generate and install an ULTRIX-11 kernel that supports your system processor and all the system devices. This kernel is the basic memory-resident portion of the operating system that supports system calls, maintains the file system, and deals directly with the processor and peripheral devices.

The remaining distribution diskettes contain optional software. You should use the osload command to install any of the optional software you need to support your users. Refer to Appendix E, Loading the Games, Manuals, and

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Documents Files, for information on loading the on-line manuals.

Some of the diskettes are processor dependent, that is, you use them only with certain processor types. Table 5.1 shows which diskettes can be used with which processors.

Table 5.1 Processor Dependent Diskettes

<u>PDP-11/23+</u>	<u>PDP-11/73</u>
SYSGEN #2	SYSGEN #3
F11CMDS #1	J11CMDS #1
F11CMDS #2	J11CMDS #2

After verifying that the installation was successful, you perform various administrative tasks to make the system available to other users.

5.1.1. RD51, RD52 and RX50 Unit Numbering

The Micro/PDP-11 Winchester and diskette drives do not have unit number assignment plugs. Here are the disk unit number assignments:

- The system disk (RD51 or RD52)

The ULTRIX-11 system disk is always the RD51 or RD52 Winchester disk mounted in the basic Micro/PDP-11 system. The system disk is always unit 0.

- The second RD51 or RD52 disk

If your Micro/PDP-11 system is equipped with a second Winchester disk, it is always unit 1.

- RX50 diskette drives

The RX50 diskette drives are units 1 and 2 in the basic Micro/PDP-11 system, or units 2 and 3 if the optional second Winchester disk is present.

5.1.2. Inserting and Removing RX50 Diskettes

The automatic installation procedure requires that you insert and remove diskettes. The procedure tells you when to do this.

The automatic installation procedure identifies the RX50 diskette drive by unit number and physical mounting position. Each diskette is identified by its name, which is printed on the third line of the diskette label.

For example:

Insert (BOOT) diskette into RX50 unit 1 (top/left)

or

Remove (BOOT) diskette from RX50 unit 2 (lower/right)

The terms (top/left) and (lower/right) refer to the physical position of the RX50 units, which depend on whether the Micro/PDP-11 is mounted vertically or horizontally.

5.2. The Automatic Installation Procedure

After the RX50 diskette boots, you are in the automatic installation procedure. Follow these steps:

1. Mount the distribution boot media.

Insert the BOOT diskette into the lower or right-hand RX50 diskette drive.

If you have a second Winchester disk, it should be powered on with the green light lit, indicating the disk is ready.

2. Boot the diskette.

Be sure the HALT pushbutton is released, then boot the distribution RX50 diskette.

If you have a second Winchester disk, boot unit 3. Otherwise boot unit 2.

The three most common types of Micro/PDP-11 bootstraps are shown below:

- Micro/PDP-11 with 11/23+ (KDF11-B) Processor

To boot from the diskette, press the RESTART pushbutton. The bootstrap automatically locates the RX50 unit containing the bootable diskette and boots from that unit.

To boot from the Winchester disk, remove any bootable diskettes from the RX50 drives and press the RESTART pushbutton. The bootstrap boots from Winchester disk, unit 0.

You can bypass the auto-boot sequence and specify the device to be bootstrapped. To initiate the manual boot sequence, press the RESTART pushbutton and then press <CTRL/P>. The system displays a boot menu.

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- Micro/PDP-11 with KDJ11-A Processor

The KDJ11-A, also known as the DCJ11, processor module does not include a bootstrap. Therefore you must add a multifunction module with bootstrap ROMs. The two most common multifunction modules are the MXV11-B and the MRV11-D. Both modules use the MXV11-B2 bootstrap ROMs. The MXV11-B2 boot ROMs have two bootstrap modes: auto-boot and manual boot.

To auto-boot, press the RESTART pushbutton. The bootstrap performs a lengthy (about 25 seconds) processor self test, then boots the first bootable MSCP device. If a bootable RX50 diskette is loaded in one of the drives, it is bootstrapped. Otherwise, the Winchester disk unit 0 is booted.

You can bypass the auto-boot sequence and the self test by pressing <CTRL/C> immediately after pressing the RESTART pushbutton. The bootstrap then prints this prompt:

BOOT>

Type help in response to the BOOT> prompt to print boot instructions.

To manually boot a device, type one of these commands:

DL 0	(Boot from RL02 unit 0)
DU 0	(Boot from Winchester disk unit 0)
DU 1	(Boot from 2nd Winchester disk unit 1)
DU 1	(Boot from RX50 unit 1)
DU 2	(Boot from RX50 unit 2)
DU 3	(Boot from RX50 unit 3)

You can boot a device that is not at the standard Control and Status Register (CSR) address by preceding the BOOT> prompt with the device's CSR address. For example, to boot an RC25 disk at CSR address 172160, type:

172160 DU 0

- Micro/PDP-11 with 11/73 (KDJ11-B) Processor

Press the RESTART pushbutton. The bootstrap executes the system self tests and then prints a boot prompt message. Respond to the boot prompt with one of these boot commands:

B DL0	(Boot from RL02 unit 0)
B DU0	(Boot from Winchester disk unit 0)
B DU1	(Boot from 2nd Winchester disk unit 1)
B DU1	(Boot from RX50 unit 1)
B DU2	(Boot from RX50 unit 2)
B DU3	(Boot from RX50 unit 3)

To get boot instructions, type HELP in response to the boot prompt message.

After successfully booting, the system displays this prompt:

Sizing Memory...

To list options, type help then press <RETURN>

Boot:

If any of your system devices are not at the standard CSR addresses, use the help option and then the csr option in response to the boot prompt. For further information on the csr option, see Section 3.7.3, CSR Address Option, in the ULTRIX-11 System Management Guide.

3. Load the sdload program.

If your Micro/PDP-11 processor has a second Winchester drive, type:

rx(3,0)sdload

Otherwise type:

rx(2,0)sdload

Once loaded, sdload starts running automatically.

4. Answer the automatic installation procedure questions.

The sdload program prints some initial messages and then asks questions about your system.

After you have answered the questions, the sdload phase of the automatic installation procedure begins. During the sdload phase, you must insert and remove the root and /usr diskettes.

At the beginning of the setup phase, you are asked to type the current date and time. Then, you are asked to insert and remove the SYSGEN diskettes, and finally, to remove the BOOT diskette.

Other than this, the setup phase is completely automatic.

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You only use two of the three SYSGEN diskettes.

If an error occurs, the automatic installation procedure prints instructions on how to recover from the error or where to get help if you cannot recover.

The setup phase takes several minutes. The length of time depends on your processor. When the system prints the message shown below, the automatic installation procedure is complete.

***** ULTRIX-11 INITIAL SETUP COMPLETED *****

5.3. Creating the Device-Dependent Special Files

To be accessible by the ULTRIX-11 operating system, each device must have special files in the /dev directory. The generic command format is:

```
# cd /dev  
# msf device n  
# cd /  
# sync
```

device is the generic device name, such as r102, rd51, rx50, tsv05, or tk25.

n is the unit number of the device.

The following sections for creating special files all refer back to this format.

NOTE

If you have one or more MSCP disk controllers (UDA50, KLESI, RQDX1, RUX1), omit this section and follow the instructions given in Appendix I, Multiple MASSBUS/MSCP Disk Controllers.

5.3.1. Creating Special Files for Other Disks

The automatic installation procedure creates the special files for the RD51 unit 0, the second RD if present, and the RX50 diskette drives.

For disks other than the system disk, you create the special files with the msf command. For example, to create special files for two RL02 disks, type:

```
# cd /dev  
# msf rl02 0  
# msf rl02 1  
# cd /  
# sync
```

5.3.2. Creating Special Files for Tape Drives

If you have a TK25 or TSV05 tape drive, you create the special files with the msf command.

For example, to create special files for a system with a TK25 on drive 0, type:

```
# cd /dev  
# msf tk25 0  
# cd /  
# sync
```

To create special files for a system with a TSV05, drive 0, type:

```
# cd /dev  
# msf tsv05 0  
# cd /  
# sync
```

5.3.3. Creating Special Files for Communications Devices

Communications special files allow you to use other terminals in addition to the console terminal. The terminals have names in the form /dev/ttynn where nn is the unique number assigned to each line.

To set up the special files for your system configuration, you must know what types of communications controllers you have, how many of each type, and how many lines each controller can handle.

Table 5.2 describes the various communications controllers supported by the ULTRIX-11 system, how many lines each can handle, and the ULTRIX-11 name of each type.

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Table 5.2 ULTRIX-11 Supported Communications Controllers

<u>Controller</u>	<u>Lines/Unit</u>	<u>ULTRIX-11 Name</u>
DLV11-A/B	1	kl11
DLV11-F	1	kl11
DLV11-E	1	dl11
DLV11-J	4	kl11
DZV11	4	dzv11
DZQ11	4	dzq11
DHV11	8	dhv11

NOTES

The DLV11-J is the equivalent of four DLV11s and should be viewed as four DLV11s.

Although the console terminal is on a DL11/DLV11-type line, its special file (/dev/console) already exists. Do not include it in your count of DL11/DLV11-type controllers. For example, if the last line of your DLV11-J is used as the console, you count the DLV11-J as three DLV11-type controllers instead of four.

The second single line unit (SLU) built into some Micro/PDP-11 systems should be counted as a DLV11-type controller. The PDP-11/23+ system has the second SLU; the PDP-11/73 does not. For the KDJ11-A, the presence of the second SLU depends upon the type of multifunction module used.

During system generation, you need to differentiate between a KL11 and a DL11. At this point, however, group all KL11s and DL11s together and specify them as DL11s.

You reference terminals on an ULTRIX-11 system by special file names, such as tty00 or tty23. To assign these names to the lines of your communications controllers, you must specify the type of controller, the controller's unit number, and the first line number to use for that controller.

First, type this command sequence to remove any existing communications device special files:

```
# cd /dev
# make ttyclean
:
:           (prints several messages)
:
```

Then, use a variation of the msf command to create the communications device special files. The format is:

```
# msf device n ttynn
```

device is the communications device's ULTRIX-11 name, such as kl11, dl11, dzv11, dzq11, or dhv11.

n is the number of units for DL11 or KL11 controllers. It is the unit number for all other communications controllers.

ttynn is the first tty line to be assigned to that controller.

Assign the line for the first communications controller on your system tty00. For subsequent controllers, assign lines at the next available tty number.

NOTE

All KL11 and DL11 type controllers must be grouped together and assigned to contiguous tty numbers by a single execution of the msf command.

Here are examples of command sequences that create the communications device special files for various Micro/PDP-11 configurations. Modify one of these command sequences to match your configuration:

- Basic Micro/PDP-11 with DZV11 and second SLU

```
# cd /dev
# msf dzv11 0 tty00
# msf kl11 1 tty04      (second SLU is a KL11)
# cd /
# sync
```

- Micro/PDP-11 with two DZQ11 and second SLU

```
# cd /dev
# msf dzq11 0 tty00
# msf dzq11 1 tty04
```

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```
# msf kl11 1 tty08      (second SLU is a KL11)
# cd /
# sync
```

- Micro/PDP-11 with DHV11 and no second SLU

```
# cd /dev
# msf dhv11 0 tty00
# msf dhv11 1 tty08      (if 2nd DHV11 is present)
# cd /
# sync
```

- Micro/PDP-11 with one DZV11 and one DHV11

```
# cd /dev
# msf dzv11 0 tty00
# msf dhv11 0 tty04
# cd /
# sync
```

- Micro/PDP-11 with one DLV11-J (four line unit)

The last DLV11-J line is for the console port and the three remaining lines are for user terminals.

```
# cd /dev
# msf kl11 3 tty00
# cd /
# sync
```

- Micro/PDP-11 with one DZV11, one DLV11-E, and second SLU

```
# cd /dev
# msf dzv11 0 tty00
# msf kl11 2 tty04
# cd /
# sync
```

NOTE

In this example, you specify one DL11 and one KL11 during system generation. The DLV11-E is a DL11 and the second SLU is a KL11.

5.3.4. Creating Communications Lines as Printer Ports

You can use communications lines as printer ports for adding printers to your system. To set up a communications line as a printer port, type:

```

# cd /
# chmod 700 /dev/ttynn
# chog daemon /dev/ttynn
# /etc/mount -a
# mkdir /usr/spool/lpdx
# chmod 755 /usr/spool/lpdx
# chog daemon /usr/spool/lpdx
# ln /usr/lib/ulf /usr/lib/lpx
# sync
# /etc/umount -a

```

ttynn is the terminal number assigned to the printer port. Once assigned to a printer port, this terminal line is dedicated to the printer and can no longer be used to log in to the system.

You must change the mode of the entry for this terminal line in the /etc/ttys file to nologins. You do this in Section 5.10.2, Modifying the /etc/ttys File.)

x can be any number, but by convention it represents the number of the printer. For example, if you are configuring a second printer into your system, you should define x as 2.

For each printer port you add to your system, the names for its spooling directory, output filter, and printer must all have the same value for x.

lpd_x is the name of the spooling directory for the printer. Each printer maintains its own separate spooling directory. The directory /usr/spool/lpd is the spooling directory for the main line printer, generally accessible through /dev/lp. You name all other spooling directories after the number of the printer. For example, the spooling directory for printer P2 is /usr/spool/lpd2. The jobs for printer P2 are queued in this spooling directory.

lpx is the output filter name linked to /usr/lib/ulf. For example, printer P2 uses the output filter /usr/lib/lp2. The filter program /usr/lib/ulf checks to see by what name it was called, and then looks for the appropriate printer entry in /etc/printcap.

If the number of the printer does not match the output filter name, errors result. For

example, specifying the output filter /usr/lib/lp2 for the third printer incorrectly sets up printer P3 according to the specifications given for printer P2. In addition, directly invoking the filter /usr/lib/ulf causes an error because the filter program mistakenly searches for the nonexistent entry "ulf" in the printer description file (/etc/printcap).

Edit the printer description file /etc/printcap to include an entry for the printer. The /etc/printcap file must contain a printer type entry for each printer connected to the system. It already contains an entry for lp, the default printer.

Here is a sample of various printcap entries:

```
lp0|lp|0>Main printer - LP11 type interface:\n  :lp=/dev/lp:du#1:sd=/usr/spool/lpd:mx#5000:\n  :lf=/usr/adm/lp.err:\nlp1|1|LA100 printer:\n  :dn=/usr/lib/lpd:lp=/dev/tty00:\n  :sd=/usr/spool/lpd1:sh:br#4800:fc#077777:\n  :fs#06020:of=/usr/lib/lp1:\nlp2|2|LA50 printer:\n  :dn=/usr/lib/lpd:lp=/dev/tty05:\n  :sd=/usr/spool/lpd2:br#4800:fc#077777:\n  :fs#016620:of=/usr/lib/lp2:lf=/usr/adm/lp2.err:\nlp3|3|LA180 DECWRITER III:\n  :lp=/dev/ttyh0:br#1200:fc#077777:fs#06320:\n  :of=/usr/lib/lp3:sd=/usr/spool/lpd3:
```

For example, to add a second printer to a system, replacing tty05 and known as printer P2, type:

```
# cd /\n# chmod 700 /dev/tty05\n# chgrp daemon /dev/tty05\n# /etc/mount -a\n# mkdir /usr/spool/lpd2\n# chmod 755 /usr/spool/lpd2\n# chgrp daemon /usr/spool/lpd2\n# ln /usr/lib/ulf /usr/lib/lp2\n# sync\n# /etc/umount -a
```

In this example, the terminal line is tty05 (tty_{nn}). The print jobs for the second printer are queued in the /usr/spool/lpd2 spooling directory.

You need to add an appropriate printcap entry for printer P2 to the /etc/printcap file.

In our example, this command prints files on printer P2 once the system is running in multiuser mode:

```
# lpr -P2 file
```

Refer to printcap in the ULTRIX-11 Programmer's Manual, Volume 1 for a complete description of the printer capability data base.

In addition to editing the /etc/printcap file, you need to set the terminal's mode in the /etc/ttys file to nologins. You do this in Section 5.10.2, Modifying the /etc/ttys File.

5.4. Naming the System

To name your system, edit the /etc/rc file with the ed text editor. Choose a site name and substitute it for "noname" in the last line of the /etc/rc file.

For example, as distributed, the last line in the /etc/rc file reads:

```
hostname noname
```

If you want to name your system site mypdp11, modify the last line of the /etc/rc file so it reads:

```
hostname mypdp11
```

The name you choose must be made up of no more than 32 lowercase alphanumeric characters.

If your system is connecting to a uucp network, then the first six characters of your site name must be different from any other site name on the network. To verify if your name is unique, ask the site through which you are connecting for a list of existing site names.

5.5. Generating the ULTRIX-11 System

The preconfigured ULTRIX-11 operating system supports the system disk, RX50 diskette drives, and the console terminal. No other devices are supported.

The system generation program sysgen produces an ULTRIX-11 operating system configured to support your exact system configuration.

To generate the system, you:

1. Complete the work sheet in Appendix G

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2. Run the sysgen program
3. Respond to the sysgen prompts
4. Create the new ULTRIX-11 operating system
5. Install and boot the new ULTRIX-11 operating system

The steps below outline the system generation program (sysgen). If you would like more detailed information about the system generation program, read Chapter 2, ULTRIX-11 System Generation, in the ULTRIX-11 System Management Guide.

To aid you during the system generation process, sysgen provides extensive on-line help.

For a sample system generation, refer to the first example in Appendix C, System Generation Examples.

To begin, complete the work sheet in Appendix G. This places all the information required for the installation in one easily accessible place. After completing the worksheet, follow these steps to generate the system:

1. To mount the /usr file system, type:

```
# cd /
# /etc/mount -a
```

2. To go to the configuration directory, type:

```
# cd /sys/conf
```

3. To run the sysgen program, type:

```
# sysgen
```

The sysgen program responds by printing these messages:

```
ULTRIX-11 System Generation Program
```

```
For help, type h then press <RETURN>
```

```
sysgen>
```

The sysgen program is ready to accept commands.

4. To familiarize yourself with sysgen, type h and read the general help message:

```
sysgen> h
```

5. To print a list of all the ULTRIX-11 supported devices, type:

```
sysgen> d
```

6. To create the ULTRIX-11 configuration file, first type the help command for create:

```
sysgen> h c
```

Then, start the system generation dialogue by typing:

```
sysgen> c
```

Answer each sysgen prompt, using the system generation example in Appendix C as a guide. If you are unsure of the response, type a question mark (?) for on-line help.

To change an answer, press <CTRL/D> to move back to the previous major question.

The sysgen program displays default responses in angle brackets (<>). Press <RETURN> to accept the default. When sysgen displays more than one response in angle brackets or parentheses (), it is giving you possible responses to the question.

When sysgen returns this message, you have finished creating the configuration file:

```
ULTRIX-11 System Generation Program
```

```
For help, type h then press <RETURN>
```

```
sysgen>
```

7. To review your answers, print a listing of your responses by typing:

```
sysgen> p
```

The sysgen program prompts you for the name of your kernel configuration file. Type the configuration name and press <RETURN>. The sysgen program then prints all of your responses.

Verify your answers. If you need to change a response, create the system generation again by using the c command as described in step 6.

8. Make the new ULTRIX-11 operating system kernel.

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Up to this point, you have entered responses into the configuration file. The kernel does not yet exist. Create the kernel with the make command by typing:

```
sysgen> m
```

The sysgen program prompts you for the name of your kernel configuration file. Type the configuration name and press <RETURN>. The sysgen program starts building the new ULTRIX-11 operating system. The m command generates a large number of messages. You can ignore all the messages except the last one, which tells you that the system generation was successful.

See Example 1 in Appendix C, System Generation Examples, for a sample dialogue.

9. Exit the sysgen program.

Complete the system generation phase by pressing <CTRL/D>:

```
sysgen> <CTRL/D>
```

```
#
```

The # prompt displays again, and the system generation is complete.

5.6. Installing the New ULTRIX-11 Operating System

To install the new ULTRIX-11 operating system, follow these steps:

1. Save the preconfigured ULTRIX-11 system.

To save the preconfigured ULTRIX-11 system for backup purposes, type:

```
# cd /sys/conf  
# mv /unix /ounix
```

2. Move the new operating system to the root directory.

To move the new operating system into the root directory and name the new operating system unix, type:

```
# mv kernel.os /unix
```

kernel is the configuration name that you assigned your kernel when you generated the system. For example, if you named your kernel configuration file testunix, type:

```
# mv testunix.os /unix
```

The default value for kernel.os is unix.os.

3. Change the mode of /unix.

To change the mode of /unix, type:

```
# chmod 644 /unix
```

4. Shut down the system.

Type these commands:

```
# cd /
# sync
# /etc/umount -a
```

Then, halt your processor.

NOTE

These commands for shutting down the system are for the installation procedure only. Do not use them to shut down the ULTRIX-11 system during normal multiuser operation. Refer to Chapter 5, ULTRIX-11 Operator Services, in the ULTRIX-11 System Management Guide for the proper shutdown procedure.

5. Boot the new ULTRIX-11 operating system.

Be sure that the processor's HALT switch is released. Then, bootstrap the system disk (drive 0).

The boot program prints these messages while loading the operating system:

Sizing Memory...

