Ciprico
Reference Manual

Rimfire 3200/3400

VMEbus SMD Disk Controller

Sun® End User
Installation Guide

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Notice

This version of the Rimfire 3200/3400 SunOS driver includes new procedures for modifying the drive label. To enable Extended Addressing, you must now add the characters */EAD* to the ASCII text portion of the drive label. To enable the Short Sector Present option, you must now add the characters */SSP* to the ASCII text portion of the drive label. In each case, the */EAD* and */SSP* characters must be preceded by a space and must be capitalized, as illustrated in the following example:

```
<Fujitsu-m2372 Swallow III cyl 743 alt 2 hd 27 sec 67 apc 27 /SSP>
```

These procedures differ from those used in earlier versions (before Version 2.0) of the Rimfire 3200\3400 SunOS driver.

In addition, the procedures for partitioning have been modified for greater convenience. For further details see page B-8.

Preface

This guide is intended to assist in the installation of Ciprico's® Rimfire® 3200/3400 controllers in Sun® Microsystems' Workstations. References to the Rimfire 3200/3400 controller apply to all members of the Rimfire 3200 and Rimfire 3400 product lines. References to the Rimfire 3200 controller refer to all members of the Rimfire 3200 product line. References to the Rimfire 3400 refer to all members of the Rimfire 3400 product line.

The following items are recommended for successful hardware and software installation:

Equipment:

- Sun-3 or Sun-4 Workstation with a 1/4 inch or 1/2 inch tape drive or access (via a network) to a 1/4 inch or 1/2 inch tape drive
- Rimfire 3200/3400 VMEbus SMD controller
- SunOS distribution tapes
- SMD disk drives and cabling
- Ciprico's Utility and Installation tape (includes the Ciprico 3200 SunOS driver). (Driver model numbers SSP3223/2 for 1/4 inch tape and SSP3223/1 for 1/2 inch tape.)

References:

- Sun Microsystems' documentation and reference manuals for the appropriate Sun Workstation
- The appropriate drive manufacturer's reference manual

Revision History

Publication #	Revision	Date	Description
21016900	01	02/28/89	Preliminary, Class 'B' Manual
21016901	01	04/25/89	Revision incorporates addition of Rimfire 3224 controller to the product series, procedures for installing additional controllers, Specifications (Appendix A), Error Code information (Appendix D), cabling information (Appendix E), and Appendix C for manually installing drivers.
21016902	01	06/27/89	Revision incorporates new *tar* command parameters for reading 1/4" tape and removal of restrictions regarding the use of greater than 1024 cylinders.
21016903	A	11/17/89	Revision incorporates addition of non-bootable Rimfire 3200/3400 information, revisions for Version 2.0 of the Rimfire 3200/3400 SunOS driver, and suggested drive settings (Appendix G).

Table of Contents

Figures

Tables

Section 1 - Introduction

Within the Rimfire 3200 and 3400 product lines, there are both bootable (3223 and 3224) and non-bootable controllers for the Sun environment.

Bootable Controllers

Bootable Rimfire controllers (3223 and 3224) are designed to boot emulate a Sun SMD controller in Sun-3™ and Sun-4™ environments. Section 2 contains procedures for installing bootable Rimfire controllers.

Rimfire 3223/3224 Controllers

The Rimfire 3223/3224 controllers use an 80186 microprocessor to manage a 512 Kbyte cache. The cache is used to preread data across track and cylinder boundaries, effectively increasing performance. Disk data subsequent to a request are preread into the controller's cache memory. Because files may span track boundaries, cross- track lookahead prereads multiple tracks without losing revolutions. Future sequential requests are then satisfied directly from the cache. This technique eliminates costly seek and rotational delays.

Multiple circular command queues link the operating system and the Rimfire 3223/3224 controller. Each queue receives requests from the operating system driver asynchronously without handshake timing restrictions. With access to all pending disk requests, the Rimfire 3223/3224 controller reduces physical latency times by optimizing disk head motion and minimizing disk accesses.

The combination of Ciprico's proprietary Short Burst FIFO gate array and VMEbus interface maximize system bus utilization, allowing a transfer rate capability of 30 Mbytes/second. Only a small portion of the available bus bandwidth is used by the controller for data transfers.

Additionally, the controller operates with all SMD interfaced disk drives at data rates up to 24 MHz. Up to four SMD compatible drives are supported.

To simplify installation and conversion, the Rimfire 3223/3224 controller has an I/O connector scheme and physical dimensions corresponding to Sun's SMD4™ disk controller.

Boot compatibility is accomplished without the need for hardware or firmware modifications to the Sun Workstation. A Sun controller is not required for the primary boot disk. Both on-line and off-line disk formatting are possible, with Ciprico's disk utilities (including *Standalone rfutil* and *Installation Script* programs) simplifying the installation process.

Non-Bootable Controllers

Unlike the Rimfire 3223/3224 controllers, the following controllers are not designed to boot emulate a Sun SMD controller:

- Rimfire 3200 controllers (excluding the Rimfire 3223 and Rimfire 3224)
- Rimfire 3400 controllers

Section 3 contains procedures for installing non-bootable Rimfire series controllers.