```
Boot: rd(0,0)unix      (<CTRL/C> aborts auto-boot)
```

Once loaded, the operating system starts running in single-user mode and prints these start-up messages:

ULTRIX-11 Kernel V2.0

```
realmem = xxxxx
buffers = yyyyy
usermem = zzzzz
erase = delete, kill = ^U, intr = ^C
#
```

The realmem message (xxxxx) displays the entire size of memory in bytes. The buffers message (yyyyy) displays the total amount of memory occupied by the system's I/O buffer cache. The usermem message (zzzzz) displays the amount of free memory in bytes; that is, the realmem minus the number of bytes used by the buffer cache in the ULTRIX-11 operating system.

Erase deletes individual characters, kill removes an entire line of input, and intr (interrupt) interrupts a program. The system reminds you that it has changed these control characters from the standard UNIX V7 characters (where erase = #, kill = @, intr = delete).

is the ULTRIX-11 superuser prompt, indicating that the operating system is up and running in single-user mode.

6. Set the date and time.

Type the date and time in this format:

date yyymmddhhmm.ss

yy equals the last two digits of the year (00-99)

mm equals the number of the month of the year (01-12)

dd equals the number of the day of the month (01-31)

hh equals the hour of the day based on 24 hours (00-23)

mm equals the minutes of the hour (00-59)

ss equals the seconds of the minute (00-59)
The entry of seconds is optional.

For example, to set the time and date to 6:30 PM on August 28, 1984, type:

date 8408281830

7. Remove the sysgen files.

The sysgen files use a large amount of disk space. However, you may want to retain these files until you are sure that you do not need any further system generations. Otherwise, you can use the osload command to remove the sysgen files.

To remove the sysgen files, type:

```
# osload unload sysgen
```

You can also use the osload command in the future to reload the sysgen files. Refer to Section 5.8, Loading Optional Software, for more information about the osload command.

5.7. Checking the ULTRIX-11 File System

To make sure all the ULTRIX-11 files are properly loaded on the system disk, run the file consistency check program fsck.

Type these commands:

```
# cd /
# sync
# fsck
```

The fsck program checks the file systems and prints the number of files, the number of blocks used, and the number of free blocks on each of the file systems.

If an error occurs, fsck prints a message describing the error and asks if it should make the necessary repairs. If you answer yes to the repair prompt, fsck attempts to fix the problem. If fsck makes any repairs, it prints this message:

```
***** FILE SYSTEM WAS MODIFIED *****
```

The fsck program must run without errors. If an error does occur, the system disk media may be defective, or you may have made an error in loading ULTRIX-11, or there may be a hardware fault that does not allow ULTRIX-11 to be loaded properly. For media faults, read Section 1.2.3, Disk Media Qualification.

5.8. Loading Optional Software

The ULTRIX-11 distribution kit consists of 30 RX50 diskettes containing these four groups of software:

- Boot and stand-alone programs

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- The root and /usr file systems (base ULTRIX-11 system)
- Optional software
- ULTRIX-11 on-line manuals in nroff format

Table 5.3 lists the number of each diskette group according to contents and the contents of each group.

Table 5.3 Diskette Groups and Contents of Each

<u>Number of Diskettes</u>	<u>Contents</u>
1	BOOT and stand-alone programs
6	ROOT file system (base ULTRIX-11 system)
3	/USR file system (base ULTRIX-11 system)
3	SYSGEN program and files
1	USEP (User-mode System Exerciser Package)
2	F11CMDS (optional commands for 11/23+ processor)
2	J11CMDS (optional commands for 11/73 processor)
1	UUCP (UUCP software)
1	SCCS/PLOT (Source Code Control System and PLOT)
1	F77 (FORTRAN 77 software)
1	DOCPREP (documentation preparation software)
2	LEARN (computer aided instruction)
1	DICTIONARY (dictionary files)
1	GAMES (games programs)
4	MANUALS (NROFF - Programmer's Manual Volume 1)

This packaging scheme allows maximum flexibility when allocating storage on the system disk. The root and /usr diskettes contain the minimum subset of binaries and other files required to operate the ULTRIX-11 system.

Table 5.4 shows the approximate number of free disk blocks available to load optional software and/or allocate to user file storage, after you have loaded the base ULTRIX-11 system.

Table 5.4 Free Disk Blocks Available on Each File System

<u>Disk Type</u>	<u>Root</u>	<u>/usr</u>	<u>User</u>
RD51	1550	10900	-
RD52	1550	10900	37325

The user file system is present only on the RD52 disk. The entire user file system is available for user file storage

because the ULTRIX-11 operating system does not occupy this file system.

5.8.1. Diskettes NOT Loaded as Optional Software

The root and /usr diskettes are required software which the automatic installation procedure loads.

The on-line manuals diskettes are not loaded as optional software. Refer to Appendix E, Loading the Games, Manuals, and Documents Files, for instructions on how to load the on-line manuals.

5.8.2. Diskettes Loaded as Optional Software (PDP-11/23+)

Table 5.5, produced by the print feature of the osload command, lists the items of optional software you can load from the diskettes, for the Micro/PDP-11 system with a PDP-11/23+ processor. The table also lists the amount of disk storage consumed by loading each item.

Table 5.5 Optional Software for the Micro/PDP-11 with a PDP-11/23+ Processor

<u>Item</u>	<u>Files</u>	<u>Blocks</u>	<u>Diskettes</u>	<u>Description</u>
awk	2	137	F11CMDS #1	AWK program and library
dict	4	413	DICTIONARY	Words files, not needed for spell
ex	4	213	F11CMDS #1	Extended editor (same as vi)
eqn	3	118	DOCPREP	Typeset math (eqn, neqn, checkeq)
f77	5	465	F77	Fortran 77 and libraries
games	58	533	GAMES	Fun and games programs
learn	21	1132	LEARN 1 & 2	Learn (computer aided instruction)
lex	2	65	F11CMDS #1	LEX program and library
libsa	1	102	J11CMDS #2	Library for stand-alone programs
lint	6	167	F11CMDS #2	C program verifier
nroff	53	324	DOCPREP	NROFF (text formatting program)
orphan	6	67	GAMES	Unsupported commands
pcc	3	183	F11CMDS #1	Portable C compiler
plot	12	190	SCCS/PLOT	PLOT (graphics filters)
ratfor	1	27	F77	Rational Fortran dialect (needs f77)
refer	9	174	DICTIONARY	Refer program, library and papers
roff	2	21	DOCPREP	ROFF (text formatting program)
saprogs	9	195	BOOT	Stand-alone programs
sccs	30	502	SCCS/PLOT	Source Code Control System
spell	7	302	F11CMDS #2	Spell and associated programs
sysgen	143	1019	SYSGEN 1 & 2	Overlay kernel system generation
struct	3	136	F11CMDS #2	Structure a Fortran program
tbl	1	61	DOCPREP	Format tables for NROFF and TROFF
tip	1	80	F11CMDS #2	TIP/CU (connect to a remote system)
troff	1	83	DOCPREP	TROFF (text formatting,

				needs NROFF)
usat	45	200	SYSGEN #1	ULTRIX-11 System Acceptance Test
usep	54	342	USEP	User-Mode System Exerciser Package
uucp	31	635	UUCP	UUCP (unix to unix copy)
vi	4	213	F11CMDS #1	VI screen editor (same as ex)
yacc	2	57	F11CMDS #1	YACC (yet another compiler-compiler)

5.8.3. Diskettes Loaded as Optional Software (PDP-11/73)

Table 5.6, produced by the print feature of the osload command, lists the items of optional software you can load from the diskettes, for the Micro/PDP-11 system with a PDP-11/73 processor. The table also lists the amount of disk storage consumed by loading each item.

Table 5.6 Optional Software for the Micro/PDP-11 System with a PDP-11/73 Processor

<u>Item</u>	<u>Files</u>	<u>Blocks</u>	<u>Diskettes</u>	<u>Description</u>
awk	2	134	J11CMDS #1	AWK program and library
dict	4	413	DICTIONARY	Words files, not needed for spell
ex	4	205	J11CMDS #1	Extended editor (same as vi)
eqn	3	118	DOCPREP	Typeset math (eqn, neqn, checkeq)
f77	5	465	F77	Fortran 77 and libraries
games	58	533	GAMES	Fun and games programs
learn	21	1132	LEARN 1 & 2	Learn (computer aided instruction)
lex	2	65	J11CMDS #1	LEX program and library
libsa	1	102	J11CMDS #2	Library for stand-alone programs
lint	6	137	J11CMDS #2	C program verifier
nroff	53	324	DOCPREP	NROFF (text formatting program)
orphan	6	67	GAMES	Unsupported commands
pcc	2	163	J11CMDS #1	Portable C compiler
plot	12	190	SCCS/PLOT	PLOT (graphics filters)
ratfor	1	27	F77	Rational Fortran dialect (needs f77)
refer	9	174	DICTIONARY	Refer program, library and papers
roff	2	21	DOCPREP	ROFF (text formatting program)
saprogs	9	195	BOOT	Stand-alone programs
sccts	30	502	SCCS/PLOT	Source Code Control System
spell	7	333	J11CMDS #2	Spell and associated programs
sysgen	77	902	SYSGEN 1 & 3	Split I & D kernel system generation
struct	3	136	F11CMD2+J11CMD2	Structure a Fortran program
tbl	1	61	DOCPREP	Format tables for NROFF and TROFF
tip	1	80	F11CMDS #2	TIP/CU (connect to a remote system)

troff	1	83	DOCPREP	TROFF (text formatting, needs NROFF)
usat	45	200	SYSGEN #1	ULTRIX-11 System Acceptance Test
usep	54	342	USEP	User-Mode System Exerciser Package
uucp	31	635	UUCP	UUCP (unix to unix copy)
vi	4	205	J11CMDS #1	VI screen editor (same as ex)
yacc	2	56	J11CMDS #1	YACC (yet another compiler-compiler)

5.8.4. Optional Software Load Command (osload)

The optional software load command, osload, facilitates loading optional software.

The osload program lets you load and unload optional software by specifying the file's name. In addition, osload is completely self documenting.

The osload program requests that you insert or remove the appropriate diskettes in the same manner as the automatic installation procedure. It provides on-line help with loading the diskettes.

To execute the osload command, type:

```
# osload
```

The osload command prints some initial messages followed by its command prompt.

To obtain information about how to use osload, respond to the command prompt with h:

```
command <help rxunit rmdir list print load unload exit>: h
```

You can also use the osload command in a noninteractive mode. For more information, type:

```
# osload help
```

Some osload commands can only be executed by the superuser.

NOTE

Load and unload optional software in single-user mode only.

Some osload commands require that the /usr file system be mounted. The osload program asks if it can mount the /usr

file system for you.

As a rule, when you unload an item of optional software with the osload command only the files originally loaded by osload are removed. User created files are preserved. However, there are a few exceptions to this rule. In those cases, osload warns you that it is going to remove all the files in a directory and lets you stop the unload operation.

When loading several items of optional software, you can save loading time by sorting the list of items and grouping together those items to be loaded from the same diskette.

5.9. ULTRIX-11 Installation Verification

You should verify the installation with the ULTRIX-11 system acceptance test (usat) facility.

Because the usat program is optional software, you must load it using the osload command. See Section 5.8, Loading Optional Software.

The /usr file system must be mounted before you run any tests with usat. To mount the /usr file system, type:

```
# cd /
# /etc/mount -a
```

To obtain a list of the ULTRIX-11 commands that usat can test, type:

```
# usat help
```

Many of the features which usat tests are optional software, and therefore must be loaded before they can be tested. These files, in the most efficient order to load, are: osload, load, usat, awk, ex, lex, pcc, yacc, lint, spell, tip, uucp, nroff, tcp, f77, and learn.

To test all commands and features, type:

```
# usat all          (this takes from 7 to 25 minutes,
                     depending on the processor)
```

You can redirect the usat program's output to a log file by typing:

```
# usat all > usat.log
```

During usat testing, a number of messages appear on the terminal. The usat installation verification was successful if the last message is:

NO ERRORS DETECTED

When you have finished the usat installation verification, unmount the /usr file system by typing:

```
# cd /
# /etc/umount -a
```

If the installation verification fails, follow these steps:

1. Check to be sure that the file that failed was loaded on the system. If it was not loaded, load it using osload and then run usat again.
2. Run usat again on the file that failed.
3. If the verification fails again, review your installation procedure. Be sure you followed each step correctly.
4. If you installed the system correctly and the error persists, call the Digital Telephone Support Center.

5.10. Making the ULTRIX-11 System Available to Users

The ULTRIX-11 operating system installation is complete, but you must perform some administrative tasks before you make the system available to users.

Except for modifying user terminal entries in the /etc/ttys file, all of these administrative tasks require you to edit text files, using the basic ULTRIX-11 text editor ed. See Appendix H, The ed Command Summary Sheet, for information on this editor.

These sections cover the basic approach to setting up your system:

- Storing User Files
- Modifying the /etc/ttys File
- Creating the User Accounts
- Connecting to Remote Systems

5.10.1. Storing User Files

Allocating user file storage depends on the number and type of disks on your Micro/PDP-11 system. The examples below are of user file storage methods for various system disks.

On the system disk, the root file system occupies partition 0, and the /usr file system occupies partition 1. NEVER attempt to create user file systems on these partitions, or on partition 7, which overlaps partitions 0 and 1.

- RD51 system disk.

If your RD51 system disk is the only Winchester disk on the system, you must store the user files in the root and/or the /usr file systems. There are no other file systems available. Proceed directly to Section 5.10.2, Modifying the /etc/ttys File.

- RD52 system disk.

The RD52 disk has a third file system (rd02), which the ULTRIX-11 operating system does not use. You should store the user files in this file system. Follow these steps to initialize the rd02 file system for user file storage:

1. Use the rasize command to determine the size of the rd02 file system:

```
# rasize
```

2. Make an empty file system on the rd02 partition of the RD52 disk:

```
# /etc/mkfs /dev/rrd02 size rd52 cpu fsname volname
```

size is the size of the file system in blocks. You can obtain this number from the rasize command.

cpu is the last two digits of the processor type, such as 23, 24, 34, 40, 44, 45, 55, 60, 70, or 73.

fsname is the file system name recorded in the super block. It can be no more than six characters in length.

volname is the volume name label recorded in the super block. It can be no more than six characters in length.

For example, to create a file system on an RD52 with a PDP-11/23 processor, type:

```
# /etc/mkfs /dev/rrd02 38880 rd52 23 user system
```

3. Create a user file directory.

These commands create the user file directory. In this example the directory name is user; you may use any name provided that it does not already exist:

```
# cd /
# mkdir user
# chmod 755 user
```

NOTE

The user file system must be logically mounted on the user directory before you can actually store files on the file system. Do not mount the user file system at this time. However, the command sequence is:

```
# cd /
# /etc/mount /dev/rd02 /user
```

The user file system is mounted when you install the user accounts.

4. Edit the file system table (/etc/fstab).

Use the ed editor to append this line to the end of the /etc/fstab file:

```
/dev/rd02:/user:rw
```

Adding the rd02 file system entry to the table makes it known to all system commands that deal with file systems.

This entry also causes the rd02 file system to be mounted on /user automatically each time the system enters multiuser mode. The rd02 (user) file system is then available for user file storage.

- Additional disk drives.

You can also store the user files on any additional Winchester disk drives. To initialize these disks, follow the same procedure as for the RD52 disk above, with these changes:

- Use the rasize command to obtain Winchester disk sizes.
- The file system name changes to rdn7, where n is the disk unit number.
- File storage on RX50 diskette

You can either use steps 1 through 4 above (RD52 system disk), or you can use the tar command to store the user files on RX50 diskettes.

Using steps 1 through 4:

Use the procedure in steps 1 through 4 to store user files on RX50 diskettes. For example, to copy all the user files in directory mydir to a diskette in RX50 drive 2, type:

```
# /etc/mkfs /dev/rx2 800 rx50 cpu mydir users  
# /etc/mount /dev/rx2 /mnt  
# cd /usr/mydir  
# cp * /mnt  
# /etc/umount /dev/rx2
```

cpu is the processor type, such as 23 or 73. mnt is a directory used to temporarily mount disks.

While the diskette is logically mounted on a directory, you can manipulate the files on the diskette in the same manner you would any other ULTRIX-11 files.

Using the tar Command:

You can also store files on RX50 diskettes with the tape archive command, tar. The tar command stores files on the diskette and recovers them from the diskette without creating a file system or logically mounting the diskette.

For example, to archive all of the files in directory mydir onto RX50 drive 2, type:

```
# cd /usr/mydir  
# tar cvd2 ./*
```

The files must fit onto a single diskette (800 blocks). The archive cannot be updated, that is, updating a single file requires that the entire archive be rewritten. You can extract single files or groups of files from the archive.

Archives in tar format are interchangeable between the ULTRIX-11 system and most other versions of UNIX software. Files stored on a diskette under the ULTRIX-11 file system might not be compatible with other versions of the UNIX operating system.

For further details on user file storage, see Section 4.6, Setting Up User File Systems, in the ULTRIX-11 System Management Guide.

5.10.2. Modifying the /etc/ttys File (Enabling User Terminals)

Each terminal entry in the /etc/ttys file controls the characteristics of a specific terminal. The /etc/ttys file entry also controls the mode of each terminal.

A terminal can be in one of four modes:

disabled	Disables the terminal
remote	Enables a remote (dial-up) terminal
local	Enables a local terminal
nologins	Enables a local terminal but does not allow users to log in the system

As distributed, all terminal entries are in the disabled mode. You should modify all entries for active hardwired terminals so they are in local mode. You should modify all entries for dial-up terminals so they are in remote mode. You should also modify all entries for printer ports (lpr), and tip and uucp dial-out lines so they are in nologins mode.

You should also remove all entries for terminals that your system does not have.

You modify a terminal's characteristics by modifying its entry in the /etc/ttys file, using the terminal enabling editor, ted. To modify the /etc/ttys file, type:

```
# ted
```

The ted program has an on-line help facility to help you modify user terminals.

In single-user mode, ted modifies only the entries in the /etc/ttys file. The terminal characteristics are not changed until the system enters multiuser mode.

In multiuser mode, ted modifies the terminal characteristics interactively.

See Section 4.7.5, Editing the /etc/ttys File, in the ULTRIX-11 System Management Guide for further information on modifying user terminal characteristics.

5.10.3. Editing the Terminal Type File

The terminal type file /etc/ttystype identifies the terminal type to system programs, such as vi. Entries in this file have this format:

type ttynn

For example:

vt100 tty00

To see a listing of the existing terminal type file, type:

cat /etc/ttymime

Use the ed text editor to modify entries in the /etc/ttymime file.

If your system console is a CRT (video terminal), then you must modify the first line of the /etc/ttymime file so it correctly identifies your console. For example, if your system console is a VT100, edit the first line of the /etc/ttymime file so it reads:

vt100 console

For more information on editing the /etc/ttymime file, see Section 4.7.4, Editing the /etc/ttymime File, in the ULTRIX-11 System Management Guide.

5.10.4. Creating the User Accounts

To create new user accounts, edit the /etc/passwd file. Each line in this file describes one user account, in the form:

name:passwd:user-ID:group-ID:real-name:directory:shell

name is the user's login name. It can have a maximum of eight lowercase characters.

passwd is the user's encrypted password. When you create the user's entry in the /etc/passwd file, leave this field blank.

user-ID is a unique user-identification number.

group-ID is a common group-identification number. This groups together several users who are working on a common project so they can share files.

real-name is the user's real name, such as Jane Doe.

directory is the pathname of the user's home directory. This is where the user's account resides.

shell specifies the user's shell program. If this

entry is blank then the Bourne shell is the default.

These steps create a demonstration account and two user accounts:

1. Edit the /etc/passwd file.

Using the ed editor, add these lines to the /etc/passwd file. Make sure that the new entries do not conflict with any existing entries:

```
demo::10:20:demonstration account:/usr/demo:  
jad::20:30:Jane Anne Doe:/user/jad:/bin/csh  
smith::21:30:John W. Smith:/user/smith:/bin/csh
```

Note that the demo account is in a separate home directory and uses the Bourne shell, and that the jad and smith accounts have the same parent directory and use the C shell.

2. Mount the user file systems.

Mount the file systems where the user's home directories will be located:

```
# cd /  
# /etc/mount -a
```

The -a option to the mount command specifies that all file systems in the /etc/fstab file be mounted.

3. Set up the home directories.

Create the home directories and change the owners to the new users:

```
# cd /usr  
# mkdir demo  
# chog demo demo  
# cd /user  
# mkdir jad smith  
# chog jad jad  
# chog smith smith  
# cd /
```

4. Unmount the user file systems.

To unmount the user file systems, type:

```
# cd /  
# /etc/umount -a
```

5. Create start-up files for each account.

Refer to Chapter 6, Completing the Installation, for details on multiuser mode, logging in and out, and passwords.

After you create the new accounts, bring the ULTRIX-11 system up to multiuser mode.

Log in to each account and create the user's start-up files. If the user has the Bourne shell (/bin/sh), create a .profile file in the home directory. If the user has the C shell (/bin/csh), create a .login and a .cshrc file in the home directory.

These files contain lists of commands that the shell program executes each time the user logs in to the system. For further information about these start-up files, read Introduction to the C Shell and Introduction to the UNIX Shell, in the ULTRIX-11 Programmer's Manual, Volume 2A and refer to csh and sh in Section 1 of the ULTRIX-11 Programmer's Manual, Volume 1.

Type each new user's password into the /etc/passwd file by executing the passwd command.

5.10.5. Connecting to Remote Systems

You can access remote systems with the ULTRIX-11 tip facility. Refer to Section 4.9, Setting Up tip Connections, in the ULTRIX-11 System Management Guide for instructions.

If your system participates in the UNIX users network (sometimes called USENET), refer to the UUCP Installation and Administration Guide in the ULTRIX-11 Programmer's Manual, Volume 2B for uucp setup instructions.

Chapter 6

Completing the Installation

This chapter describes the procedures for bringing the system up to multiuser mode, logging in and out of the system, and creating user account passwords. It also describes where to find further information on system administrator duties.

6.1. Bringing the System Up to Multiuser Mode

Up to this point, you have been operating the ULTRIX-11 system in single-user mode. To transfer to multiuser mode, press <CTRL/D>.

The ULTRIX-11 system responds by printing several messages such as copyright information, the time and date, and error file blocks.

The ULTRIX-11 system then displays the login prompt:

ULTRIX-11 System v2.0 (system)

login:

system is the name you gave your ULTRIX-11 site. The ULTRIX-11 operating system is now in multiuser mode and is ready to accept user logins.

6.2. Logging in to the System

To log in to the ULTRIX-11 system, enter the account name at the login prompt. If the account has a password, you must enter it when the system displays the password prompt. If the login is unsuccessful (for example you misspell your login name or password), the system informs you and then repeats the login prompt. You can try again.

After a successful login, the ULTRIX-11 system prints the # prompt if you are the superuser. For all other users, the

6-2 Completing the Installation

ULTRIX-11 system prints a % prompt if you are running the C shell (/bin/csh), or a \$ prompt if you are running the Bourne shell (/bin/sh).

6.3. Logging out of the System

To log out of the ULTRIX-11 system, press <CTRL/D>. The system then responds with the login prompt, indicating that the terminal is available for another user to log in.

6.4. Creating User Account Passwords

As distributed, the ULTRIX-11 system does not have any passwords for its accounts. You should create passwords for every account on the system.

To create a password, log in to the account as the user and enter the passwd command.

The passwd command prompts you to enter a password, and then asks you verify it. The password must be at least six characters long. For example:

```
$ passwd
Changing password for name
New password:          (password does not echo)
Retype new password:   (password does not echo)
$
```

name is the login name for the account.

The password you enter does not echo on the terminal. Be sure to remember the new password.

6.5. Administering the System

The ULTRIX-11 system installation is now complete and your system is available for multiuser operation.

You must regularly perform such administrative functions as:

- Managing the error log file
- Checking all file systems for consistency and free space
- Backing up the file system
- Monitoring general system performance

Refer to Chapter 4, System Maintenance and Administrative Functions, in the ULTRIX-11 System Management Guide for detailed information about all system administration and maintenance functions.

Appendix A

Magnetic Tape Boot Programs

This appendix explains how to boot the system from magnetic tape.

Mount the distribution magnetic tape on drive 0. Make sure the tape drive is on line and ready, and the tape is rewound to load point (BOT).

Find your tape drive below, and manually deposit the instructions into the addresses listed. All addresses and their contents are given in octal.

Start the processor at address 10000. Following a brief period of tape motion, the Boot: prompt should print on the console terminal. If the boot fails, verify that the boot program instructions were loaded correctly, ensure that the tape is at load point, and try the boot again.

- TM11-TU10/TE10

<u>Address</u>	<u>Instructions</u>	<u>Assembler Code</u>
10000	12700	start: mov \$mtcma,r0
10002	172526	
10004	10040	mov r0,-(r0)
10006	12740	mov \$60003,-(r0)
10010	60003	
10012	105710	1: tstb (r0)
10014	100376	bpl 1b
10016	5007	clr pc

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- TM02/3-TU16/TE16/TU77

<u>Address</u>	<u>Instructions</u>	<u>Assembler Code</u>
10000	12700	
10002	172440	
10004	12737	
10006	40	mov \$40,*\$htcs2
10010	172450	
10012	12737	mov \$1300,*\$httc
10014	1300	
10016	172472	
10020	112710	
10022	71	movb \$71,(r0)
10024	105710	
10026	100376	1: tstb (r0)
10030	5007	bpl 1b
		clr pc

- TSV05/TK25

<u>Address</u>	<u>Instructions</u>	<u>Assembler Code</u>
07776	46523	
10000	12701	
10002	172522	
10004	10102	
10006	5000	start: mov \$tsdb+2,r1
10010	105711	
10012	100376	
10014	10704	mov r1,r2
10016	112737	clr r0
10020	200	
10022	172523	
10024	5242	
10026	105711	1: tstb (r1)
10030	100376	bpl 1b
10032	5711	mov pc,r4
10034	100761	movb \$200,*\$tsdb+3
10036	5007	
		inc -(r2)
		2: tstb (r1)
		bpl 2b
		tst (r1)
		bmi start
		clr pc

● TS11/TU80

<u>Address</u>	<u>Instructions</u>	<u>Assembler Code</u>
001000	140001	
001002	0	
001004	0	
001006	1000	
001010	140004	
001012	1012	
001014	0	
001016	10003	
001020	10702	
10000	12701	start: mov \$tstb,r1
10002	172520	
10004	10102	mov r1,r2
10006	5722	tst (r2)+
10010	105712	1: tstb (r2)
10012	100376	bpl 1b
10014	12711	mov \$1010,(r1)
10016	1010	
10020	105712	2: tstb (r2)
10022	100376	bpl 1b
10024	12711	mov \$1000,(r1)
10026	1000	
10030	105712	3: tstb (r2)
10032	100376	bpl 3\$
10034	5007	clr pc

Appendix B

Disk Media Qualification (bads, rabads, dskinit)

To use disk media with the ULTRIX-11 operating system, the media must either be completely free of bad blocks or be supported by the ULTRIX-11 bad block replacement software.

A bad block is defined as a disk block from which the operating system is unable to read valid data using normal hardware and software error recovery mechanisms.

This appendix describes the procedures to qualify disk media for use with the ULTRIX-11 operating system, which varies depending on the type of disk.

The ULTRIX-11 software includes three stand-alone programs to qualify and/or initialize disk media. The `bads` program scans the disk for bad blocks. The `rabads` program initializes Digital Storage Architecture (DSA) disks. The `dskinit` program formats and performs media surface verification on disks supported by the ULTRIX-11 bad block replacement software.

Table B-1 lists which of the three stand-alone programs can be used with each disk. Most of the disks are supported by more than one of the programs. The asterisk (*) indicates the program you use to qualify the disk for use with the ULTRIX-11 software. Use of the other programs is optional.

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Table B-1 Stand-alone Programs with Various Disks

<u>Disk</u>	<u>bads</u>	<u>rabads</u>	<u>dskinit</u>
RX50	yes	*	no
RK05	*	no	no
ML11	*	no	no
RL01	*	no	no
RL02	*	no	no
RC25	yes	*	no
RD51	yes	*	no
RD52	yes	*	no
RK06/7	yes	no	*
RP02/3	*	no	no
RA60	yes	*	no
RA80	yes	*	no
RA81	yes	*	no
RM02/3	yes	no	*
RM05	yes	no	*
RP04/5	yes	no	*
RP06	yes	no	*

Select the program indicated by an asterisk and use it to qualify your disk or disks. Refer to the appropriate sections for instructions on how to use the stand-alone program you need to qualify your disks:

- Section 1. Loading Stand-alone Programs
- Section 2. bads - Disk Bad Block Scan
- Section 3. rabads - MSCP Disk Initialization Program
- Section 4. dskinit - Disk Initialization Program

1. Loading Stand-alone Programs

The stand-alone media qualification programs (bads, rabads, dskinit) do not run under control of the ULTRIX-11 operating system. You use the ULTRIX-11 boot program to load and run stand-alone programs.

Before you can load a stand-alone program, you must follow these steps to load the boot program:

1.1. Shut Down the Operating System

If the operating system is running, use the operator services program to shut down the system to single-user mode and then halt the processor. Refer to Chapter 5, ULTRIX-11 Operator Services, in the ULTRIX-11 System Management Guide for operator services program instructions.

1.2. Load the Boot Program

You can load the boot program from your system disk or one of four distribution media.

To load the boot program, use the method below that corresponds with your type of load media:

- Loading boot from RX50 diskette.

Mount the boot diskette in RX50 drive 2.

Use your hardware bootstrap to boot RX50 unit 2.

After a successful RX50 boot, the system displays this prompt:

Sizing Memory...

To list options, type help then press <RETURN>

Boot:

- Loading boot from magnetic tape.

Mount the distribution magnetic tape on drive 0. Be sure the tape drive is on line and ready, and the tape is rewound to load point (BOT).

Boot the tape by executing your hardware bootstrap or one of the magnetic tape boot programs in Appendix A, Magnetic Tape Boot Programs.

After successfully booting, the system displays this prompt:

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Sizing Memory...

To list options, type help then press <RETURN>

Boot:

- Loading boot from a disk.

Mount the disk in drive 0, unless you are loading from an RC25 system disk. Be sure the drive is on line and ready. The disk can be your system disk or the "ROOT AND /USR" disk from the RL02 or RC25 distribution kit.

Read all the instructions in this step before continuing. Use your hardware bootstrap to boot the disk. If you are loading the boot program from an RC25 system disk, boot unit 1. Otherwise, boot unit 0.

After a successful disk boot, the system displays this prompt:

Sizing Memory...

Boot: xx(y,0)unix (<CTRL/C> aborts auto-boot)

NOTE

The xx represents the 2-character ULTRIX-11 name for the disk such as hk, hp, ra, rc, rd, rl, or rp. The y represents the disk unit number.

As soon as this message appears, interrupt the automatic boot by pressing <CTRL/C>.

The boot program cancels the automatic boot and prints:

To list options, type help and press <RETURN>

Boot:

There may be a delay of several seconds between the time you press <CTRL/C> and when the Boot: prompt appears.

NOTE

If you wait too long to press <CTRL/C>, the operating system loads into memory and begins printing several messages. In this case, halt the processor and repeat this step from the beginning.

1.3. Verify Device Hardware CSR Addresses

If your devices are configured at the standard Control and Status Register (CSR) address, omit this section and continue with the next one, Load the Stand-alone Boot Program. In most cases, your devices are at the standard CSR address. The most common exception to this is when multiple MSCP disk controllers are present. Use Table B-2 to verify that the boot program's device CSR address table matches your hardware configuration.

Table B-2 Standard CSR Addresses for Various Devices

<u>Name</u>	<u>CSR</u>	<u>Device Type</u>
hk	177440	RK06/7
hp	176700	RM02/3/5, RP04/5/6, ML11 (1st RL11/RH70)
hm	176300	RM02/3/5, RP04/5/6, ML11 (2nd RL11/RH70)
hj	176400	RM02/3/5, RP04/5/6, ML11 (3rd RL11/RH70)
ra	172150	RA60/RA80/RA81
rc	172150	RC25
rd	172150	RD51/RD52
rx	172150	RX50
rk	177400	RK05
rl	174400	RL01/2
rp	176710	RP02/3
ht	172440	TU16/TE16/TU77
tm	172520	TU10/TE10/TS03
ts	172520	TS11/TU80/TSV05/TK25

If you have any devices at nonstandard CSR addresses, use the csr command to enter the correct CSR address in the boot program's address table. To use this command, type csr in response to the Boot: prompt.

The boot program asks if you want to print its current device CSR address table. Type y to print the list of addresses or n not to print it.

Enter the 2-character ULTRIX-11 name for the device, (see Table B-2, Standard CSR Addresses for Various Disks).

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Enter the correct CSR address for the device.

The boot program asks you to confirm your entry. If you answer y, the device's entry in the boot CSR address table is updated. If you answer n, the table is not modified.

You can verify the change of address by asking the boot program to print its device CSR address table.

1.4. Load the Stand-alone Program

To load the stand-alone program, use the command below that corresponds with the program you want to use:

- Loading from RX50 diskette.

To load a stand-alone program from an RX50 diskette, type:

Boot: rx(2,0)prog

prog is bads, rabads, or dskinit, depending on which stand-alone program you are using (see Table B-1, Stand-alone Programs with Various Disks).

- Loading from magnetic tape.

To load a stand-alone program from magnetic tape, type one of these commands at the Boot: prompt:

<u>Command</u>	<u>Controller Type</u>
<u>tm(0,0)prog</u>	(TM11 controller at 800 bits/in)
<u>ht(0,0)prog</u>	(TM02/3 controller at 800 bits/in)
<u>ht(4,0)prog</u>	(TM02/3 controller at 1600 bits/in)
<u>ts(0,0)prog</u>	(TS11 controller at 1600 bits/in)
<u>ts(0,0)prog</u>	(TSV05 controller at 1600 bits/in)
<u>ts(0,0)prog</u>	(TU80 controller at 1600 bits/in)

prog is bads, rabads, or dskinit, depending on which stand-alone program you are using.

For example, to load the dskinit program from an 800 bits/in tape on a TM11 controller, type:

Boot: tm(0,0)dskinit

- Loading from a disk.

To load a stand-alone program from your disk, type:

Boot: xx(y,0)/sas/prog

Substitute the 2-character ULTRIX-11 disk name for xx. Refer to Table B-2 for the name of your disk.

y is the unit number of your disk. It is 1 for an RC25 system disk and 0 for all other disks.

prog is the name of the stand-alone program you are using: bads, rabads, or dskinit.

For example, to load the bads program from an RL02 disk, type:

Boot: r1(0,0)/sas/bads

After successfully loading, the stand-alone program prints an initial message and then its prompt.

Proceed now to the section pertaining to the stand-alone program you are using:

Section 2. bads - Disk Bad Block Scan

Section 3. rabads - MSCP Disk Initialization Program

Section 4. dskinit - Disk Initialization Program

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2. **bads - Disk Bad Block Scan Program**

You use the **bads** program to scan the disk media for bad blocks. You can also use the **bads** program to print the contents of the disk's bad block file, if one exists.

The **bads** program identifies bad blocks by reading each block and checking for hardware-detected errors. The bad block scan is read only. It does not write test data patterns on the disk prior to the scan, and it does not do a data compare test.

Follow the instructions in Section 1, Loading Stand-alone Programs, to load the **bads** program. After successfully loading, the **bads** program prints this message:

```
Quick Bad Block Scan Program
```

```
Disk type <cr to exit, ? for list of disks>:
```

To scan the disk, type the generic name of your disk, such as **r102** or **rp06**. If you type a "?", the **bads** program prints a list of the generic disk names.

For MASSBUS disks, you specify a controller number in addition to the generic disk name. This is necessary because the MASSBUS disk software device driver supports multiple controllers. A generic disk type can appear on more than one disk controller. For example, the system could have **RP06** disks on the first and second RH11/RH70 controllers.

You specify a controller number by appending **_#** to the end of the generic disk name. The **#** is the controller, such as **0**, **1**, **2**, or **3**. For example, **rp05_1**, **rp04_1**, **rm02_2** and **m111_1** all specify disks on controllers other than the first one. Note that the first controller is **0**, not **1**. If the disk is on the first MASSBUS disk controller, you do not need to append **_0** to the generic disk name. Controller **0** is the default. Respond to the "Disk type" prompt with a **?** for a list of the disks that can appear on more than one controller.

The **bads** program prompts you for this information:

- Unit number:

Enter the unit number of the disk to be scanned for bad blocks.

- Print bad sector file <[y] or n> ?

The **bads** program prints this message only if the disk is supported by the ULTRIX-11 bad block replacement software. Supported disks are RK06, RM02/3/5, and RP04/5/6.

To print the bad block file, type y. Type n to skip the bad block file printout.

- Scan disk pack for bad blocks <[y] or n> ?

Type y to scan the disk for bad blocks or n to abort the scan and return to the Disk type: prompt.

- Block offset:

Type 0 to start the scan at the beginning of the disk or type the block number where you would like the scan to begin.

- # of blocks <cr for full pack>:

Press <RETURN> to check the entire disk, or type the number of blocks to be checked.

The **bads** program scans the specified area of the disk and reports any bad blocks found. Then, the program prints a bad block summary. The bad block summary indicates whether or not your disk media can be used with the ULTRIX-11 software.

For the disks supported by the ULTRIX-11 bad block replacement software (RK06/7, RM02/3/5, RP04/5/6), the number of bad blocks found might not be zero. This is acceptable for these disks because the software revectorizes the bad blocks to alternate blocks. The **bads** program prints a FATAL error message if it finds too many bad blocks. For all other disks, the number of bad blocks found must be zero.

After the bad block summary, the program again asks for the disk type. You can scan another disk by entering its type or press <RETURN> to exit from the **bads** program and return to the Boot: prompt.

This example shows how to use the **bads** program to scan an RL02 and an RK06 disk pack. The **bads** program has already

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been loaded:

Quick Bad Block Scan Program

Disk type <cr to exit, ? for list of disks>: r102

Unit number: 0

Scan disk pack for bad block <[y] or n> ? y

Block offset: 0

of blocks <cr for full pack>: <RETURN>

READING

20480 blocks checked

0 bad blocks found

Disk type <cr to exit, ? for list of disks>: rk06

Unit number: 2

Print bad sector file <[y] or n> ? y

Bad sector file at block 27104 of hk(2,0)

Cartridge serial number: 32657

Block	Cyl	Trk	Sec
19372	293	1	12

Scan disk pack for bad blocks <[y] or n> ? y

Block offset: 0

of blocks <cr for full pack>: <RETURN>

READING

HK unit 2 disk error:

cs1=100220 cs2=102 ds=100301 err=200 hkdc=293 track=1 sect=12

Block	Cyl	Trk	Sec
19372	293	1	12

BAD SECTOR

HK 2 ECC bn = 27125

27126 blocks checked

1 bad blocks found

Disk type <cr to exit, ? for list of disks>: <RETURN>
Exit called

Boot:

3. rabads - MSCP Disk Initialization Program

You use the rabads program to qualify RX50, RD51, RD52, RA60, RA80, and RA81 disks for use with the ULTRIX-11 software. All MSCP disks except the RX50 must be initialized by the rabads program before they can be used with the ULTRIX-11 operating system. Only the system disk is initialized by the automatic installation procedure. You must manually run the rabads program on any additional MSCP disks.

For the RX50 disk, rabads only identifies bad blocks. For all other MSCP disks, rabads identifies bad blocks and takes the appropriate action to cause the disk hardware to replace them. The disk hardware replaces a bad block by revectoring it to a replacement block.

NOTE

The rabads program must run to completion. If the program is interrupted at any time, start rabads again. If rabads is interrupted during a bad block replacement, the system informs you when the disk is brought on line.

Follow the instructions in Section 1, Loading Stand-alone Programs, to load the rabads program. After successfully loading, the rabads program prints this message:

ULTRIX-11 MSCP Disk Initialization Program

rabads <help exit drives status table init replace>:

To execute one of the rabads commands, type the first letter of the command. For example, to obtain on-line help, type:

rabads <help exit drives status table init replace>: h

The rabads program has these commands:

help prints the on-line help message.

exit gets you out of the rabads program and returns you to the Boot: prompt.

drives lists the disks that the rabads program supports.

status prints the disk status and geometry information:

controller type and microcode revision level
drive type and status (on-line or off-line)
size of the disk in blocks disk geometry

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information

table prints the disk's Revector Control Table (RCT).

The RCT contains the information that the controller needs to accomplish bad block replacement.

init initializes the disk for use with the ULTRIX-11 software.

The init command reads the specified area of the disk, usually the entire disk, and identifies any bad blocks. If it finds a bad block, the program causes the controller to replace that block.

NOTE

Be sure the disk is WRITE ENABLED if you are using the init command.

replace forces a specified disk block to be replaced.

The replace command lets you force any specified block to be replaced. Be cautious with this command. Once a block has been replaced, it is permanently revectored to the replacement block.

NOTE

Be sure the disk is WRITE ENABLED if you are using the replace command.

Use the init command to initialize the disk. This command prompts you for this information:

- Disk type <ra60 ra80 ra81 rx50 rd51 rd52 rc25>:

Type the generic name of the disk you are initializing. Select from the list of disks enclosed in the angle brackets.

- Unit number <0-7>:

Type the unit number of the disk you are initializing.

- Starting block number <0>:

Enter the starting block number of the area of the disk you are initializing. You should type 0, which initializes the entire disk.

- Number of blocks to check <xxxxxx>:

xxxxxx is the size of the disk you are initializing in blocks. Enter the size in blocks of the area of the disk you are initializing. You should type the number enclosed in angle brackets (xxxxxx). This initializes the entire disk.

- Rewrite blocks written with "forced error" (? for help) <y or n> ?

The on-line help message explains the meaning of "forced error." When you are initializing a new disk to be used with the ULTRIX-11 software, you must answer yes to this question. For more information, refer to Section 4.3, Dynamic Bad Blocks on MSCP Disks, in the ULTRIX-11 System Management Guide.

The rabads program initializes the specified area of the disk and reports the number of bad blocks found. The program also reports the number of bad blocks that were successfully replaced.

You can use the initialized disk with the ULTRIX-11 software if the number of bad blocks replaced equals the number of bad blocks found. If these numbers are not equal, you cannot use the disk.

Here is a sample rabads dialogue for initializing a new RA60 disk:

```
ULTRIX-11 MSCP Disk Initialization Program
rabads <help exit drives status table init replace>: i
disk type <ra60 ra80 ra81 rx50 rd51 rd52 rc25>; ra60
unit number <0-7>: 0
Starting block number <0>: 0
Number of blocks to check <400176>: 400176
Rewrite blocks written with "forced error" <? for help> <y or n> ? Y
READING...
400176 blocks checked
0 bad blocks found
0 bad blocks replaced
```

4. dskinit - Disk Initialization Program

The dskinit program initializes disks supported by the ULTRIX-11 bad block replacement software (RK06/7, RM02/3/5, RP04/5/6). The system disk is initialized during the automatic installation procedure. You must manually run the dskinit program to initialize any additional RK06/7, RM02/3/5, or RP04/5/6 disks.

The dskinit program can perform any or all of these functions:

- Print the bad block file, if one exists
- Format the disk media
- Perform disk media surface verification
- Add new entries to the bad block file

Follow the instructions in Section 1, Loading Stand-alone Programs, to load the dskinit program. After successfully loading, the dskinit program prints this message:

Disk Surface Verify and Format Program

Disk type <cr to exit, ? for list of disks>:

Type the generic name of your disk, such as rp06 or rk07. If you type a "?", dskinit prints a list of the generic disk names.

For MASSBUS disks, you specify a controller number in addition to the generic disk name. This is necessary because the MASSBUS disk software device driver supports multiple controllers. A generic disk type can appear on more than one disk controller. For example, the system could have RP06 disks on the first and second RH11/RH70 controllers.

You specify a controller number by appending # to the end of the generic disk name. The # is the controller, such as 0, 1, 2, or 3. For example, rp05_1, rp04_1, rm02_2 and rm05_1 all specify disks on controllers other than the first one. Note that the first controller is 0, not 1. If the disk is on the first MASSBUS disk controller, you do not need to append _0 to the generic disk name. Controller 0 is the default. Respond to the "Disk type" prompt with a ? for a list of the disks that can appear on more than one controller.

The dskinit program prompts you for this information:

- Unit number:

Enter the unit number of the disk you are initializing.

- Bad block file.

The program prints the location and contents of the bad block file. It then prints the next prompt.

- Add to bad blocks file <y or [n]> ?

You can manually add blocks to the bad block file and have them replaced by an alternate block.

For new disk packs, you should answer n to this question and y to the following question about initializing the pack. This lets dskinit automatically detect all bad blocks and enter them into the bad block file.

If you type y, you must enter a list of new bad block entries. Each entry consists of the cylinder, track, and sector address of the bad block, in decimal. Beginning a line with <RETURN> terminates the list. The dskinit program makes the new entries and prints the new bad block file.

- Initialize pack <y or [n]> ?

The dskinit program asks if you want to initialize the disk. If you type n, dskinit exits and returns you to the Boot: prompt. This lets you make new entries in the bad block file without formatting or verifying the disk.

If you type y, the disk initialization process continues.

- Format disk <y or [n]> ?

The program asks if you want to format the disk. Type y for yes, or n for no.

Formatting involves organizing the data bits on each disk track into 512 byte sectors and writing the appropriate format information in the header words of each sector.

Disk packs are formatted at the factory and do not require reformatting unless they are formatted incorrectly. To see if your disk requires reformatting, you can use the bads program to determine the state of the disk. If the bads program can read the disk, then you do not need to reformat the disk. If the bads

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program cannot read the disk, type y in response to this prompt and dskinit reformats the disk for you.

- Use current bad sector file <y or [n]> ?

If you answer y, the current bad block file is retained and any new bad blocks found during verification are entered into the current bad block file.

If you answer n, the contents of the current bad block file are destroyed and only the bad blocks found during verification are entered into the bad block file.

Always answer y to this prompt unless you are sure the disk pack has no bad block file, or you want to completely reinitialize the bad block file.

At this point, dskinit may prompt you for the disk pack serial number. The serial number is located on the bottom of the disk pack.

- number of patterns <1 to 8> ?

The program prompts for the number of test patterns to use for surface verification.

The more test patterns you use, the more thorough the surface verification. However, each pattern requires 10-90 minutes to run, depending on the size of the disk. Table B-3 gives the length of time required to run each test pattern on each disk.

Table B-3 Time Per Pattern to Run Surface Verification

<u>Disk</u>	<u>Minutes/Pattern</u>
RK06	10
RK07	20
RM02	20
RM03	15
RM05	90
RP04/5	30
RP06	60

This example shows how to initialize an RK06 disk pack with the dskinit program. After completing the initialization, dskinit prompts you for the disk type. You can initialize another disk or you can press <RETURN> to exit from dskinit and be returned to the Boot: prompt.

Disk Surface Verify and Format Program

Disk type (cr to exit): rk06

Unit number: 2

Bad sector file at block 27104 of hk(2,0)

Cartridge serial number: 32657

Block	Cyl	Trk	Sec
19372	293	1	12

Add to bad blocks file <y or [n]> ? y

Adding to bad block sector information

Format is (cylinder track sector) in decimal. (cr to end)

293 1 13

Revectoring block 19373 cyl = 293 trk = 1 sec = 13

Writing bad sector file starting at block 27104 of hk(2,0)

Bad sector file at block 27104 of hk(2,0)

Block	Cyl	Trk	Sec
19372	293	1	12
19373	293	1	13

Initialize Pack <y or [n]> ? y

Format disk (y or [n]) ? n

Use current bad sector file ([y] or n) ? y

Bad sector file at block 27104 of hk(2,0)

number of patterns <1 to 8> ? 1

Pattern 1 = 072307135143

WRITING

HK unit 2 disk error:

cs1=100222 cs2=202 ds=100301 err=200 hkdc=293 track=1 sect=12

HK unit 2 disk error:

cs1=100222 cs2=202 ds=100301 err=200 hkdc=293 track=1 sect=13

READING

HK unit 2 disk error:

cs1=100220 cs2=202 ds=100301 err=200 hkdc=293 track=1 sect=12

HK unit 2 disk error:

cs1=100220 cs2=202 ds=100301 err=200 hkdc=293 track=1 sect=13

Verify Complete

No additional bad blocks found

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Bad sector file at block 27104 of hk(2,0)
Cartridge serial number: 32657

Block	Cyl	Trk	Sec
19372	293	1	12
19373	293	1	13

Disk type (cr to exit):
Exit called

Boot
:

Appendix C

System Generation Examples

This appendix provides two examples of the system generation program, sysgen. The first example is of sysgen running on a Micro/PDP-11 processor, and the second example is of sysgen running on a PDP-11/44 processor.

The examples show most of the on-line help messages and sysgen's prompts.

You must press <RETURN> after entering all responses to sysgen's prompts. The <RETURN> is not shown in the examples. Throughout the examples, a prompt with no user response after it indicates a response of <RETURN>, only.

Proceed now to Section 1, First sysgen Example - Micro/PDP-11, or Section 2, Second sysgen Example - PDP-11/44.

C-2 sysgen Examples

1. First sysgen Example - Micro/PDP-11

Enter the sysgen command and answer all the prompts:

```
# sysgen  
  
ULTRIX-11 System Generation Program  
  
For help, type h then press <RETURN>  
  
sysgen> h
```

The "sysgen>" prompt indicates the sysgen program is ready to accept commands. To execute a command you type the first letter of the command, then press <RETURN>. Some of the commands will ask you for additional information, such as a file name. For more help with a command, type h followed by the command letter then press <RETURN>. For example, "h c" for the create command.

Command	Description
<CTRL/D>	Exit from sysgen (backup one question in "c" command).
<CTRL/C>	Cancel current command, return to "sysgen>" prompt.
!command	Escape to the shell and execute "command".
[c]reate	Create an ULTRIX-11 kernel configuration file.
[r]emove	Remove an existing configuration file.
[l]ist	List names of all existing configuration files.
[p]rint	Print a configuration file.
[m]ake	Make the ULTRIX-11 kernel.
[i]nstall	Print instructions for installing the new kernel.
[d]evice	List configurable processors and peripherals.
[s]ource	Compile and archive a source code module (u1.c, etc.).

The sysgen sequence is: use "c" to create the configuration file, "m" to make the new kernel, and "i" for installation instructions.

```
sysgen> d
```

Memory managed PDP-11 processors:

(23, 23+, 24, 34, 40, 44, 45, 55, 60, 70, 73)

Disk Controllers:

Number	Name	Description
1	hp	(first) RH11/RH70 - 8 RM02/3/5, RP04/5/6, ML11
1	hm	(second) RH11/RH70 - 8 RM02/3/5, RP04/5/6, ML11
1	hj	(third) RH11/RH70 - 8 RM02/3/5, RP04/5/6, ML11
1	hs	RJS04 (RH11/RH70) with up to 8 RS03/4
1	hk	RK611/RK711 with up to 8 RK06/7
1	ra	UDA50 with up to 4 RA80/RA81/RA60
1	rc	KLESI with up to 2 RC25 (4 units)
1	rd/rx	RQDX1 with up to 4 RD51/RD52/RX50
1	rx	RUX1 with up to 4 RX50
1	rp	RP11 with up to 8 RP02/3
1	rl	RL11 with up to 4 RL01/2
1	rk	RK11 with up to 8 RK05
1	hx	RX211 with one dual RX02 drive

Press <RETURN> for more:

Magtape Controllers:

Number	Name	Description
1	ht	TM02/3 with up to 64 TU16/TE16/TU77
1	tm	TM11 with up to 8 TU10/TE10/TS03
1	ts	TS11/TSV05/TU80/TK25

Miscellaneous Devices:

Number	Name	Description
1	lp	LP11 controller with 1 LP11 type printer
1	ct	C/A/T phototypesetter interface via DR11-C

Press <RETURN> for more:

Communications Devices:

Number	Name	Description
8	dh	DH11 16 line asynchronous multiplexer
8	dhd़m	DM11-BB modem control option for DH11
8	dhu	DHU11 16 line asynchronous multiplexer
4	dhv	DHV11 8 line asynchronous multiplexer
16	dz	DZ11 8 line asynchronous multiplexer
8	dzv	DZV11 4 line asynchronous multiplexer
8	dzq	DZQ11 4 line asynchronous multiplexer
16	kl	DL11/DLV11 single line unit (CSR 776500)
32	d़l	DL11/DLV11 single line unit (CSR 775610)
4	du	DU11 single line synchronous interface
1	dn	DN11 4 line auto call unit interface

sysgen> c

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For help, answer the question with ?<RETURN>
To backup to the previous question, type <CTRL/D>

Configuration name <unix> ? ?

To use the default configuration name of "unix", press <RETURN>.

To use an alternate configuration name, enter the name and press <RETURN>. The configuration name is limited to a maximum length of eight characters. Digital recommends you use only alphanumeric characters in the configuration name.

Configuration name <unix> ?

Configuration file exists, overwrite it <no> ? y

Processor type:

(23 23+ 24 34 40 44 45 55 60 70 73) < 23 > ? ?

If the new kernel is being generated for the current CPU, press <RETURN>. The number enclosed in <>, which is the current CPU type, will be used. If the new kernel is for another system enter the numeric portion of the processor type name, then press <RETURN>. The numbers enclosed in () list the supported CPU types.

For example, you would enter 70 for the PDP11/70 or 23+ for a PDP11/23 plus processor.

The Micro/PDP-11 may be any of the following processor types:

23+ - KDF11-B (F11)
73 - KDJ11-A (J11)
83 - KDJ11-B (J11)

If the target processor is not listed, select the processor type that most closely resembles your processor. Remember, separate I and D space is the most important processor feature.

Processor type:

(23 23+ 24 34 40 44 45 55 60 70 73) < 23 > ? 23+

Memory size in K bytes (K = 1024) < 512 > ? ?

Sysgen is requesting the amount of memory on the target processor. The memory size is specified in K bytes, where, K is 1024 bytes. If the new kernel is being generated for the current CPU, press <RETURN> to use the value enclosed in <>, which is the current processor's memory size. If the new kernel is for another system, enter the memory size then press <RETURN>.

For example, if the processor has 256 K bytes of memory, you would enter 256, if the processor has one megabyte of memory you would

sysgen Examples C-5

enter 1024.

The minimum memory size is 192K bytes. The maximum memory size is 3840K bytes. 3840K bytes is four megabytes of memory minus the 256K bytes of address space reserved for the I/O page.

Memory size in K bytes (K = 1024) < 512 > ? 512

I/O buffer cache size (NBUF: min = 16, max = 200) < 100 > ? ?

NBUF sets the size of the I/O buffer cache in the ULTRIX-11 kernel. Increasing the number of buffers should improve system performance. However, increasing NBUF also increases the amount of memory consumed by the operating system. Digital recommends you use the default NBUF for the initial system generation and delay experimenting with the size of the buffer cache until reliable system operation has been established.

To use the default value for NBUF, press <RETURN>. To change the size of the I/O buffer cache, enter the number of buffers then press <RETURN>.

Each NBUF costs 30 bytes of kernel data space for the buffer header and 512 bytes of memory (outside of kernel data space) for the actual buffer.

I/O buffer cache size (NBUF: min = 16, max = 200) < 100 > ? 100

Please enter the system (ROOT) disk controller first.

Disk controller type:

< rh11 rh70 rp11 rk611 rk711,
 r111 rx211 rk11 uda50 rqdx1 klesi rjs04 rux1 > ? ?

Sysgen is requesting a list of all the disk controllers to be configured into the kernel. Enter the name of the system disk controller first, then enter the names of the other controllers on your system. When you have entered all your disk controllers, terminate the list by pressing <RETURN>. Consult the list below for the names and usage each type of disk controller.

When you enter a disk controller name, sysgen will ask a series of questions about the controller and the drives connected to it. Type the answer to each question then press <RETURN>. Remember, you can just press <RETURN> to use the default answer or ?<RETURN> for help.

Note - all of the Q22 bus controllers may be used on processors with the 18 bit Q bus (jumper selectable). CAUTION, if a Q bus controller (rxv21, rlv11) is used on a processor with the Q22 bus, the disk may be accessed in buffered I/O mode only. Attempting RAW I/O transfers will cause errors. The PDP11/23 has an 18 bit Q bus, PDP11/23+ has a Q22 bus.

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Press <RETURN> for more:

Name	Usage	Disk Drives Supported
rh11	Unibus	RM02, RP04/5/6, ML11
rh70	11/70 Massbus	RM02/3/5, RP04/5/6, ML11
rp11	Unibus	RP02/3
rk611	Unibus	RK06/7
rk711	Unibus	RK06/7
rl11	Unibus	RL01/2
rlv11	Q bus	RL01/2 (* specify rl11)
rlv12	Q22 bus	RL01/2 (* specify rl11)
rx211	Unibus	RX02
rxv21	Q bus	RX02 (* specify rx211)
rk11	Unibus	RK05
uda50	Unibus	RA60, RA80, RA81
rqdx1	Q22 bus	RX50, RD51, RD52
rux1	Unibus	RX50
klesi	Unibus/Q22 bus	RC25
rjs04	Unibus	RS03/4

Disk controller type:

```
< rh11 rh70 rp11 rk611 rk711,
  rl11 rx211 rk11 uda50 rqdx1 klesi rjs04 rux1 > ? rqdx1
```

First MSCP disk controller:

```
Drive 0 type < rx50 rd51 rd52 > ? ?
```

Sysgen is requesting a list of the drives connected to the disk controller. The names enclosed in < > are the drive types that may be attached to the specified disk controller. Enter the type of each drive, in order, starting with unit zero. To terminate the list of drive types, just press <RETURN>.

Sysgen assumes the disk units are numbered sequentially, starting with unit zero. To allow for non-sequential unit numbering, a drive type may be entered even if the disk drive is not physically present. The operating system will ignore any non-existent units. For example, if three RP06 disks are to be numbered 0, 1, and 4, you would also specify drives two and three as RP06 disks. Drives two and three would be ignored by the system. Non-sequential unit numbering is not recommended, because it wastes kernel data space by allocating slots in the disk driver information tables for non-existent drives.

```
Drive 0 type < rx50 rd51 rd52 > ? rd51
```

```
Drive 1 type < rx50 rd51 rd52 > ? rx50
```

```
Drive 2 type < rx50 rd51 rd52 > ? rx50
```

```
Drive 3 type < rx50 rd51 rd52 > ?
```

CSR address <172150> ? ?

The number enclosed in < > is the default CSR address for the device. To use the default CSR address, press <RETURN>. If the device is not configured at the default CSR address, enter the actual address, then press <RETURN>. CSR addresses are always entered as octal numbers.

A device's CSR address specifies the I/O page address used by the operating system to access the device. The term CSR actually denotes the Control and Status Register, which is normally the first in a group of I/O page registers for the device.

CSR address <172150> ?

Vector address <154> ? ?

The number enclosed in < > is the default interrupt vector address for the device. To use the default vector, press <RETURN>. If the device is not configured at the default vector address, enter the actual vector address followed by <RETURN>. The vector address is always entered as an octal number.

A device's vector address is the address the processor will use to vector to the interrupt service routine for the device. The vector area is in low memory (locations 0 - 0776).

Vector address <154> ?

Is the system disk on this controller <yes> ? ?

Sysgen is asking if the system disk is connected to the current disk controller. The system disk is where the ULTRIX-11 ROOT file system is located. Sysgen will ask this question only if the system disk has not already been specified.

If the system disk is on this controller, enter yes<RETURN> or just <RETURN>. If not, enter no<RETURN>.

Is the system disk on this controller <yes> ? yes

System disk unit number <0> ? ?

Sysgen is asking for the unit number of the system disk. The default unit number is <1> for the RC25 and <0> for all other disks. To use the default unit number, press <RETURN>.

You can specify a different unit number by entering the number followed by <RETURN>. If you do not use the default unit number, the following items must be considered:

- Not all hardware bootstraps can boot from units other than zero. You can load the boot from the distribution tape.

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- The boot file specification will change. For example, unit two would be ??(2,0)unix, where ?? is the disk mnemonic.
- The /etc/fstab must be modified, see fstab(5) in the ULTRIX-11 Programmer's Manual, Volume 1.
- You must remake the file /dev/swap so that commands can access the swap area, see /dev/makefile.

System disk unit number <0> ? 0

Disk controller type:

```
< rh11 rh70 rp11 rk611 rk711,  
 r11 rx211 rk11 uda50 rqdx1 klesi rjs04 rux1 > ?
```

Use standard placement of root, swap, and error log <yes> ? ?

Sysgen contains tables that define the standard location of the ULTRIX-11 ROOT, PIPE, SWAP, and ERROR LOG file systems on each type of disk. Digital strongly recommends you use the standard placements for these file systems. Type yes<RETURN> or just <RETURN> to use the standard placements.

If you intend to experiment with the placement of these file systems, wait until the initial system installation has been completed and reliable system operation is established before generating a system with nonstandard placements. Also, backup your disks before booting a kernel with nonstandard placements!

To use nonstandard placements, answer no<RETURN>. Sysgen will ask a series of questions about the placement of the ROOT, SWAP, PIPE, and ERROR LOG file systems. Along with each question sysgen will print a default value, enclosed in <>, which is the standard placement for the item in question. You may use the default value or enter a new value. WARNING, sysgen accepts your answers without checking them for errors!

Press <RETURN> for more:

The following hints may be helpful:

- Placing the ROOT and SWAP on separate disk controllers will improve system performance. Placing them on different drives on the same controller is of little benefit.
- If the system make heavy use of pipes, placing the PIPE device on a separate disk controller should improve system performance. Otherwise PIPE and ROOT should be the same.
- All four file systems may exist within the same partition. Care must be taken to prevent file system overlap.
- The mkconf program (called by sysgen to make the kernel)

does some checking of file system placements.

- Some of the auto-boot features may not function with non-standard placements of the ROOT, PIPE, SWAP, and ERROR LOG. Refer to Section 3 of the ULTRIX-11 System Management Guide.
- If the standard placements are not used, the only available crash dump devices will be magtape and RQDX1/RX50 (unit 2).

Use standard placement of root, swap, and error log <yes> ?

Magtape controller:

```
< tm02 tm03 tm11 ts11 tsv05 tu80 tk25 > ?
```

Sysgen is requesting a list of the magtape controllers to be configured into the new kernel. Most systems will have only a single magtape controller, however, multiple controllers may be included. Only one of each type controller may be configured, that is, one TM02/3, one TM11, one TS11/TU80/TSV05/TK25.

Enter a magtape controller name, from the list below, then press <RETURN>. Sysgen will ask several questions about the controller and the drives connected to it. Answer each question then press <RETURN>. After you have entered the last magtape controller, terminate the list of controllers by pressing <RETURN>.

Name	Usage	Tape Drives Supported
---	----	-----
tm02/3	Unibus	TU16, TE16, TU77
tm11	Unibus	TU10, TE10, TS03
ts11	Unibus	TS11
tsv05	Qbus/Q22bus	TSV05
tu80	Unibus	TU80
tk25	Qbus/Q22bus	TK25

Magtape controller:

```
< tm02 tm03 tm11 ts11 tsv05 tu80 tk25 > ?
```

Crash dump device < rx50 rd51 ?

Sysgen is requesting the name of the crash dump device. Select the crash dump device from the list of names enclosed in < >. Enter the name then press <RETURN>. There is no default crash dump device, you must enter one of the names from the list.

The ULTRIX-11 system takes a crash dump by writing an image of memory to the crash dump device. The "memory image" is copied to a file on the system disk for analysis by the CDA (Crash Dump Analysis) program.

Digital recommends you select a magtape for the crash dump device if one is available. This will ensure that all of the system's

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memory will be saved in the crash dump.

If a magtape is not available, the crash dump can be written to the swap area of the system disk. If the system disk controller is an RQDX1, you may select the RX50 floppy disk drive as the crash dump device.

Depending on the type of disk and the amount of memory, the swap area may not be large enough to hold the entire "memory image". In this case, some crash dump data may be lost.

Crash dump device < rx50 rd51 > ? rx50

LP11 line printer present <no> ? ?

Communications devices:

< dz dzv dzq dh dhu dhv dhdm du dn k1 d1 > ? ?

Enter the name of one of the communications devices listed below, then press <RETURN>. Sysgen will ask questions about the device. Answer these questions, then enter the name of the next device to be configured. If there are no more communications devices, press <RETURN> to terminate the list of devices.

Name	Device	Description
dz	DZ11	8 line multiplexer
dzv	DZV11	4 line DZ11 for Q bus
dzq	DZQ11	4 line multiplexer (DZV11 replacement)
dh	DH11	16 line multiplexer
dhdm	DM11-BB	DH11 modem control
dhu	DHU11	16 line multiplexer
dhv	DHV11	8 line DHU11 for Q bus
du	DU11	synchronous line interface
dn	DN11	auto-call unit interface
k1	DL11/DLV11	(CSR 776500) single line unit
d1	DL11/DLV11	(CSR 775610) single line unit

Press <RETURN> for more:

The first "k1" is reserved for the console terminal. The console terminal is automatically configured, do not count it in the "k1" specification. Use the "k1" and "d1" names for the equivalent DLV11 Q bus devices.

Communications devices:

< dz dzv dzq dh dhu dhv dhdm du dn k1 d1 > ? k1

Number of units <1> ?

CSR address <176500> ?

Vector address <300> ?

Communications devices:

< dz dzv dzq dh dhu dhv dhdm du dn k1 d1 > ? dzv

Number of units <1> ? ?

Enter the number of communications device units to be configured, then press <RETURN>. To use the default value of one unit press <RETURN>.

You can use the "d" command to list the maximum number of units allowed for each type of communications device.

Number of units <1> ?

CSR address <160100> ?

Vector address <300> ? 310

Communications devices:

< dz dzv dzq dh dhu dhv dhdm du dn k1 d1 > ?

Include C/A/T phototypesetter driver <no> ?

User devices:

< u1 u2 u3 u4 > ?

Include Kernel floating point simulator <no> ? ?

If your processor is equipped with floating point hardware, type no<RETURN> or just <RETURN>. If your processor does not have the floating point hardware, type yes<RETURN>. Including the floating point simulation code will allow programs to execute floating point instructions on a processor without floating point hardware.

If the processor does not have floating point hardware and the floating point simulation code is not included in the kernel, any program that executes floating point instructions will be core dumped with an illegal instruction trap.

Include Kernel floating point simulator <no> ? yes

Use standard system parameters <yes> ? ?

The ULTRIX-11 system parameters specify the size of the kernel's internal data structures, such as the process table. The values of these parameters are used to adjust the sizes of the internal data structures to match the expected system load, that is, the number of users and job mix.

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Sysgen contains a table of standard values for these parameters. Digital recommends that the standard parameters be used for the initial system generation, and that experimentation with the parameter values be delayed until reliable system operation is established. To use the standard parameters, answer yes<RETURN> or just <RETURN>.

To change the parameters, answer no<RETURN>. Sysgen will ask for the value of each parameter. Sysgen will also print the standard value of each parameter, enclosed in <>.

Press <RETURN> for more:

The system parameters are:

Param	OV_VAL	ID_VAL	COST	Description
NINODE	90	200	74	In-core inode table size
NFILE	80	175	8	Number of open files
NMOUNT	5	8	6	Number of mounted file systems
MAXUPRC	15	25	0	Maximum processes per user
NCALL	20	20	6	Number of callouts
NPROC	75	150	42	Number of processes allowed
NTEXT	25	40	12	Number of shared text segments
NCLIST	85	115	16	Number of cblocks in clist
CANBSIZ	256	256	1	TTY canon buffer size
NCARGS	5120	5120	0	Exec() argument list size
MSGBUFS	128	128	1	Error message buffer size
MAXSEG	61440	61440	0	Memory size limit
MAPSIZE	67	105	4	Core/swap map size

Use standard system parameters <yes> ? yes

Line frequency in hertz <60> ? ?

Enter the AC power line frequency then press <RETURN>. The default value is 60 hertz. The line frequency should be 60 hertz for the United States or 50 hertz for Europe. If you insist, sysgen will accept any value for the power line frequency. This allows for the one hertz variation in AC line frequency that occurs in some areas.

Line frequency in hertz <60> ?

Timezone (hours ahead of GMT) <5=EST 6=CST 7=MST 8=PST> ? ?

Sysgen is requesting the timezone for your local area. Specify the timezone as the number of hours ahead of GMT (Greenwich Mean Time). Do not include daylight savings time in the timezone specification. For example, Eastern Standard Time is five hours ahead of GMT.

Timezone (hours ahead of GMT) <5=EST 6=CST 7=MST 8=PST> ? 5

Does your area use daylight savings time <yes> ? ?

The operating system automatically compensates for the presence or absence of daylight savings time. If your local area uses daylight savings time, answer yes<RETURN> or just <RETURN>. If not, answer no<RETURN>.

Does your area use daylight savings time <yes> ?

ULTRIX-11 System Generation Program

For help, type h then press <RETURN>

sysgen> m

Configuration name <unix> ?

***** CREATING ULTRIX-11 CONFIGURATION AND VECTOR TABLES *****

Device Address Vector units

console	177560	60	
kw11-1	177456	100	
kw11-p	172540	104	
rq	172150	154	3 (crash dump device)
kl	176500	300	1
dzv	160100	310	1

Filsys Device maj/min start length

root	ra	2/0	
pipe	ra	2/0	
swap	ra	2/0	5868 2600
errlog	ra	20/0	5800 68

***** MAKING KERNEL FOR NON SEPARATE I & D SPACE PROCESSORS *****

```

as - -o l.o l.s
as -V -o dump_ov.o mch0.s dump.s
as -V -o mch_ov.o mch0.s mch.s
cc -c -O -DK_OV -DKERNEL -V c.c
mv c.o c_ov.o
cc -c -O -DK_OV -DKERNEL -V dds.c
mv dds.o dds_ov.o
cc -S -DKERNEL ec.c
ed - ec.s < :comm-to-bss
as - -o ec.o ec.s
rm ec.s

```

The output file will be named unix_ov !!!!!

ovload

The unix_ov sizes must be within the following limits:

C-14 sysgen Examples

```
root text segment > 8192 but <= 16384
overlay text segments <= 8192, 7 overlays maximum
bss + data segments <= 24576 total

root+(overlay 1, overlay 2,...overlay n)+data+bss = root+data = (total)
size unix.ov
15872+(8192,8192,8192,8064,8128,8192,1216)+2568+18748 = 37188b
= 0110504b (66048 total text)

rm *.o

New kernel is now named 'unix.os'!

***** CHECKING SIZE OF NEW ULTRIX-11 OPERATING SYSTEM *****
'unix.os' within limits, SYSGEN successful!

sysgen> ^D

#
```

2. Second sysgen Example - PDP-11/44

```
# sysgen
```

ULTRIX-11 System Generation Program

For help, type h then press <RETURN>

```
sysgen> h
```

The "sysgen>" prompt indicates the sysgen program is ready to accept commands. To execute a command you type the first letter of the command, then press <RETURN>. Some of the commands will ask you for additional information, such as a file name. For more help with a command, type h followed by the command letter then press <RETURN>. For example, "h c" for the create command.

Command	Description
<CTRL/D>	Exit from sysgen (backup one question in "c" command).
<CTRL/C>	Cancel current command, return to "sysgen>" prompt.
!command	Escape to the shell and execute "command".
[c]reate	Create an ULTRIX-11 kernel configuration file.
[r]emove	Remove an existing configuration file.
[l]ist	List names of all existing configuration files.
[p]rint	Print a configuration file.
[m]ake	Make the ULTRIX-11 kernel.
[i]nstall	Print instructions for installing the new kernel.
[d]evice	List configurable processors and peripherals.
[s]ource	Compile and archive a source code module (u1.c, etc.).

The sysgen sequence is: use "c" to create the configuration file, "m" to make the new kernel, and "i" for installation instructions.