Rimfire 3200 Controllers

The Ciprico Rimfire 3200 series controllers are intelligent disk drive controllers which operate SMD, SMD-E, or HSMD drives from a single VMEbus slot. They support drive data rates to 24 MHz, and transfer data across the VMEbus at burst rates to 30 Mbytes/second. Rimfire 3200 series controllers support multiple hosts. They improve system performance and decrease host workload.The Rimfire 3200 controller reduces system overhead and increases the speed of disk operations by means of a number of performance features. Host controlled features include data caching on read/write operations, automatic read-ahead, and automatic request sorting by disk address (reducing seek times).

Reduced latency reads/writes are performed and single-track operations are combined whenever possible, minimizing disk revolutions. The controller supports fully concurrent two-drive (Rimfire 3200 series) or four-drive (Rimfire 3220 series and Rimfire 3230 series) operation, including implied overlap seeks. It generates a variety of disk formatting schemes and provides for inter-track and inter-cylinder skews (spiral formatting).

The Rimfire 3200 controller transfers data to or from any address on the VMEbus. It operates at a burst rate of 30 Mbytes/second with a 30 ns memory response time, and sustains a data throughput between 4 and 7.5 Mbytes/second. It supports transfer widths of 8, 16 or 32 bits and address widths of 24 or 32 bits.

A write to a Channel Attention port alerts the Rimfire 3200 controller for a command. Commands are issued either singularly or in circular lists in host memory. This command list feature enables issue of disk commands without arbitration for controller time.

Rimfire 3200 hardware is based on the Intel 80186 microprocessor. A National Semiconductor 8466 digital data controller performs disk operations, and a proprietary FIFO gate array performs bus operations. The gate array also swaps bytes and words as required by all 16 and 32 bit processor families. An onboard cache memory consists of 512 Kbytes of dynamic RAM, dedicated solely to disk operations. A separate 64-Kbyte static RAM area functions as a scratchpad for current operations.

Rimfire 3400 Controllers

The Ciprico Rimfire 3400 controller controls up to four ESDI (Enhanced Small Device Interface) disk drives from a single VMEbus slot. It supports drive data rates to 20 MHz, and can transfer data across the VMEbus at rates of up to 30 Mbytes/ second. The Rimfire 3400 controller incorporates support for multiple host applications; its features improve performance and decrease host workload for a variety of one to four drive configurations.

The Rimfire 3400 controller reduces system overhead and increases the speed of disk operations by means of a number of performance features. Host controlled features include data caching on read/write operations, automatic read-ahead, and automatic request sorting by disk address (reducing seek times). Whenever possible, reduced latency read/write operations are performed and operations in a single track are combined, minimizing the number of disk revolutions required. The controller supports fully concurrent operation of four drives, including implied overlap seeks. It can generate a variety of disk formats, with provisions for inter-track and inter-cylinder skews (spiral formatting).

The Rimfire 3400 controller can transfer data to or from any address on the VMEbus. It has a VMEbus burst transfer rate capability of 30 Mbytes/second with minimum memory response time and can sustain a cache throughput of 6 Mbytes/second. The controller supports data transfer widths of 8, 16, or 32 bits and address widths of 24 or 32 bits.

The controller is alerted for commands by writing to a Channel Attention port which has no timing restrictions. Commands may be issued to the controller either singularly or in circular lists in host memory. The command list feature allows issue of disk commands without arbitration for controller time. The similarities between the Rimfire 3200 and Rimfire 3400 controllers allow use of a single driver by both controllers.

Rimfire 3400 hardware is based on the Intel 80186 microprocessor. Disk operations are performed by a National Semiconductor 8466 disk data controller and bus performance is improved by a proprietary FIFO gate array. The FIFO gate array also performs hardware byte and word swapping, allowing support of all 16 and 32 bit processor families. The onboard cache consists of 512 Kbytes of dynamic RAM. The processor uses a separate 64 Kbyte static RAM area as a scratchpad for keeping track of ongoing operations, leaving the entire cache available for disk data.

Section 2 - Bootable Controller Installation

This section describes procedures for installing bootable Rimfire 3200 controllers in a Sun Microsystems' workstation. Information in this section may vary with the particular Sun Workstation and version of SunOS you are using.

Throughout this section, there are references and file names reflecting the Sun system and version of SunOS you are using (for example *sunX* or *4.X*). These references are dependent on the Sun system and version of SunOS you are using. In such cases, *X* should be replaced by the version number for your software or hardware.

The examples in this section include values and file names that may differ from those displayed on your screen, due to variations in system configuration. Throughout this section, **bold** print is used to indicate system dependent variables.

Throughout this section, you are instructed to press the *Enter* key. On some keyboards this key is marked *Return* rather than *Enter*.

Hardware Installation Procedures

This section describes installation of a bootable Rimfire 3200 controller in a Sun Microsystems' workstation. Installation procedures are dependent on the model of Sun workstation.

Required Equipment:

- Sun 3 or Sun 4 Workstation
- Bootable Rimfire 3200 VMEbus SMD controller

To perform hardware installation, UNIX must be shut down and the Sun system powered off. As an added precaution, disconnect the power cord from the system.