```
sysgen> d
```

Memory managed PDP-11 processors:

(23, 23+, 24, 34, 40, 44, 45, 55, 60, 70, 73)

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Disk Controllers:

Number	Name	Description
1	hp	(first) RH11/RH70 - 8 RM02/3/5, RP04/5/6, ML11
1	hm	(second) RH11/RH70 - 8 RM02/3/5, RP04/5/6, ML11
1	hj	(third) RH11/RH70 - 8 RM02/3/5, RP04/5/6, ML11
1	hs	RJS04 (RH11/RH70) with up to 8 RS03/4
1	hk	RK611/RK711 with up to 8 RK06/7
1	ra	UDA50 with up to 4 RA80/RA81/RA60
1	rc	KLESI with up to 2 RC25 (4 units)
1	rd/rx	RQDX1 with up to 4 RD51/RD52/RX50
1	rx	RUX1 with up to 4 RX50
1	rp	RP11 with up to 8 RP02/3
1	rl	RL11 with up to 4 RL01/2
1	rk	RK11 with up to 8 RK05
1	hx	RX211 with one dual RX02 drive

Press <RETURN> for more:

Magtape Controllers:

Number	Name	Description
1	ht	TM02/3 with up to 64 TU16/TE16/TU77
1	tm	TM11 with up to 8 TU10/TE10/TS03
1	ts	TS11/TSV05/TU80/TK25

Miscellaneous Devices:

Number	Name	Description
1	lp	LP11 controller with 1 LP11 type printer
1	ct	C/A/T phototypesetter interface via DR11-C

Press <RETURN> for more:

Communications Devices:

Number	Name	Description
8	dh	DH11 16 line asynchronous multiplexer
8	dhd़m	DM11-BB modem control option for DH11
8	duh	DHU11 16 line asynchronous multiplexer
4	dhv	DHV11 8 line asynchronous multiplexer
16	dz	DZ11 8 line asynchronous multiplexer
8	dzv	DZV11 4 line asynchronous multiplexer
8	dzq	DZQ11 4 line asynchronous multiplexer
16	k1	DL11/DLV11 single line unit (CSR 776500)
32	dl	DL11/DLV11 single line unit (CSR 775610)
4	du	DU11 single line synchronous interface
1	dn	DN11 4 line auto call unit interface

sysgen> c

For help, answer the question with ?<RETURN>
To backup to the previous question, type <CTRL/D>

Configuration name <unix> ? ?

To use the default configuration name of "unix", press <RETURN>.

To use an alternate configuration name, enter the name and press <RETURN>. The configuration name is limited to a maximum length of eight characters. Digital recommends you use only alphanumeric characters in the configuration name.

Configuration name <unix> ?

Configuration file exists, overwrite it <no> ? y

Processor type:

(23 23+ 24 34 40 44 45 55 60 70 73) < 44 > ? ?

If the new kernel is being generated for the current CPU, press <RETURN>. The number enclosed in < >, which is the current CPU type, will be used. If the new kernel is for another system enter the numeric portion of the processor type name, then press <RETURN>. The numbers enclosed in () list the supported CPU types.

For example, you would enter 70 for the PDP11/70 or 23+ for a PDP11/23 plus processor.

The Micro/PDP-11 may be any of the following processor types:

23+ - KDF11-B (F11)
73 - KDJ11-A (J11)
83 - KDJ11-B (J11)

If the target processor is not listed, select the processor type that most closely resembles your processor. Remember, separate I and D space is the most important processor feature.

Processor type:

(23 23+ 24 34 40 44 45 55 60 70 73) < 44 > ? 44

Memory size in K bytes (K = 1024) < 512 > ? ?

Sysgen is requesting the amount of memory on the target processor. The memory size is specified in K bytes, where, K is 1024 bytes. If the new kernel is being generated for the current CPU, press <RETURN> to use the value enclosed in < >, which is the current processor's memory size. If the new kernel is for another system, enter the memory size then press <RETURN>.

For example, if the processor has 256 K bytes of memory, you would enter 256, if the processor has one megabyte of memory you would

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enter 1024.

The minimum memory size is 192K bytes. The maximum memory size is 3840K bytes. 3840K bytes is four megabytes of memory minus the 256K bytes of address space reserved for the I/O page.

Memory size in K bytes (K = 1024) < 512 > ? 512

I/O buffer cache size (NBUF: min = 16, max = 144) < 100 > ? ?

NBUF sets the size of the I/O buffer cache in the ULTRIX-11 kernel. Increasing the number of buffers should improve system performance. However, increasing NBUF also increases the amount of memory consumed by the operating system. Digital recommends you use the default NBUF for the initial system generation and delay experimenting with the size of the buffer cache until reliable system operation has been established.

To use the default value for NBUF, press <RETURN>. To change the size of the I/O buffer cache, enter the number of buffers then press <RETURN>.

Each NBUF costs 30 bytes of kernel data space for the buffer header and 512 bytes of memory (outside of kernel data space) for the actual buffer.

I/O buffer cache size (NBUF: min = 16, max = 144) < 100 > ? 100

Please enter the system (ROOT) disk controller first.

Disk controller type:

< rh11 rh70 rp11 rk611 rk711,
 r11 rx211 rk11 uda50 rqdx1 klesi rjs04 rux1 > ? ?

Sysgen is requesting a list of all the disk controllers to be configured into the kernel. Enter the name of the system disk controller first, then enter the names of the other controllers on your system. When you have entered all your disk controllers, terminate the list by pressing <RETURN>. Consult the list below for the names and usage each type of disk controller.

When you enter a disk controller name, sysgen will ask a series of questions about the controller and the drives connected to it. Type the answer to each question then press <RETURN>. Remember, you can just press <RETURN> to use the default answer or ?<RETURN> for help.

Note - all of the Q22 bus controllers may be used on processors with the 18 bit Q bus (jumper selectable). CAUTION, if a Q bus controller (rxv21, rlv11) is used on a processor with the Q22 bus, the disk may be accessed in buffered I/O mode only. Attempting RAW I/O transfers will cause errors. The PDP11/23 has an 18 bit Q bus, PDP11/23+ has a Q22 bus.

Press <RETURN> for more:

Name	Usage	Disk Drives Supported
rh11	Unibus	RM02, RP04/5/6, ML11
rh70	11/70 Massbus	RM02/3/5, RP04/5/6, ML11
rp11	Unibus	RP02/3
rk611	Unibus	RK06/7
rk711	Unibus	RK06/7
r111	Unibus	RL01/2
rlv11	Q bus	RL01/2 (* specify r111)
rlv12	Q22 bus	RL01/2 (* specify r111)
rx211	Unibus	RX02
rxv21	Q bus	RX02 (* specify rx211)
rk11	Unibus	RK05
uda50	Unibus	RA60, RA80, RA81
rqdx1	Q22 bus	RX50, RD51, RD52
rux1	Unibus	RX50
klesi	Unibus/Q22 bus	RC25
rjs04	Unibus	RS03/4

Disk controller type:

```
< rh11 rh70 rp11 rk611 rk711,
  r111 rx211 rk11 uda50 rqdx1 klesi rjs04 rux1 > ? rh11
```

First MASSBUS disk controller:

```
Drive 0 type < rm02 rp04 rp05 rp06 ml11 > ? ?
```

Sysgen is requesting a list of the drives connected to the disk controller. The names enclosed in < > are the drive types that may be attached to the specified disk controller. Enter the type of each drive, in order, starting with unit zero. To terminate the list of drive types, just press <RETURN>.

Sysgen assumes the disk units are numbered sequentially, starting with unit zero. To allow for non-sequential unit numbering, a drive type may be entered even if the disk drive is not physically present. The operating system will ignore any non-existent units. For example, if three RP06 disks are to be numbered 0, 1, and 4, you would also specify drives two and three as RP06 disks. Drives two and three would be ignored by the system. Non-sequential unit numbering is not recommended, because it wastes kernel data space by allocating slots in the disk driver information tables for non-existent drives.

```
Drive 0 type < rm02 rp04 rp05 rp06 ml11 > ? rm02
```

```
Drive 1 type < rm02 rp04 rp05 rp06 ml11 > ? rm02
```

```
Drive 2 type < rm02 rp04 rp05 rp06 ml11 > ?
```

```
CSR address <176700> ? ?
```

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The number enclosed in < > is the default CSR address for the device. To use the default CSR address, press <RETURN>. If the device is not configured at the default CSR address, enter the actual address, then press <RETURN>. CSR addresses are always entered as octal numbers.

A device's CSR address specifies the I/O page address used by the operating system to access the device. The term CSR actually denotes the Control and Status Register, which is normally the first in a group of I/O page registers for the device.

CSR address <176700> ?

Vector address <254> ? ?

The number enclosed in < > is the default interrupt vector address for the device. To use the default vector, press <RETURN>. If the device is not configured at the default vector address, enter the actual vector address followed by <RETURN>. The vector address is always entered as an octal number.

A device's vector address is the address the processor will use to vector to the interrupt service routine for the device. The vector area is in low memory (locations 0 - 0776).

Vector address <254> ?

Is the system disk on this controller <yes> ? ?

Sysgen is asking if the system disk is connected to the current disk controller. The system disk is where the ULTRIX-11 ROOT file system is located. Sysgen will ask this question only if the system disk has not already been specified.

If the system disk is on this controller, enter yes<RETURN> or just <RETURN>. If not, enter no<RETURN>.

Is the system disk on this controller <yes> ? yes

System disk unit number <0> ? ?

Sysgen is asking for the unit number of the system disk. The default unit number is <1> for the RC25 and <0> for all other disks. To use the default unit number, press <RETURN>.

You can specify a different unit number by entering the number followed by <RETURN>. If you do not use the default unit number, the following items must be considered:

- Not all hardware bootstraps can boot from units other than zero. You can load the boot from the distribution tape.
- The boot file specification will change. For example, unit two would be ??(2,0)unix, where ?? is the disk mnemonic.

- The /etc/fstab must be modified, see fstab(5) in the ULTRIX-11 Programmer's Manual, Volume 1.
- You must remake the file /dev/swap so that commands can access the swap area, see /dev/makefile.

System disk unit number <0> ? 0

Disk controller type:

< rh11 rh70 rp11 rk611 rk711,
rl11 rx211 rk11 uda50 rqdx1 klesi rjs04 rux1 > ? rk711

Drive 0 type < rk06 rk07 > ? rk07

Drive 1 type < rk06 rk07 > ? rk07

Drive 2 type < rk06 rk07 > ?

CSR address <177440> ?

Vector address <210> ?

Disk controller type:

< rh11 rh70 rp11 rk611 rk711,
rl11 rx211 rk11 uda50 rqdx1 klesi rjs04 rux1 > ?

Use standard placement of root, swap, and error log <yes> ? ?

Sysgen contains tables that define the standard location of the ULTRIX-11 ROOT, PIPE, SWAP, and ERROR LOG file systems on each type of disk. Digital strongly recommends you use the standard placements for these file systems. Type yes<RETURN> or just <RETURN> to use the standard placements.

If you intend to experiment with the placement of these file systems, wait until the initial system installation has been completed and reliable system operation is established before generating a system with nonstandard placements. Also, backup your disks before booting a kernel with nonstandard placements!

To use nonstandard placements, answer no<RETURN>. Sysgen will ask a series of questions about the placement of the ROOT, SWAP, PIPE, and ERROR LOG file systems. Along with each question sysgen will print a default value, enclosed in <>, which is the standard placement for the item in question. You may use the default value or enter a new value. WARNING, sysgen accepts your answers without checking them for errors!

Press <RETURN> for more:

The following hints may be helpful:

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- Placing the ROOT and SWAP on separate disk controllers will improve system performance. Placing them on different drives on the same controller is of little benefit.
- If the system make heavy use of pipes, placing the PIPE device on a separate disk controller should improve system performance. Otherwise PIPE and ROOT should be the same,
- All four file systems may exist within the same partition. Care must be taken to prevent file system overlap.
- The mkconf program (called by sysgen to make the kernel) does some checking of file system placements.
- Some of the auto-boot features may not function with non-standard placements of the ROOT, PIPE, SWAP, and ERROR LOG. Refer to Section 3 of the ULTRIX-11 System Management Guide.
- If the standard placements are not used, the only available crash dump devices will be magtape and RQDX1/RX50 (unit 2).

Use standard placement of root, swap, and error log <yes> ? yes

Magtape controller:

```
< tm02 tm03 tm11 ts11 tsv05 tu80 tk25 > ? ?
```

Sysgen is requesting a list of the magtape controllers to be configured into the new kernel. Most systems will have only a single magtape controller, however, multiple controllers may be included. Only one of each type controller may be configured, that is, one TM02/3, one TM11, one TS11/TU80/TSV05/TK25.

Enter a magtape controller name, from the list below, then press <RETURN>. Sysgen will ask several questions about the controller and the drives connected to it. Answer each question then press <RETURN>. After you have entered the last magtape controller, terminate the list of controllers by pressing <RETURN>.

Name	Usage	Tape Drives Supported
tm02/3	Unibus	TU16, TE16, TU77
tm11	Unibus	TU10, TE10, TS03
ts11	Unibus	TS11
tsv05	Qbus/Q22bus	TSV05
tu80	Unibus	TU80
tk25	Qbus/Q22bus	TK25

Magtape controller:

```
< tm02 tm03 tm11 ts11 tsv05 tu80 tk25 > ? tm03
```

Number of magtape units <1> ? ?

Sysgen is requesting the number of tape drives connected to the magtape controller. Enter the number of magtape units then press <RETURN>. To use the default response of one unit, press <RETURN>.

Sysgen asks for the number of magtape units instead of the type of each unit, because the software drivers for magtapes adapt to the drive type automatically.

Sysgen expects magtape units to be numbered sequentially. However, non-sequential numbering may be used by setting the number of units to one more than the highest numbered unit. For example, if three tape units were to be numbered 0, 1, and 4, you would specify 5 magtape units. The system will ignore the nonexistent units. Non-sequential unit numbering is not recommended because the system must allocate space in the magtape driver information tables for nonexistent units.

Number of magtape units <1> ?

CSR address <172440> ?

Vector address <224> ?

Magtape controller:

< tm02 tm03 tm11 ts11 tsv05 tu80 tk25 > ?

Crash dump device < tm03 rm02 > ? ?

Sysgen is requesting the name of the crash dump device. Select the crash dump device from the list of names enclosed in <>. Enter the name then press <RETURN>. There is no default crash dump device, you must enter one of the names from the list.

The ULTRIX-11 system takes a crash dump by writing an image of memory to the crash dump device. The "memory image" is copied to a file on the system disk for analysis by the CDA (Crash Dump Analysis) program.

Digital recommends you select a magtape for the crash dump device if one is available. This will ensure that all of the system's memory will be saved in the crash dump.

If a magtape is not available, the crash dump can be written to the swap area of the system disk. If the system disk controller is an RQDX1, you may select the RX50 floppy disk drive as the crash dump device.

Depending on the type of disk and the amount of memory, the swap area may not be large enough to hold the entire "memory image". In this case, some crash dump data may be lost.

Crash dump device < tm03 rm02 > ? tm03

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LP11 line printer present <no> ?

Communications devices:

< dz dzv dzq dh dhu dhv dhdm du dn k1 d1 > ? ?

Enter the name of one of the communications devices listed below, then press <RETURN>. Sysgen will ask questions about the device. Answer these questions, then enter the name of the next device to be configured. If there are no more communications devices, press <RETURN> to terminate the list of devices.

Name	Device	Description
dz	DZ11	8 line multiplexer
dzv	DZV11	4 line DZ11 for Q bus
dzq	DZQ11	4 line multiplexer (DZV11 replacement)
dh	DH11	16 line multiplexer
dhdm	DM11-BB	DH11 modem control
dhu	DHU11	16 line multiplexer
dhv	DHV11	8 line DHU11 for Q bus
du	DU11	synchronous line interface
dn	DN11	auto-call unit interface
k1	DL11/DLV11	(CSR 776500) single line unit
d1	DL11/DLV11	(CSR 775610) single line unit

Press <RETURN> for more:

The first "k1" is reserved for the console terminal. The console terminal is automatically configured, do not count it in the "k1" specification. Use the "k1" and "d1" names for the equivalent DLV11 Q bus devices.

Communications devices:

< dz dzv dzq dh dhu dhv dhdm du dn k1 d1 > ? k1

Number of units <1> ? ?

Enter the number of communications device units to be configured, then press <RETURN>. To use the default value of one unit press <RETURN>.

You can use the "d" command to list the maximum number of units allowed for each type of communications device.

Number of units <1> ?

CSR address <176500> ?

Vector address <300> ?

Communications devices:

< dz dzv dzq dh dhu dhv dhdm du dn k1 dl > ? dh

Number of units <1> ?

CSR address <160020> ?

Vector address <300> ? 320

Communications devices:

< dz dzv dzq dh dhu dhv dhdm du dn k1 dl > ? dhdm

Number of units <1> ?

CSR address <170500> ?

Vector address <300> ? 310

Communications devices:

< dz dzv dzq dh dhu dhv dhdm du dn k1 dl > ?

Include C/A/T phototypesetter driver <no> ?

User devices:

< u1 u2 u3 u4 > ?

Include Kernel floating point simulator <no> ? ?

If your processor is equipped with floating point hardware, type no<RETURN> or just <RETURN>. If your processor does not have the floating point hardware, type yes<RETURN>. Including the floating point simulation code will allow programs to execute floating point instructions on a processor without floating point hardware.

If the processor does not have floating point hardware and the floating point simulation code is not included in the kernel, any program that executes floating point instructions will be core dumped with an illegal instruction trap.

Include Kernel floating point simulator <no> ?

Use standard system parameters <yes> ? ?

The ULTRIX-11 system parameters specify the size of the kernel's internal data structures, such as the process table. The values of these parameters are used to adjust the sizes of the internal data structures to match the expected system load, that is, the number of users and job mix.

Sysgen contains a table of standard values for these parameters. Digital recommends that the standard parameters be used for the initial system generation, and that experimentation with the

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parameter values be delayed until reliable system operation is established. To use the standard parameters, answer yes<RETURN> or just <RETURN>.

To change the parameters, answer no<RETURN>. Sysgen will ask for the value of each parameter. Sysgen will also print the standard value of each parameter, enclosed in <>.

Press <RETURN> for more:

The system parameters are:

Param	OV_VAL	ID_VAL	COST	Description
NINODE	90	200	74	In-core inode table size
NFILE	80	175	8	Number of open files
NMOUNT	5	8	6	Number of mounted file systems
MAXUPRC	15	25	0	Maximum processes per user
NCALL	20	20	6	Number of callouts
NPROC	75	150	42	Number of processes allowed
NTEXT	25	40	12	Number of shared text segments
NCLIST	85	115	16	Number of cblocks in clist
CANBSIZ	256	256	1	TTY canon buffer size
NCARGS	5120	5120	0	Exec() argument list size
MSGBUFS	128	128	1	Error message buffer size
MAXSEG	61440	61440	0	Memory size limit
MAPSIZE	67	105	4	Core/swap map size

Use standard system parameters <yes> ? yes

Line frequency in hertz <60> ? ?

Enter the AC power line frequency then press <RETURN>. The default value is 60 hertz. The line frequency should be 60 hertz for the United States or 50 hertz for Europe. If you insist, sysgen will accept any value for the power line frequency. This allows for the one hertz variation in AC line frequency that occurs in some areas.

Line frequency in hertz <60> ?

Timezone (hours ahead of GMT) <5=EST 6=CST 7=MST 8=PST> ? ?

Sysgen is requesting the timezone for your local area. Specify the timezone as the number of hours ahead of GMT (Greenwich Mean Time). Do not include daylight savings time in the timezone specification. For example, Eastern Standard Time is five hours ahead of GMT.

Timezone (hours ahead of GMT) <5=EST 6=CST 7=MST 8=PST> ? 5

Does your area use daylight savings time <yes> ? ?

The operating system automatically compensates for the presence or absence of daylight savings time. If your local area uses

daylight savings time, answer yes<RETURN> or just <RETURN>. If not, answer no<RETURN>.

Does your area use daylight savings time <yes> ?

ULTRIX-11 System Generation Program

For help, type h then press <RETURN>

sysgen> m

Configuration name <unix> ?

***** CREATING ULTRIX-11 CONFIGURATION AND VECTOR TABLES *****

Device Address Vector units

console	177560	60		
kw11-1	177456	100		
kw11-p	172540	104		
hk	177440	210	2	
ht	172440	224	1	(crash dump device)
hp	176700	254	2	
kl	176500	300	1	
dhd़m	170500	310	1	
dh	160020	320	1	

Filsys Device maj/min start length

root	hp	9/0		
pipe	hp	9/0		
swap	hp	9/1	200	6000
errlog	hp	27/1	0	200

***** MAKING KERNEL FOR SEPARATE I & D SPACE PROCESSORS *****

```

as - -o l.o l.s
as -o dump_id.o mch0.s dump.s
as -o mch_id.o mch0.s mch.s
cc -c -O -DSEP_ID -DKERNEL c.c
cc -c -O -DSEP_ID -DKERNEL dds.c
cc -S -DKERNEL ec.c
ed - ec.s < :comm-to-bss
as - -o ec.o ec.s
rm ec.s

```

The output file will be named unix_id !!!!

ovload

The unix_id sizes must be within the following limits:

root text segment > 49152 but <= 57344

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```
overlay text segments <= 8192, 7 overlays maximum
bss + data segments <= 49088 total

root+(overlay 1, overlay 2,...overlay n)+data+bss = root+data = (total)

size unix id
50624+(7680,6144)+4424+33388 = 88436b = 0254564b (64448 total text)
rm *.o

New kernel is now named 'unix.os'!

***** CHECKING SIZE OF NEW ULTRIX-11 OPERATING SYSTEM *****
'unix.os' within limits, SYSGEN successful!
sysgen> ^D

#
```

Appendix D

Stand-alone Copy Program

The copy program lets you copy a specified number of records, of a specified size, from one device to another device. Use the copy program to image copy disks or magnetic tapes. The copy program can also copy disk to magnetic tape and vice versa.

The stand-alone copy program does not run under control of the ULTRIX-11 operating system. You use the ULTRIX-11 boot program to load and run the stand-alone copy program.

Follow these four steps to load the copy program:

1. Shut down the operating system.

If the operating system is running, use the operator services program to shut down the system to single-user mode and then halt the processor. Refer to Chapter 5, ULTRIX-11 Operator Services, in the ULTRIX-11 System Management Guide for instructions on the operator services program.

2. Load the boot program.

You can load the boot program from your system disk or one of four distribution media.

To load the boot program, use the method below that corresponds with your type of load media:

- Load the boot program from RX50 diskette.

Mount the boot diskette in RX50 drive 2.

Use your hardware bootstrap to boot RX50 unit 2.

After a successful RX50 boot, the system displays this prompt:

D-2 Copy Program

Sizing Memory...

To list options, type help then press <RETURN>

Boot:

- Load the boot program from magnetic tape.

Mount the distribution magnetic tape on drive 0. Be sure the tape drive is on line and ready, and the tape is rewound to load point (BOT).

Boot the tape by executing your hardware bootstrap or one of the magnetic tape boot programs in Appendix A.

After successfully booting, the system displays this prompt:

Sizing Memory...

To list options, type help then press <RETURN>

Boot:

- Load the boot program from a disk.

Mount the disk in drive 0, and be sure the drive is on line and ready. The disk can be your system disk or the "ROOT AND /USR" disk from the RL02 or RC25 distribution kit.

Read all the instructions in this step before continuing.

Use your hardware bootstrap to boot the disk. If you are loading the boot program from an RC25 system disk, boot unit 1. Otherwise, boot unit 0.

The boot program prints this message:

Sizing Memory...

Boot: xx(y,0)unix (<CTRL/C> aborts auto-boot)

xx represents the 2-character ULTRIX-11 name for the disk (hk, hp, ra rc, rd, rl or rp). The y represents the disk unit number. It is 1 for an RC25 disk, and 0 for all other disks.

As soon as this message appears, interrupt the

automatic boot by pressing <CTRL/C>.

The boot program cancels the automatic boot and prints:

To list options, type help then press <RETURN>

boot:

There may be a delay of several seconds between the time you press <CTRL/C> and the appearance of the Boot: prompt.

NOTE

If you wait too long to press <CTRL/C>, the operating system loads into memory and begins printing several messages. In this case, halt the processor and repeat this step from the beginning.

3. Verify device hardware CSR addresses

If your devices are configured at the standard Control and Status Register (CSR) addresses, omit this step and continue with step 4. In most cases, your devices are at the standard CSR address. The most common exception to this is when multiple MSCP disk controllers are present. Use Table D-1 to verify that the boot program's device CSR address table matches your hardware configuration.

D-4 Copy Program

Table D-1 Standard CSR Address for Various Devices

<u>Name</u>	<u>CSR</u>	<u>Device Type</u>
hk	177440	RK06/7
hp	176700	RM02/3/5, RP04/5/6, ML11 (1st RH11/RH70)
hm	176300	RM02/3/5, RP04/5/6, ML11 (2nd RH11/RH70)
hj	176400	RM02/3/5, RP04/5/6, ML11 (3rd RH11/RH70)
ra	172150	RA60/RA80/RA81
rc	172150	RC25
rd	172150	RD51/RD52
rx	172150	RX50
rk	177400	RK05
rl	174400	RL01/2
rp	176710	RP02/3
ht	172440	TU16/TE16/TU77
tm	172520	TU10/TE10/TS03
ts	172520	TS11/TU80/TSV05/TK25

If you have any devices at nonstandard CSR addresses, use the csr command to enter the correct CSR address in the boot program's address table. To use this command, type csr in response to the Boot: prompt.

The boot program asks if you want to print its current device CSR address table. Type y to print the list of addresses or n not to print it.

Enter the 2-character ULTRIX-11 name for the device. See Table D-1, Standard CSR Address for Various Devices, for a list of device names.

Enter the correct CSR address for the device.

The boot program asks you to confirm your entry. If you answer y, the device's entry in the boot CSR address table is updated. If you answer n, the table is not modified.

You can verify the change of address by asking the boot program to print its device CSR address table.

4. Load the stand-alone copy program.

To load the copy program, use the method below that corresponds with your type of load media:

- Load the copy program from RX50 diskette.

To load the copy program from RX50 diskette, type:

Boot: rx(2,0)copy

- Load the copy program from magnetic tape.

To load the copy program from magnetic tape, type one of these commands at the Boot: prompt:

<u>Command</u>	<u>Controller Type</u>
tm(0,0)copy	TM11 controller at 800 bits/in
ht(0,0)copy	TM02/3 controller at 800 bits/in
ht(4,0)copy	TM02/3 controller at 1600 bits/in
ts(0,0)copy	TS11 controller at 1600 bits/in
ts(0,0)copy	TSV05 controller at 1600 bits/in
ts(0,0)copy	TU80 controller at 1600 bits/in

For example, to load the copy program from an 800 bits/in tape on a TM11 controller, type:

Boot: tm(0,0)copy

Consult your hardware documentation for the name of your tape controller. The TU10 and TE10 tape drives use the TM11 controller, the TU16 and TE16 use the TM02/3 controller, and the TU77 uses the TM03 controller.

- Load the copy program from a disk.

To load the copy program from your disk, type:

Boot: xx(y,0)/sas/copy

The xx represents the 2-character ULTRIX-11 name for the disk, such as hk, hp, ra, rc, rd, rl, or rp. The y represents the disk unit number. It is 1 for an RC25 system disk and 0 for all other disks.

Refer to Table D-1, Standard CSR Address for Various Devices, for the name of your disk.

For example, to load the copy program from an RL02 disk, type:

Boot: rl(0,0)/sas/copy

5. Run the stand-alone copy program.

After successfully loading, the stand-alone copy program prints this message:

D-6 Copy Program

ULTRIX-11 Stand-alone Copy Program

Input File:

The copy program displays a series of prompts.

At the Input File: and Output File: prompts, the program is requesting a device file specification.

Enter a file specification with this format:

dev(unit,offset)

dev is the ULTRIX-11 device mnemonic. The device mnemonic is the 2-character device name that the ULTRIX-11 software uses. Refer to Table D-1, Standard CSR Address for Various Devices, for the device names.

unit is the device unit number. The unit is the unit number of the device, except when copying to or from the ht (TU16/TE16/TU77) tape at 1600 bits/in. In that case, unit is the unit number plus four, that is, you use units 0 through 3 for 800 bits/in or 4 through 7 for 1600 bits/in. Unit 4 is physical unit 0 at 1600 bits/in.

offset is an offset from the beginning of the device. For disks, offset is the number of blocks from the beginning of the disk where the copy starts. An offset of 0 starts the copy at the beginning of the disk.

For magnetic tapes, offset is the number of files from the beginning of the tape where the copy is to start. An offset of 0 starts the copy at the beginning of the tape. An offset of 3 causes the tape to be positioned after the third EOF (end of file) mark. If you use a nonzero offset, you must be sure there are actually that many files on the tape, or the copy will fail.

The copy program prompts you for this information:

- Input File:

Enter the file specification for the device you want to copy from.

- Output File:

Enter the file specification for the device you want to copy to.

- Record Size <16384 MAX> :

The record size may be any even number of bytes in the range of 2 through 16384. DIGITAL recommends you use multiples of 512 bytes for the record size.

For copying disks, the optimum record size is the number of logical blocks per track times 512. For example, with the RP06 disk, use 11264 (22 X 512).

If the optimum number of records is greater than 16384, use any number of blocks per record that divides evenly into the total number of blocks to be copied. Otherwise, the remainder of the blocks will not be copied.

- Number of Records:

Enter the number of records to be copied. For copying disks, this is the number of tracks, assuming you used a record size equal to the number of blocks per track times 512.

If the disk has a bad block file (RK06/7, RP04/5/6, or RM02/3/5) subtract 2 from the number of tracks. You cannot copy the bad block file, because the bad block information is valid only for the current disk.

For example, to copy an RP06 disk pack, use:

$$815 \times 19 - 2 = 15483$$

The RP06 has 815 cylinders and 19 tracks per cylinder.

- Ready to copy dev to dev <y or n> ?

To begin the copy answer y and press <RETURN>.

To abort the copy answer n and press <RETURN>.

After the copy has completed, the program prints this message:

Copy Complete

More files to copy <y or n> ?

If you answer y, the program prompts you for information about the next copy.

If you answer n, the program exits and returns you to the Boot: prompt.

D-8 Copy Program

This example shows how to copy a disk pack in RL02 drive 0 to a magnetic tape on TE16 unit 0 at 1600 bits/in:

ULTRIX-11 Stand-alone Copy Program

Input File: rl(0,0)

Output File: ht(4,0)

Record Size: 10240

Number of Records: 1024

Ready to copy rl(0,0) to ht(4,0) <y or n> ? y

Copy Complete

More files to copy <y or n> ? n
Exit called

Boot:

Appendix E

Loading the Games, Manuals, and Documents Files

The games, manuals, and documents files are included on the ULTRIX-11 distribution but the installation procedure does not load them onto the system disk. This is because loading these files consumes more disk storage space than may be available on systems with the smaller system disks, such as r101, r102, or rk06 disks.

The default locations for loading these files are in sub-directories of /usr: /usr/games, /usr/man, and /usr/doc. The ULTRIX-11 /usr file system is not large enough to hold these files. Therefore, you must select an alternate location for them. Refer to Section 4.6, Setting Up User File Systems, in the ULTRIX-11 System Management Guide for assistance.

Table E-1 lists the approximate numbers of blocks of disk storage required for loading the optional files.

Table E-1 Blocks Used by the Optional Files

<u>Size</u>	<u>Directory</u>	<u>Files Description</u>
540	./games	Games programs
2400	./man	On-line manuals
5200	./doc	ULTRIX-11 documents

If you load the on-line manuals, you must first edit the /bin/man file. This file is the shell procedure used to implement the man command (see man(1) in the ULTRIX-11 Programmer's Manual, Volume 1). Line five of the /bin/man file does a change directory to /usr/man (cd /usr/man). Modify this command to change to the new directory, where the on-line manual files will be loaded.

The next four sections describe how to load the optional files from the four distribution media.

E-2 Optional Files

1. Loading from the Magnetic Tape Distribution

This section explains how to load the games, manuals, and document files onto your system from magnetic tape.

1.1. Mount the Tape

Mount the distribution magnetic tape on drive 0. Be sure the tape is on line and at load point (BOT).

1.2. Position the Tape

Position the tape to the beginning of the files using one of these commands:

```
dd if=/dev/nrmt0 of=/dev/null bs=20b files=14 ( 800 bit/in)
dd if=/dev/nrht0 of=/dev/null bs=20b files=14 (1600 bit/in)
```

1.2.1. Mount the File System

Be sure that the file system where the files are to be loaded is mounted, then change to the directory where the files will be loaded.

1.3. Extract the Files

Use the tar command to extract the files you want to load onto the system.

For example, to load all of the files, type:

```
tar xnp ./games ./man ./doc (800 bit/in)
tar xp ./games ./man ./doc (1600 bit/in)
```

Use the tar command to extract a single file, a group of files, or all of the files.

Each time you use the tar command, you must reposition the tape as in step 2.

2. Loading from the RL02 Distribution

This section explains how to load the games, manuals, and document files onto your system from the RL02 distribution.

The second RL02 disk pack contains the games, on-line manuals, and documents files. Load the second RL02 disk pack into an available drive and be sure the drive is on-line and ready. Then write protect the drive.

The optional files are stored on the RL02 in two forms. The first disk partition is an ULTRIX-11 file system containing the optional files. The second partition contains the optional files in tar (tape archiver) format. Refer to Appendix D, Disk Logical Partition Sizes, in the ULTRIX-11 System Management Guide for the RL02 disk partition layout.

Storing the optional files in this way lets you load them by mounting the file system and copying the files or extracting them with the tar command.

First you copy the files, then you extract them.

2.1. Copying the Files

Here are the steps for copying the files:

1. Mount the file system on an available directory.

In this case, assume the directory is /mnt:

```
/etc/mount /dev/rln0 /mnt -r
```

n is the unit number of the RL02 drive.
-r means mount read only.

All of the optional files are now available in the sub-directories of /mnt: /mnt/games, /mnt/man, and /mnt/doc.

2. Use the cp command to copy the files from /mnt to any other directory. For example:

```
cp /mnt/games/* /usr/games
```

This copies all of the game files to /usr/games.

3. Unmount the file system after copying the files you want copied:

```
/etc/umount /dev/rln0
```

n is the unit number of the RL02 drive.

E-4 Optional Files

2.2. Extracting the Files

Here are the steps for extracting the files with the tar command:

1. Be sure the file system where the files are to be loaded is mounted and has sufficient free space to hold the files. Then, change to the directory into which the files will be extracted. Remember that the files are extracted as subdirectories: ./games, ./man, and ./doc.
2. Use the tar command to list the files on the optional files RL02 disk:

```
tar tvbf 20 /dev/rrln1
```

n is the unit number of the RL02 drive.

3. Use the tar command to extract the files you want on your system.

For example, to extract all the files from an RL02 in drive 0, type:

```
tar xpbf 20 /dev/rrl01
```

To extract only the games, type:

```
tar xpbf 20 /dev/rrl01 ./games
```

3. Loading from the RC25 Distribution

This section explains how to load the games, manuals, and document files onto your system from the RC25 distribution.

Partition 3 of the RC25 distribution disk contains the optional files in tape archiver (tar) format. Mount the RC25 distribution disk in RC25 unit 0 (removable). Then write protect RC25 unit 0.

NOTE

Remember, you must use the opser program to shut down the system to single-user mode before you can change the RC25 removable cartridge.

3.1. Mount the File System

Be sure the file system where the files are to be loaded is mounted and has sufficient free space to hold the files. Then, change to the directory into which the files will be extracted. Remember, the files are extracted as subdirectories: ./games, ./man, ./doc.

3.2. List the Files

Use the tar command to list the files on the optional files partition of the RC25 disk:

```
tar tvbf 20 /dev/rrc03
```

3.3. Extract the Files

Use the tar command to extract the files you want on your system:

For example, to extract all the files, type:

```
tar xpbf 20 /dev/rrc03
```

To extract only the game files, type:

```
tar xpbf 20 /dev/rrc03 ./games
```

E-6 Optional Files

4. Loading from the RX50 Diskette Distribution

This section explains how to load the manuals files onto your system from the RX50 diskette distribution.

You can load the games files using the osload command. Refer to Section 5.8.4, Optional Software Load Command (osload), osload command instructions.

The documents files are not supplied with the RX50 distribution kit.

The on-line manuals files are located on the diskettes labeled **MANUALS**.

4.1. List the Files

Obtain a directory listing of files on each diskette.

Load the diskette into RX50 drive 2 and type this command:

```
tar tvd2
```

4.2. Extract the Files

Use the tar command to extract the file or files you want loaded onto your system:

For example, to extract the tar manual page, you load the appropriate diskette and type:

```
tar xvpd2 ./man/man1/tar.1
```

Appendix F

Stand-alone Programs (icheck, mkfs, restor)

In addition to the stand-alone programs described in Appendix B, Disk Media Qualification (bads, rabads, dskinit), and Appendix D, Stand-alone Copy Program, the ULTRIX-11 distribution contains the stand-alone programs listed in Table F-1.

Table F-1 ULTRIX-11 Stand-alone Programs

<u>Program</u>	<u>Description</u>
icheck	File system storage consistency check
mkfs	Make an ULTRIX-11 file system
restor	Restore files from a file system dump

The automatic installation procedure uses these programs to install the ULTRIX-11 software. These programs are not intended for general use, because they provide only a subset of the functions available with the corresponding ULTRIX-11 operating system commands.

DIGITAL recommends you use the ULTRIX-11 commands instead of the stand-alone programs to perform the same functions. Refer to *icheck(1)*, *mkfs(1)*, and *restor(1)* in the ULTRIX-11 Programmer's Manual, Volume 1 for a description of these commands.

However, here are the procedures to load and run the stand-alone programs.

F-2 Stand-alone Programs

1. Loading Stand-alone Programs

The stand-alone programs icheck, mkfs and restor do not run under control of the ULTRIX-11 operating system. You use the ULTRIX-11 boot program to load and run them.

Before you can load a stand-alone program, you must load the boot program using this procedure:

1.1 Shut down the operating system.

If the operating system is running, use the operator services program (opser) to bring the system to single-user mode and then halt the processor. Refer to Chapter 5, ULTRIX-11 Operator Services, in the ULTRIX-11 System Management Guide for operator services program instructions.

1.2 Load the boot program.

You can load the boot program from your system disk or from one of the four distribution media.

Here are the three methods for loading the boot program. Use the one that matches your load media type.

- Loading boot from RX50 diskette.

Mount the diskette labeled BOOT into RX50 drive 2.

Use your hardware bootstrap to boot RX50 unit 2.

After a successful RX50 boot, the system displays this prompt:

Sizing Memory...

To list options, type help then press <RETURN>

Boot:

- Loading boot from magnetic tape.

Mount the distribution magnetic tape on drive 0. Be sure the tape drive is on line and ready, and the tape is rewound to load point (BOT).

Boot the tape by executing your hardware bootstrap or one of the magnetic tape boot programs in Appendix A.

After successfully booting, the system displays this prompt:

Sizing Memory...

To list options, type help then press <RETURN>

Boot:

- Loading boot from a disk.

Mount the disk in drive 0 and be sure the drive is on line and ready. The disk can be your system disk or the "ROOT AND /USR" disk from the RL02 or RC25 distribution kit.

Read all the instructions in this step before continuing.

Use your hardware bootstrap to boot the disk. If you are loading the boot program from an RC25 system disk, boot unit 1. Otherwise, boot unit 0.

The boot program prints this message:

Sizing Memory...

Boot: xx(y,0)unix (<CTRL/C> aborts auto-boot)

xx represents the 2-character ULTRIX-11 name for the disk (hk, hp, ra rc, rd, rl or rp). The y represents the disk unit number. It is 1 for an RC25 disk and 0 for all other disks.

As soon as this message appears, interrupt the automatic boot by pressing <CTRL/C>.

The boot program cancels the automatic boot and prints:

To list options, type help then press <RETURN>

boot:

There may be a delay of several seconds between the time you press <CTRL/C> and the appearance of the Boot: prompt.

F-4 Stand-alone Programs

NOTE

If you wait too long to press <CTRL/C>, the operating system loads into memory and begins printing several messages. In this case, halt the processor and repeat this step from the beginning.

1.3 Verify device hardware CSR addresses.

If your devices are configured at the standard Control and Status Register (CSR) addresses, omit this step and continue with step 4. In most cases, your devices are at the standard CSR address. The most common exception to this is when multiple MSCP disk controllers are present. Use Table F-2 to verify that the boot program's device CSR address table matches your hardware configuration.

Table F-2 Standard CSR Address for Various Devices

<u>Name</u>	<u>CSR</u>	<u>Device Type</u>
hk	177440	RK06/7
hp	176700	RM02/3/5, RP04/5/6, ML11 (1st RH11/RH70)
hm	176300	RM02/3/5, RP04/5/6, ML11 (2nd RH11/RH70)
hj	176400	RM02/3/5, RP04/5/6, ML11 (3rd RH11/RH70)
ra	172150	RA60/RA80/RA81
rc	172150	RC25
rd	172150	RD51/RD52
rx	172150	RX50
rk	177400	RK05
rl	174400	RL01/2
rp	176710	RP02/3
ht	172440	TU16/TE16/TU77
tm	172520	TU10/TE10/TS03
ts	172520	TS11/TU80/TSV05/TK25

If you have any devices at nonstandard CSR addresses, use the csr command to enter the correct CSR address in the boot program's address table. To use this command, type csr in response to the Boot: prompt.

The boot program asks if you want to print its current device CSR address table. Type y to print the list of addresses or n not to print it.

Enter the 2-character ULTRIX-11 name for the device.