Board Configuration

Figure F-1 illustrates jumper locations and their factory settings. Unless otherwise indicated, a jumper is set to *Ø* if the jumper is in and is set to *1* if the jumper is out. Inspect your Rimfire 3200 controller for proper jumper settings. Pay particular attention to the following items:

- The *JSUN* jumper must be in for the Rimfire 3200/23/24 controller to emulate a Sun SMD Boot controller.
- The address jumpers at *J13* (A9-A15) set the Rimfire address. The Rimfire address is dependent on whether the controller is the first (address = Øx2ØØØ) or second (address = Øx3ØØØ) Rimfire 3200 controller in your system.
- The combined settings of the address jumpers at *JX1* (A3-A7) and *JX2* (A8-A15) set the SMD Boot Emulation address and should be set to address ØxEE4Ø.
- The SMD Boot Emulation controllers must be located at address ØxEE4Ø. Other controllers present at this address must be readdressed.

The following examples further illustrate Rimfire 3200 controller addressing:

Example 1: Suppose the first Rimfire 3200 controller is to be the primary controller used for booting. There will also be a second Rimfire 3200 controller which may be used for adding devices. The controllers would be addressed as follows:

	Emulation Address	Rimfire Address
1st Rimfire:	ØxEE4Ø	Øx2ØØØ
2nd Rimfire:	N/A	Øx3ØØØ

Example 2: Suppose the Rimfire 3200 controller is installed in a system already containing a Xylogics® SMD controller. The Rimfire 3200 controller will not be used for booting (*JSUN* jumper removed). The Rimfire 3200 controller would be addressed as follows:

	Emulation Address	Rimfire Address
Rimfire Controller	N/A	Øx2ØØØ

Controller Installation

1. VME card slots on the Sun workstation are covered by metal plates. Inside each slot, are EMI plates. Select an unused slot and remove the two hex head screws holding the cover plate on the rear of the system. Remove the cover plate and slide the EMI plate out of the slot.

2. Rimfire bootable controllers are Sun-sized cards and will fit directly into the card cage. Insert the controller into the slot, pressing it firmly into the connectors.

3. Fasten the controller into place with the hex head screws from the rear cover plate.

4. Remove the front cover plate from the workstation to allow access to the backplane. On some Sun Workstations, you will also need to move the power supply to access the backplane. If so, remove the four screws holding the power supply cover and tilt open the power supply. Others may have a small removable panel allowing access to only the jumper area of the backplane.

5. Locate the slot being used. (The number is to the right of the connector.) Remove the *BUS GRANT 3* and *IACK* jumpers (it is a good idea to simply move the jumpers down one pin so they are available, if needed). Figure 2-1 illustrates the *BUS GRANT* and *IACK* jumpers for a given slot.

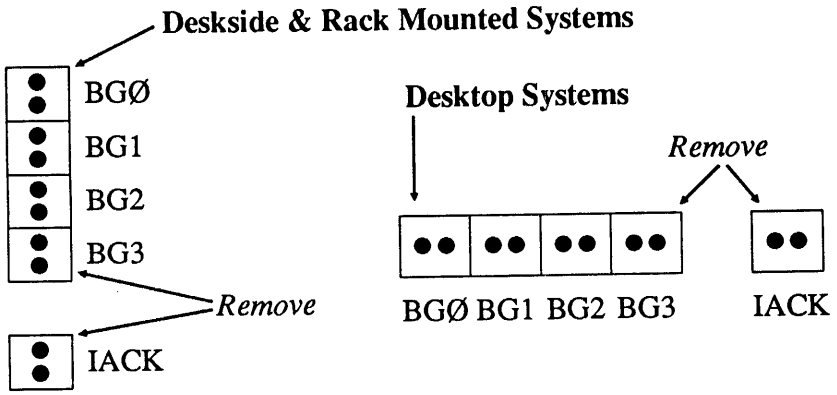


Figure 2-1 BUS GRANT and IACK Jumpers

➽ *NOTE: The BUS GRANT 3 and IACK jumpers must be removed for the Rimfire 3200 controller to operate properly.*

6. If you moved the power supply to access the backplane, tilt the power supply back to its original position and refasten the power supply cover.