See Table F-2, Standard CSR Address for Various Devices, for a list of device names.

Enter the correct CSR address for the device.

The boot program asks you to confirm your entry. If you answer y, the device's entry in the boot CSR address table is updated. If you answer n, the table is not modified.

You can verify the change of address by asking the boot program to print its device CSR address table.

1.4 Load the stand-alone program.

Here are the commands for loading the stand-alone programs. Use the one that corresponds with the program you want to run.

- Loading from RX50 diskette.

To load the stand-alone program from RX50 diskette, type:

Boot: rx(2,0)prog

prog is the name of the stand-alone program you are loading.

- Loading from magnetic tape.

To load a stand-alone program from magnetic tape, type one of these commands at the Boot: prompt:

<u>Command</u>	<u>Controller Type</u>
tm(0,0) <u>prog</u>	TM11 controller at 800 bits/in
ht(0,0) <u>prog</u>	TM02/3 controller at 800 bits/in
ht(4,0) <u>prog</u>	TM02/3 controller at 1600 bits/in
ts(0,0) <u>prog</u>	TS11 controller at 1600 bits/in
ts(0,0) <u>prog</u>	TSV05 controller at 1600 bits/in
ts(0,0) <u>prog</u>	TU80 controller at 1600 bits/in

prog is the name of the stand-alone program you are loading.

For example, to load the icheck program from an 800 bits/in tape on a TM11 controller, type:

Boot: tm(0,0)icheck

Consult your hardware documentation for the name of

F-6 Stand-alone Programs

your tape controller. The TU10 and TE10 tape drives use the TM11 controller, the TU16 and TE16 use the TM02/3 controller, and the TU77 uses the TM03 controller.

- Loading from a disk.

To load a stand-alone program from your disk, type:

Boot: xx(y,0)/sas/prog

xx is the 2-character ULTRIX-11 disk name and prog is the name of the stand-alone program you are loading. See Table F-2, Standard CSR Address for Various Devices, for the disk names.

y is the disk unit number. For an RC25 disk, y is 1. For all other disk types, y is 0.

For example, to load the mkfs program from an RL02 disk, type:

Boot: r1(0,0)/sas/mkfs

After successfully loading, the stand-alone program prints an initial message and then its prompt.

Several of the stand-alone program prompts request a device file specification. Enter a file specification with this format:

dev(unit,offset)

dev is the ULTRIX-11 device mnemonic. The device mnemonic is the 2-character device name that the ULTRIX-11 software uses. Refer to the Table F-2, Standard CSR Address for Various Devices, for the device names.

unit is the device unit number. The unit is the unit number of the device, except when copying to or from the ht (TU16/TE16/TU77) tape at 1600 bits/in. In that case unit is the unit number plus four, that is, you use units 0 through 3 for 800 bits/in and 4 through 7 for 1600 bits/in. Unit 4 is physical unit 0 at 1600 bits/in.

offset is an offset from the beginning of the device. For disks, offset is the number of blocks from the beginning of the disk where the copy starts. An offset of 0 starts the copy at the beginning of the disk.

For magnetic tapes, offset is the number of files from the beginning of the tape where the copy is to start. An offset of 0 starts the copy at the beginning of the tape. An offset of 3 causes the tape to be positioned after the third end of file (EOF) mark. If you use an offset greater than 0, you must be sure there are actually that many files on the tape, or the stand-alone program will fail.

F-8 Stand-alone Programs

2. icheck - File System Storage Consistency Check

You can use the icheck program to verify the consistency of an ULTRIX-11 file system. Refer to icheck(1) in the ULTRIX-11 Programmer's Manual, Volume 1, for a description of the icheck command.

Use the instructions in Section 1, Loading Stand-alone Programs, to load the stand-alone icheck program.

The icheck program prints these prompts:

- File:

You enter the device file specification of the file system to be checked. This may require you to determine the offset from the beginning of the disk where the file system is located. Refer to Appendix D, Disk Logical Partition Sizes, in the ULTRIX-11 System Management Guide for the file system layout of your disk.

For example, to check the /usr file system of the RA60 disk, type:

```
File: ra(0,15870)
```

- Salvage free list <y or n> ?

If you answer y, the program reconstructs the file system's free list, if it has been corrupted.

If you answer n, the program does not attempt to repair the free list.

The program checks the file system and prints the number of files, free blocks, and used blocks in the file system. After the file system printout, the program exits and returns you to the Boot: prompt.

3. mkfs - Make an ULTRIX-11 File System

You can use the stand-alone mkfs program to create an empty ULTRIX-11 file system on any disk partition. Refer to `mkfs(1)` in the ULTRIX-11 Programmer's Manual, Volume 1 for a description of the `mkfs` command.

Use the instructions in Section 1, Loading Stand-alone Programs, to load the stand-alone `mkfs` program.

The `mkfs` program prints these prompts:

- File system size:

Enter the size of the file system in blocks.

- Disk type:

Enter the generic disk name, such as `r101`, `rd51` or `rp06`.

The program uses the disk name and processor type to determine the optimum values for certain file system parameters. If you press only <RETURN> instead of typing the disk name, the program prompts you for these parameters:

Interleave factor:

Blocks per cylinder:

- Processor type:

Enter the numeric portion of your processor type (23, 24, 34, 40, 44, 45, 55, 60, 70, or 73). If you answered the Disk type: question with only a <RETURN>, the program does not prompt for the processor type.

- File system name:

The file system name is used to fill in the `fsname` field in the superblock of the file system. This is usually the name of the directory where the file system will be mounted, such as `root`, `/usr`, `/tmp`, and `/users`. The `fsname` can consist of up to six characters. Refer to `mkfs(1m)` and `labelit(1m)` in the ULTRIX-11 Programmer's Manual, Volume 1, for more information.

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- Volume name:

The volume name is used to fill in the volname field in the superblock of the file system. This is usually the same as the name used to label the disk pack, such as system or users. Refer to `mkfs(1m)` and `labelit(1m)` in the ULTRIX-11 Programmer's Manual, Volume 1, for more information.

- File system:

You enter the device file specification of the disk partition where the file system is to be created. This may require you to determine the offset from the beginning of the disk where the file system is located. Refer to Appendix D, Disk Logical Partition Sizes, in the ULTRIX-11 System Management Guide for the file system layout of your disk.

For example, to create a file system on partition 4 of the RA60 disk, type:

```
File system: ra(0,27156)
```

The program prints the file system parameters, creates the file system, and exits and returns you to the Boot: prompt.

4. restor - Restore Files from a File System Dump

You can use the stand-alone restor program to restore an entire file system dump onto a disk partition. The automatic installation procedure uses this program to transfer the root and /usr file systems from the magnetic tape or RX50 distributions onto the system disk. Refer to restor(1) in the ULTRIX-11 Programmer's Manual, Volume 1 for a description of the restor command.

Before restoring files onto a disk, you must create an empty file system on the disk partition. Use the mkfs program to make the file system.

Use the instructions Section 1, Loading Stand-alone Programs, to load the stand-alone restor program.

The restor program prints these prompts:

- Tape:

Enter the file specification for the device containing the file system dump. This can be a disk or magnetic tape.

For example, to restore from RX50 diskettes in drive 1, type:

Tape: rx(1,0)

To restore from the fourth file on a TM11 magnetic tape, type:

Tape: tm(0,4)

- Starting volume number <1>:

For multivolume dumps, such as the RX50 distribution kit, it is possible to start the restor from any volume. This feature is useful for starting an interrupted restore again.

To begin the restore from volume 1, press <RETURN>.

To start from another volume, type the number of the volume and press <RETURN>. Before restarting an interrupted restore, you must run the stand-alone icheck program and answer y to the "Salvage free list" question.

- Disk:

Enter the device file specification of the disk

F-12 Stand-alone Programs

partition where the files are to be restored. This may require you to determine the offset from the beginning of the disk where the file system is located. Refer to Appendix D, Disk Logical Partition Sizes, in the ULTRIX-11 System Management Guide for the file system layout of your disk.

For example, to restore onto partition 3 of an RP06 disk, type:

Disk: hp(0,27170)

- Last chance before scribbling on disk.

Press <RETURN> to begin the restore.

After the restore is complete, the program exits and returns you to the Boot: prompt.

Appendix G
Configuration Work Sheet

Fill out the information requested on these sheets before installing the ULTRIX-11 software. You then will have all the hardware information needed for the installation.

You can get the information in your Site Management Guide or hardware documentation or from your field service representative.

G-2 Work Sheet

Processor type:

Disk Devices:

1. controller type address vector

unit # and type of drives

2. controller type address vector

unit # and type of drives

3. controller type address vector

unit # and types of drives

Tape devices:

1. controller type address vector

unit # and type

2. controller type address vector

unit # and type

Communications devices:

1. controller type address vector

2. controller type address vector

3. controller type address vector

4. controller type address vector

Line printer: address vector

G-4 Work Sheet

You must associate each terminal line on your communications controllers with a tty special file. If you are unfamiliar with the procedures for configuring these lines, fill out the chart below to help organize the necessary information.

The chart provides spaces next to tty numbers 00 through 31. In the space next to tty00, write the name of your first communications controller. Also write its unit number and line number.

Continue to assign any remaining lines from your first communications controller to sequential tty numbers. When you finish with the first controller, if you have a second controller assign those lines to the next available tty numbers.

The completed chart helps relate tty numbers to the actual controller and the line number on that controller. This helps you set up the special files during installation.

tty00	_____	tty16	_____
tty01	_____	tty17	_____
tty02	_____	tty18	_____
tty03	_____	tty19	_____
tty04	_____	tty20	_____
tty05	_____	tty21	_____
tty06	_____	tty22	_____
tty07	_____	tty23	_____
tty08	_____	tty24	_____
tty09	_____	tty25	_____
tty10	_____	tty26	_____
tty11	_____	tty27	_____
tty12	_____	tty28	_____
tty13	_____	tty29	_____
tty14	_____	tty30	_____
tty15	_____	tty31	_____

Appendix H

The ed Command Summary Sheet

This appendix provides an outline of how to use the ed text editor. It provides enough information for you to edit the files necessary to install your ULTRIX-11 operating system.

Concepts

To use ed you must understand a few concepts:

command mode Whenever ed is ready to accept a command, you are in command mode. When you first invoke ed, you are in this mode.

current line The current line of a file is the line at which you are working. When you first invoke ed, the current line is the last line in the file.

text input mode While in text input mode (or append mode), ed does not give any prompts or expect any commands. Everything you enter is appended (or inserted) to the text file. To exit text input mode and return to the command mode, type a dot (.) on a line by itself.

.

A dot (.) represents the current line. If you type a dot on a line by itself, ed prints the current line. Also, typing a dot while in text mode brings you out of text mode and returns you to the command mode.

\$

A dollar sign (\$) represents the last line in the file. For example, the command .,\$p tells ed to print the current line through the last line of the file.

H-2 ed Summary

? A question mark (?) is the ed prompt. A question mark indicates ed is ready for your next command. The ed editor also prompts with a question mark if you issue a command incorrectly.

<RETURN> Remember to press the <RETURN> key after each ed command.

Pressing the <RETURN> key on a line by itself causes ed to make the next line the current line. If you are already at the last line of the file and press <RETURN>, ed responds with a question mark.

Here is a list of the most commonly used ed commands, and a brief description of each:

<u>Command</u>	<u>Action</u>
<u>ed <u>xxxx</u></u>	Edits the file <u>xxxx</u> . If the file does not exist, this command creates a new file named <u>xxxx</u> and edits it.
<u>.=</u>	Prints the number of the current line. This is useful for orientation.
<u>[n,m]p</u>	Prints the line specified. <u>n</u> is the number of the first line you want to print and <u>m</u> is the number of the last line you want to print. If you do not specify a line number, the current line is printed by default. For example: 1,10p prints the first 10 lines of the file.
<u>-</u>	Makes the previous line the current line.
<u>a</u>	Appends text below the current line. Terminate the appended text with a dot (.) on a line by itself.
<u>i</u>	Inserts text above the current line. Terminate the inserted text with a dot (.) on a line by itself.
<u>dp</u>	Deletes the current line and prints the new current line.
<u>/xxx/p</u>	Searches for the string <u>xxx</u> and prints the line containing that entry. This line becomes the current line.
<u>s/xxx/yyy/p</u>	Substitutes the string <u>yyy</u> for the string <u>xxx</u> in the current line and then prints the line.
<u>w</u>	Writes the file and incorporates all changes. To save the file with all the changes, always use the w command. Then, use the q command to exit the editor.
<u>q</u>	Quits (exits) the file. To prevent mistakes, ed does not allow you to use the q command without first writing the file with the w command. If you want to quit the ed without incorporating the changes, type q followed by <RETURN>, twice.
<u>Q</u>	Quits (exits) the file without incorporating changes. The file remains as it was before the editing session.

H-4 ed Summary

Sample ed Session

Here is a sample ed session with an example /etc/fstab file. In this example, a line is deleted, a line is modified, and a line is added. Each command is followed by <RETURN>.

```
# ed /etc/fstab
55                               (number of characters in the file)
<RETURN>
?
1,$p                             (ed is ready for your next command)
/dev/hk00:/:rw
/dev/hk02:/usr:xx
/dev/hk10:/usr/sys:rw
-                               (make the previous line the new current line)
/dev/hk02:/usr:xx
s/xx/rw/p                         (substitute rw for xx on the current line)
/dev/hk02:/usr:rw
<RETURN>
                               (this is the modified line)
/dev/hk10:/usr/sys:rw
a                               (make the next line the new current line)
/dev/hk13:/usr/users:rw            (add text after the current line)
                               (appended text)
.                               (terminate the appending mode)
<RETURN>
?
1,$p                             (ed is ready for your next command)
/dev/hk00:/:rw
/dev/hk02:/usr:rw
/dev/hk10:/usr/sys:rw
/dev/hk13:/usr/users:rw
i                               (insert text above the current line)
/dev/hk12:/usr/mnt:rw              (inserted text)
.                               (terminate the inserting mode)
1,$p                             (print the entire file)
/dev/hk00:/:rw
/dev/hk02:/usr:rw
/dev/hk10:/usr/sys:rw
/dev/hk12:/usr/mnt:rw
/dev/hk13:/usr/users:rw
-                               (make the previous line the current line)
/dev/hk12:/usr/mnt:rw
dp                               (delete the current line and
                                print the new current line)
/dev/hk13:/usr/users:rw
1,$p                             (print the entire file)
/dev/hk00:/:rw
/dev/hk02:/usr:rw
/dev/hk10:/usr/sys:rw
/dev/hk13:/usr/users:rw
w                               (write the file (save the modifications))
79                               (number of characters in the file)
q                               (quit the ed editor)
```

Refer to these articles for further information on using the ed text editor:

- The ULTRIX-11 Programmer's Manual, Volume 1
The ed(1) manual page
- The ULTRIX-11 Programmer's Manual, Volume 2A
A Tutorial Introduction to the UNIX Text Editor and the advanced editing section
- The Programmer's Pocket Guide
The ed command
- The learn program (Computer Aided Instruction)
The ULTRIX-11 learn facility contains scripts for the ed editor.

Before using the learn facility, you must mount the /usr file system, as follows:

```
# cd /
# /etc/mount -a
```

Remember to unmount the /usr file system when you have finished the learn scripts. To unmount the /usr file system, type:

```
# cd /
# /etc/umount -a
```

NOTE

On the RX50 diskette distribution, learn is optional software and must be loaded by the osload command. See Section 5.8.4, Optional Software Load Command, for information on how to use the osload program.

Appendix I

Multiple MASSBUS/MSCP Disk Controllers

This appendix describes the procedures to make the special files and generate your ULTRIX-11 kernel if your system has more than one MASSBUS and/or MSCP disk controllers.

The ULTRIX-11 software device drivers for MASSBUS and MSCP disks support multiple controllers. The HP driver can support up to three RH11/RH70 MASSBUS disk controllers. The RA driver can support up to three MSCP disks controllers. The RA driver has the restriction that only one of each type of MSCP controller is supported. The MASSBUS and MSCP disks are:

Type	<u>Controller and Disks</u>
MASSBUS	RH11 - RM02 RP04 RP05 RP06 ML11
MASSBUS	RH70 - RM02 RM03 RM05 RP04 RP05 RP06 ML11
MSCP	UDA50 - RA60 RA80 RA81
MSCP	KLESI - RC25
MSCP	RQDX1 - RX50 RD51 RD52
MSCP	RUX1 - RX50

1. MASSBUS/MSCP Disk Controller Numbers

The assignment of disk controller numbers is arbitrary except that, if the system disk is on a MASSBUS or MSCP controller, it must be on the first controller. The first controller is numbered 0, the second is 1, and the third is 2. The controller number is determined by the order in which you specify the MASSBUS and MSCP disk controllers during system generation.

Here are the conventional MASSBUS disk controller number assignments:

I-2 Multiple Disk Controllers

Name	CSR	Vector	Controller
HP	176700	254	1st RH11/RH70
HM	176300	150	2nd RH11/RH70
HJ	176400	204	3rd RH11/RH70

The MSCP disk controllers all have the same standard Control and Status Register (CSR) address (172150) and vector (154). The first MSCP controller must be at the standard CSR address and vector. This is a requirement for some hardware bootstraps and a convenience for most. The second and third MSCP controllers can be configured at any CSR/vector addresses that do not conflict with other devices on the system. Here are the suggested address assignments:

CSR	Vector	Controller
172150	154	1st UDA50/KLESI/RQDX1/RUX1
172160	400	2nd UDA50/KLESI/RQDX1/RUX1
172170	404	3rd UDA50/KLESI/RQDX1/RUX1

2. Creating the Disk Special Files

To create the disk special files, use a variation of the msf command:

```
# cd /dev  
# msf device C n  
# cd /  
# sync
```

device is the generic name of the disk, such as ra60, ra80, ra81, rc25, rx50, rd51, or rd52.

C is the controller number. This number may be omitted if the disk is on the first controller.

n is the disk unit number.

Here are some examples for creating the special files for MASSBUS and MSCP disks:

```
# cd /dev  
# msf rp06 0          (RP06 on first RH controller, unit 0)  
# msf ml11_1 0        (ML11 on second RH controller, unit 0)  
# msf rm03_2 1        (RM03 on third RH controller, unit 1)  
# msf rd51_0          (RD51 on first MSCP controller, unit 0)  
# msf rc25_1 1         (RC25 on second MSCP controller, unit 1)  
# msf ra60_2 0          (RA60 on third MSCP controller, unit 0)
```

```
# cd /  
# sync
```

3. System Generation of MASSBUS/MSCP Disks

The sysgen program asks for the type of each disk controller and reminds you to enter the system disk controller first. If the system disk is on a MASSBUS controller, specify it first. Then, enter the second and third MASSBUS controllers, if they exist. Next, enter the first, second, and third MSCP controllers, if they exist.

If the system disk is on an MSCP controller, specify it first. Then enter the second and third MSCP controllers, if they exist. Next, enter the first, second, and third MASSBUS disk controllers, if they exist.

Finally, specify any remaining non-MASSBUS/MSCP disk controllers.

The sysgen program also asks for the CSR address and vector address of each disk controller. For the first controller, use the standard CSR and vector addresses. For the second and third controllers, enter the actual CSR and vector address of the controller. The CSR address is assigned by switches or jumpers in the controller hardware. For MASSBUS controllers, the vector address is also assigned via switches or jumpers. For the MSCP controllers, the vector address is programmable; that is, the driver tells the controller what vector address to use.