7. Replace the front cover plate (if there is one on you particular system).

8. Connect the drive cables. Figure 2-2 illustrates cable connections for shielded or flat ribbon cables.

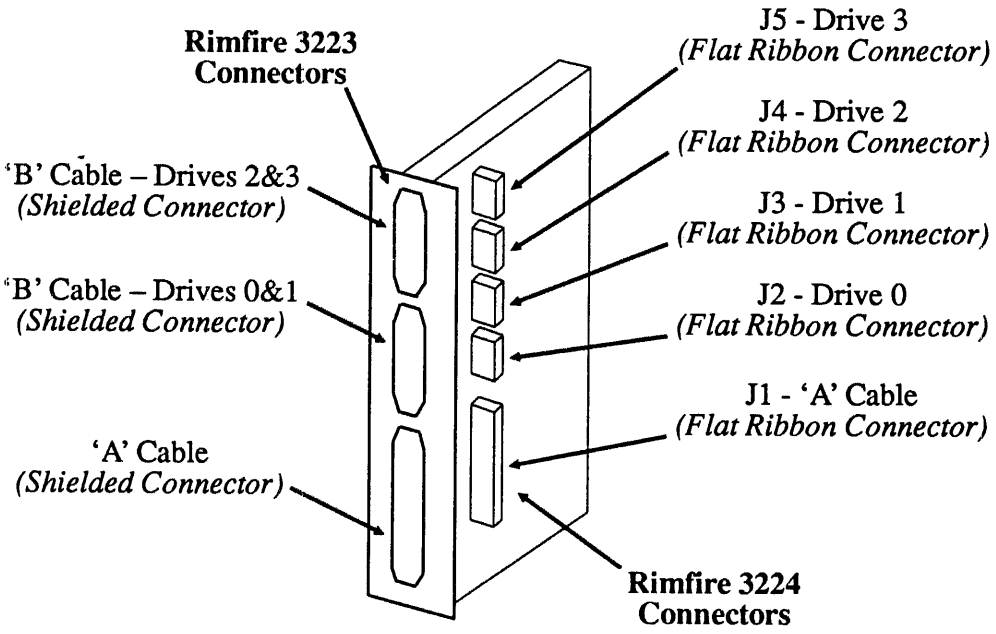


Figure 2-2 Drive Cable Connections

9. Check the drives to ensure that drive parameters (addressing, terminators, sector switches, etc.) are correct. Appendix G lists suggested parameters for drives qualified (by Ciprico) for use with Rimfire 3200/3400 controllers. For drive(s) not listed, consult the drive manufacturer's manual.

   Ensure that the sector switches on the drive match the drive configuration settings.

10. Power on the new drive(s) and wait until they are ready for operation.

11. Power the Sun system on and check for proper operation. If the board is operating correctly, the Fail and Busy lights will flash on and then turn off.

Software Installation

The remainder of this section describes steps for installing *SunOS* and the Rimfire driver.

The examples and procedures shown assume you are using 1/4 inch tape and installing the Rimfire 3200 controller as the primary boot controller.

➽ *NOTE: If you are installing the Rimfire 3200 controller as a non-bootable controller, see Section 3 for installation procedures.*

References:

- Sun Microsystems' documentation and reference manuals for the appropriate Sun Workstation
- The appropriate drive manufacturer's reference manual

Required Equipment:

- Sun 3 or Sun 4 Workstation with 1/4 inch or 1/2 inch tape drive, or access (via a network) to a 1/4 inch or 1/2 inch tape drive
- Bootable Rimfire 3200 SMD controller
- SunOS distribution tapes
- Ciprico's *Utility and Installation* tape (includes the Ciprico driver)

➽ *NOTE: For 1/2 inch tape drives, a density of 1600 bytes per inch is required to read the Ciprico 'Utility and Installation' tape.*

Loading the SunOS Boot

1. Power on the system.

2. After the memory check is complete, abort the boot process. (Note: the keys used to abort the boot process will vary with the keyboard you are using.)

   Insert *tape 1* of the Sun Operating System release tapes into the tape drive.

   At the monitor prompt, load the bootstrap program from the tape. The characters you enter to load the bootstrap program will vary with the media you are using. For example, enter *b st()* for 1/4 inch drives and press *Enter*. (For 1/2 inch tape drives, consult your Sun manual.)

3. After the *boot:* prompt appears on the screen, remove the SunOS release tape.

Loading and Configuring the *Standalone rfutil*

1. Insert the Ciprico *Utility and Installation* tape into the tape drive.

➽ *NOTE: For 1/2 inch tape drives, a density of 1600 bytes per inch is required to read the Ciprico Utility and Installation tape.*

2. Load the *Standalone rfutil* program. The characters you enter to load the program will vary with the media and system you are using. For example, possible entries for ¼ inch tape are as follows:

   `st(Ø,Ø,1)` ***for 68Ø2Ø based Sun3 systems***
   `st(Ø,Ø,2)` ***for SPARC based Sun4 systems***
   `st(Ø,Ø,3)` ***for 68Ø3Ø based Sun3 systems***

➽ *NOTE: (For 1/2 inch tape drives, consult your Sun manual.)*

Enter the appropriate characters for the media you are using and press the *Enter* key.

3. After the *Standalone rfutil* program is loaded, a prompt requests the hexadecimal address of the Rimfire 3200 controller. Enter the hexadecimal address of the Rimfire 3200 controller and press the *Enter* key. (This address is 2ØØØ for the first controller and 3ØØØ for the second controller.)

4. A prompt requests the unit (disk) with which to work. Enter one of the following:

```
Ø = First disk
1 = Second disk
2 = Third disk
3 = Fourth disk
```

➳ *NOTE: If the disk you select has not been previously formatted using a Rimfire 3200 controller, an error message will appear. Disregard the error message and proceed to the next step.*

5. A prompt (*TERM* =) requests the type of terminal that will be used. Some common terminal types are listed below. Enter the appropriate type.

```
adm3      adm3a     sun
sun-24    tvi925    tvi92Ø6
vt52      vt1ØØ
```

6. After specifying the type of terminal, the main menu appears. Proceed with formatting and verifying the drives using the following procedures.

Formatting and Verifying Drives

The formatting and verifying required for a given drive is dependent upon whether the drive has been previously formatted. The following procedures apply to unformatted drives and drives previously formatted on controllers other than a Rimfire 3200 series controller. Refer to Appendix B for complete *rfutil* command explanations.

➳ *NOTE: Drive cables must be properly connected to assure correct results when formatting and verifying drives. Figure 2-2 illustrates proper cable connections.*

1. To open the drive, select *o* from the main menu. By default, the first drive (Ø) is opened. If you wish to open a different drive, enter */dev/rrfXa*, where *X* indicates the drive number (Ø = 1st Drive, 1 = 2nd Drive, 2 = 3rd Drive, etc.).

2. After opening the proper drive, select *L* from the main menu to display a listing of predefined drive labels. Select the appropriate drive label by entering the corresponding number.

➽ *NOTE: If the drive used does not appear in the list of default drives, modify a default listing that is similar or select Ø from the list (edit current label) and then enter the configuration of the drive. The Gap 1 and Gap 2 sizes vary with the drives. Appendix G lists suggested parameters for drives qualified (by Ciprico) for use with Rimfire 3200/3400 controllers. For drive(s) not listed, consult the drive manufacturer's manual. One sector per head should be reserved on each track for slipping sectors. This value is called the Alternates Per Cylinder (APC) and should be equal to the number of heads. Two to three cylinders should be reserved at the end of the disk for mapping sectors and tracks. This value is referred to as the Number of Alternate Cylinders.*

3. If you wish to change parameters for the selected label, select *L* from the main menu, select Ø (edit the current label) and then press *Enter*. The current ASCII label is displayed, bracketed by the "Less Than" (<) and "Greater Than" (>) symbols. If no label exists, only the "Less Than" and "Greater Than" symbols are displayed.

   Press *Enter* to display parameters for the current label.

   Confirm the parameters for the drive. Parameters can be changed by entering the number for the particular parameter and entering the desired information.

   When determining the total physical sectors per track for which the drive should be set, add the number of data sectors per track plus the spare data sector, plus the short sector (for SMD).

Each disk drive manufacturer has a unique way of setting short sector. Certain drives will not require a short sector when set to the desired sector size. Appendix G lists suggested parameters for drives qualified (by Ciprico) for use with Rimfire 3200/3400 controllers. For drive(s) not listed, consult the drive manufacturer's manual.

4. Press the *Enter* key to advance to the partition information. A table, listing partition settings, is displayed; along with the following prompt:

```
Enter the hog partition  [n<one>]:
```

The presence of an asterisk (*) beside a partition letter (in the partition table) indicates that partition is the free space *hog* partition. The *hog* partition is calculated by the *rfutil* program and is the first available void on the disk. Its intended use is as a *"rest of the disk"* partition. Possible responses to the *hog* partition prompt are as follows:

n<one>	Enter *n* if you do not wish to make a *hog* partition.
Partition Letter	Enter the letter of the partition you wish to designate as the *hog* partition.
Enter	Press the *Enter* key to accept the current *hog* partition setting.

After you respond to the *hog* partition prompt, the following prompt is displayed:

```
Partition to change, <CR> when done:
```

Partitions may be changed by selecting the partition by letter, then entering the new partition information. Refer to the *l - Create or Modify the Label* command (see Appendix B) for details on modifying the partition information. Partitions A and B must be set up on the boot disk. The other partitions can be defined during the SunOS installation (see page 2-10, Loading the SunOS).

When you finish changing partitions, press the *Enter* key to accept partitions settings and submit the label to the kernel.

5. Press the *Enter* key to return to the main menu.

6. Select the *f* (Format the Drive) command from the main menu. The *rfutil* program will attempt to open a defect list for the active drive. If the drive has been formatted, the processed defect list is used. If the drive has not been formatted, the *rfutil* program will read the manufacturer's defect list (if one exists). If no processed or manufacturer's defect list exists, you will need to build a defect list from an existing file or your keyboard.

   The parameters for the drive are displayed on the screen. Verify that they are correct. If the parameters are incorrect, quit the *f* command and change any incorrect parameters using the *l* command and then the *Ø* (Edit the Current Label) option.

7. Select the option to format the entire disk (not partial format). Several prompts appear requesting verification that the entire drive is to be formatted. Enter *Y* in response to all of the prompts. Formatting begins, displaying the respective cylinder and head count as they are completed. If an error occurs, refer to Appendix D (Error Codes) for an explanation of the Error Code.

   When formatting is completed, a prompt may appear asking whether the label should be written. Enter *Y*. The program returns to the Main Menu.

➳ *NOTE: If the format does not complete correctly, the problem must be corrected and the drive successfully formatted before continuing.*

8. Select the *v* (Verify format) command to verify the disk integrity. Ciprico suggests five passes of verification. A prompt appears asking whether *rfutil* and the controller should slip and map bad sectors. Enter *y* to begin auto slipping and mapping. Generally, the entire disk should be verified. (Refer to the *v* command in Appendix B for further details.)

9. Once the verification has completed, exit the *rfutil* program.

Loading the SunOS

In the following steps, you will load the operating system software (SunOS). But, before doing so, you are instructed to tune filesystems. Running the Rimfire 3223/3224 controller on filesystems tuned for its features (as opposed to the default Sun filesystem tuning) results in a 23% to 33% increase in performance.

The only way to tune all of the Rimfire filesystems during a Sun install is to tune them before loading the SunOS software. To do this, filesystems must be tuned from the *miniroot*. Since the standard Sun filesystem tuning command (*tunefs*) does not exist in the miniroot, Ciprico provides a program (*tunerf*) for tuning filesystems.

Procedures for tuning filesystems and loading SunOS are as follows:

1. Insert the first SunOS release tape into the tape drive. For 1/4 inch tape, type *b st()* and press *Enter* to display the boot prompt (*boot:*). Refer to your Sun manual for the appropriate entry for 1/2 inch tape.

➽ *NOTE: For 1/2 inch tape drives, the drive density select switch may need to be changed.*

2. Boot and load the *miniroot* from the standard Sun distribution tape. For further details, refer to the following section in your Sun manual:

   - If you are using *SETUP*, refer to the *"Loading the Miniroot"* section.
   - If you are using *SUNINSTALL*, refer to the *"Loading the Mini UNIX"* section.

➽ *NOTE: Always refer to the Ciprico board as xy during the installation.*

3. Once the *miniroot* is loaded, insert the Ciprico tape in the tape drive and enter the following *tar* command to read in the *tunerf* executable file:

   ```
   tar xvf /dev/rstØ rf/tunerf.XXX
   ```

   Where *xxx* is your system type (sun3, sun4, or sun3x).

4. Make filesystems on the desired partitions by enter the following *newfs* command; where *a* is disk unit number (Ø, 1, 2, or 3) and *b* is the letter of the partition you wish to tune (a, d, e, f, g, or h):

   ```
   newfs /dev/rxyab
   ```

5. For each filesystem to be tuned, execute the *tunerf* program by entering the following command:

```
tunerf /dev/rxyab
```

where *a* is disk unit number (Ø, 1, 2, or 3) and *b* is the letter of the partition (a, d, e, f, g, or h) on which you made filesystems.

6. Complete the SunOS installation using *SETUP* (for SunOS3.X) or *SUNINSTALL* (for SunOS4.X). (For further details refer to your Sun manual.)

➽ *NOTE: When you reach the Disk Form portion of the SunOS installation a table of partition information (similar to the following example) is displayed. Within the table, is a column with the heading* ***"PRESERVE (Y/N)"****. To avoid making new filesystems over the filesystem you have tuned,* ***answer "yes" (y) to this category.***

PARTITION	START_CYL	BLOCKS	SIZE	MOUNT PT	PRESERVE (Y/N)
a	Ø	15884	7	/	**y**
b	XX	33440	16		
c	Ø	140624	68		
d	Ø	Ø	Ø		
e	Ø	Ø	Ø		
f	Ø	Ø	Ø		
g	XX	91256	44	/usr	**y**
h	Ø	Ø	Ø		

The system name assigned during the SunOS installation will be used as the *Hostname* when installing the Ciprico driver.

7. After completing the normal SunOS installation, reboot the system by entering *b xy()* at the monitor prompt.

Installing the Ciprico Driver

The Ciprico driver can be installed manually or by using the *Installation Script* on the distribution tape. If you choose to manually install the Ciprico driver, refer to Appendix C for further details.

Using the Installation Script

The *Installation Script* is included on Ciprico's *Utility and Installation Tape*. It is an interactive utility that steps you through the procedures for installing the Ciprico driver. Steps for installing the driver are as follows:

➽ *NOTE: In the following procedures, you are asked if it is OK to copy files to existing directories. To avoid overwriting existing files, filenames are automatically assigned a ".norf" extension.*

Throughout the following procedures, there are messages indicating whether the particular step is mandatory to driver installation. Steps noted as mandatory must be performed for successful driver installation.

Due to system variations, the information displayed on your screen (file names, software and hardware references, device counts, etc.) may differ from examples in this manual.

1. Create a directory (called *CIPRICO*) for the files on Ciprico's *Utility and Installation* tape. Enter the following line:

```
mkdir /sys/CIPRICO
```

2. Enter the following command to change to the directory you just created:

```
cd /sys/CIPRICO
```

3. Insert the Ciprico *Utility and Installation* Tape. If you are using 1/4 inch tape, read the tape by entering the following command:

```
tar xvbf 126 /dev/rst8
```

If you are using 1/2 inch tape, enter the following command:

```
tar xvbf 2Ø /dev/rmtØ
```

4. Enter the following command to switch to the */install* directory:

```
cd rf/install
```

5. Start the Install script by entering the following command:

```
doinstall rf
```

The following information is displayed:

```
(C)  C O P Y R I G H T   1 9 8 9

Ciprico, Inc.
2955 Xenium Lane
Plymouth, MN   55441
(612) 559-2034

All Rights Reserved.

+ Determining CPU architecture... CPU is a sunX
+ Determining hostname... Hostname is RIMFIRE
+ Checking for mount of /usr... /usr is mounted
+ You are running SunOS release 4.X
+ Your system configuration directory should be RIMFIRE
```

The Hostname (indicated by *"RIMFIRE"*) will be the system name assigned during SunOS installation. The *Installation Script* searches for a config file with the same name as the Hostname. If no config file with the Hostname is found, the following responses and options are displayed:

```
>>>> I can't find the configuration file /sys/sunX/conf/RIMFIRE <<<<

>>>> One possibility is that you build kernels for RIMFIRE
>>>> on another machine.  If this is the case, you will need
>>>> to abort the installation here, read in the software on the
>>>> other machine, and then restart the procedure there.

>>>> Several options are available at this point:
>>>>    1. Copy the GENERIC configuration file to RIMFIRE
>>>>       and use it.
>>>>    2. Suspend this program, create an initial configuration
>>>>       file /sys/sunX/conf/RIMFIRE manually
>>>>       and then resume at this point.
>>>>    3. Use and modify the GENERIC configuration file.
>>>>    4. Tell me the name of the configuration file to use.
>>>>    5. Abort the installation (and do it on another machine).

Please enter the number corresponding to your decision: (1/2/3/4/5)
```

6. Enter *1* to copy the *GENERIC* configuration file to *RIMFIRE* and then use the *RIMFIRE* file. The following message will appear:

```
Copy GENERIC to RIMFIRE. OK? (y/n)
```

7. Enter *y* to confirm your selection. The following lines will appear:

```
+ Checking /sys/sunX/conf/RIMFIRE

+ Successful creation of /sys/sunX/conf/RIMFIRE

+ Retrying...

+ Your system configuration directory should be RIMFIRE
+ System configuration file is /sys/sunX/conf/RIMFIRE

[The next step is mandatory for driver installation]

About to copy rf device driver files
to /sys/sundev and /sys/sunX/OBJ. OK? (y/n)
```

8. Enter *y* to copy the *rf* device driver files. The following lines will appear on your screen:

```
+ cp ../sundev/md1.h /sys.sundev/md1.h
+ cp ../sundev/md1.h /usr/include/sundev/md1.h
+ cp ../sundev/rf.c /sys/sundev/rf.c
+ cp ../sundev/rferr.h /sys/sundev/rferr.h
+ cp ../sundev/rferr.h /usr/include/sundev/rferr.h
+ cp ../sundev/rfioctl.h /sys/sundev/rfioctl.h
+ cp ../sundev/rfioctl.h /usr/include/sundev/rfioctl.h
+ cp ../sundev/rfparam.h /sys/sundev/rfparam.h
+ cp ../sundev/rfparam.h /usr/include/sundev/rfparam.h
+ cp ../sundev/rfreg.h /sys/sundev/rfreg.h
+ cp ../sundev/rfreg.h /usr/include/sundev/rfreg.h
+ Copy of rf driver files done.

About to modify /sys/sun/conf.c. OK? (y/n)
```

9. Enter *y* to modify the */sys/sun/conf.c* file. The following lines appear:

```
+ Beginning to add rf entries to /sys/sun/conf.c.
+ Making backup copy of /sys/sun/conf.c as /sys/sun/conf.c.norf.
+ Adding defines to /sys/sun/conf.c.
+ Counting block device entries...22 found.
+ Counting character device entries...63 found.
+ Adding bdevsw entry to /sys/sun/conf.c.
+ Adding cdevsw entry to /sys/sun/conf.c.
+ Checking for new entries in /sys/sun/conf.c.

+ Successful rf device description addition to /sys/sun/conf.c

[The next step is mandatory for driver installation]

About to modify /sys/sunX/conf/files. OK? (y/n)
```

10. Enter *y* to modify the */sys/sunX/conf/files* file. The modifications will be made and a backup copy (*files.norf*) will be written. The following lines will appear:

```
+ Beginning to add rf entries to /sys/sunX/conf/files.
+ Making backup copy of /sys/sunX/conf/files as /sys/sunX/conf/files.norf.
+ Adding configuration lines to /sys/sunX/conf/files.
+ Checking for new entries in /sys/sunX/conf/files.

Successful rf device addition to /sys/sunX/conf/files

[The next step is mandatory for driver installation]

About to modify /sys/sunX/conf/RIMFIRE. OK? (y/n)
```

11. Enter *y* to modify /sys/sunX/*conf/RIMFIRE*. A backup copy (*/sys/sunX/conf/RIMFIRE.norf*) will be made. The following lines will appear:

```
+ Making backup copy of /sys/sunX/conf/RIMFIRE as /sys/sunX/conf/RIMFIRE.norf.
+ Extracting controller information from /sys/sunX/conf/RIMFIRE...done.
+ No rfc controllers currently installed.
+ Adding controller rfcØ to /sys/sunX/conf/RIMFIRE

[Note: Controller address MUST NOT be the same or overlap]
[any existing devices specified in file /sys/sunX/conf/RIMFIRE.]
[Default value is displayed in braces below]
[Please be sure to preface hexidecimal number with "Øx"]

VME address of controller? [Øx2ØØØ]
```

12. If the last line on your screen displays the correct VME address for the Rimfire controller, press *Enter* to accept the current VME address.

    If the VME address is incorrect, enter the correct value and press the *Enter* key. Values must be entered in hexidecimal form and preceded by *Øx*, as illustrated in the following example:

    ```
    ØX2ØØØ
    ```

    After the VME address is entered, the following line is displayed:

    ```
    VME interrupt vector of controller?  [Øxf2]
    ```

13. If the line on your screen displays the correct VME interrupt vector, press *Enter* to accept the current VME interrupt vector.

If the VME interrupt vector is incorrect, enter the correct value and press the *Enter* key. Values must be entered in hexidecimal form and preceded by *Øx*, as illustrated in the following example:

```
Øxf2
```

After the VME interrupt vector is entered, the following line is displayed:

```
Add controller rfcØ at address Øx2ØØØ vector Øxf2 to /sys/sunX/conf/RIMFIRE? (y/n)
```

14. Enter *y* to add the Rimfire controller (at the specified VME address and VME interrupt vector) to the */sys/sunX/conf/**RIMFIRE*** file. Your screen will display the following lines:

```
Successful rfc device addition to /sys/sunX/conf/RIMFIRE

[The next step is mandatory for driver installation]

About to modify /sys/sunX/conf/RIMFIRE for device addition. OK? (y/n)
```

15. Enter *y* and the program will begin modifying the */sys/sunX/conf/**RIMFIRE*** for device addition. The following lines are displayed during the modification process:

```
+ Backup copy of /sys/sunX/conf/RIMFIRE already exists.
+ Extracting controller information from /sys/sunX/conf/RIMFIRE...done.
+ No devices attached to controller rfcØ.
+ Extracting device information from /sys/sunX/conf/RIMFIRE...done.
+ No rf devices configured in system.

Configure device rfØ at controller rfcØ? (y/n)
```

16. In this phase of the *Installation Script*, you are allowed to add drives (identified by *rf* prefixed device unit numbers) to the Rimfire controller configuration. If you enter *y*, the drive is added to the configuration and the following lines are displayed:

```
[Drive unit number of rfØ MUST NOT conflict with]
[any other disks attached to rfcØ shown above.]
Use default drive number of Ø? (y/n)
```

For each drive you add to the configuration, you are asked if you wish to use a specified default drive number. Enter *y* if you wish to use the default drive number.

If you do not wish to add the drive to the configuration enter *n*. The following prompt will appear:

```
Done configuring rf units?  (y/n)
```

If you enter *n*, you will be asked if you wish to add the next consecutive drive (identified by the next consecutive device unit number) to your configuration.

If you are finished adding drives to your configuration, enter *y*. The following lines will appear:

```
+ Successful addition of rf device(s) to /sys/sunX/conf/RIMFIRE

[Next step required for Ciprico boards ONLY with Xylogics 451 emulation jumper installed]
[Should NOT be performed when installing any other controllers]

Remove entries fo device XYCØ at CSR address Øxee4Ø? (y/n)
```

17. Enter *y* to remove the Xylogics 451 entry. The following lines are displayed:

```
+ Successful removal of xcyØ from /sys/sunX/conf/RIMFIRE

+ Making backup copy of /etc/fstab as /etc/fstab.norf.

     ******************
     CURRENT fstab FILE
     ******************

fstab: No such file or directory

Change mounting for disk xyØ in /etc/fstab to be on an rf disk? (y/n)
```

18. Enter *y* to change mounting for disk *xyØ*. The following lines are displayed:

```
+ Successful edit of /etc/fstab

Change mounting for disk rfØ in etc/fstab to be on an rf disk? (y/n)
```

19. Enter *y* to change mounting for disk *rfØ*. The following lines are displayed:

```
+ Successful edit of /etc/fstab

+ Checking /sys/sunX/conf/RIMFIRE for root file system specification.
+ Checking /sys/sunX/conf/RIMFIRE for swap file system specification.

+ Root file system currently specified as:  generic
+ Primary swap file system currently specified as:  generic

[Next step is optional UNLESS rf disks are to be root or swap disks]
[AND you are not using root generic and swap generic]

Editing config file to change root and swap specifications. OK? (y/n)
```

20. Enter *y* to change the root and swap specification in the *config* file. The following lines are displayed:

```
+ Making temporary backup copy of /sys/sunX/conf/RIMFIRE

Root disk is currently: generic. Change? (y/n)
```

21. Enter *y* to change the root disk. The following selections are displayed:

```
1. generic      2. xdØ       3. xd1       4. xd2
5. xd3          6. xd4       7. xd5       8. xd6
9. xd7          10. xd8      11. xd9      12. xd1Ø
13. xd11        14. xd12     15. xd13     16. xd14
17. xd15        18. xy2      19. xy3      20. sdØ
21. sd1         22. sd2      23. sd3      24. sd4
25. sd6         26. sdØ      27. sd1      28. sd2
29. sd3         30. sd4      31. sd6      32. sdØ
33. sd1         34. sd2      35. sd3      36. rfØ
37. rf1         38. rf2      39. rf3
Select "generic" for determining the root device at boot time.

Enter the number of the disk that contains the root filesystem. (1/2/3/4/5
/6/7/8/9/10/11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26/27/28/29/30/31/32
/33/34/35/36/37/38/39)
```

22. Enter *36* to specify *rfØ* as the root disk. The following message is displayed:

```
Root disk is now: rfØ. OK?
```

23. Enter *y* to confirm the root disk you selected in the previous step. The following question appears:

```
Swap specification is currently: generic. Change? (y/n)
```

24. Enter *y* to change the swap specification. The following selections are displayed:

```
1. generic      2. xdØ       3. xd1       4. xd2
5. xd3          6. xd4       7. xd5       8. xd6
9. xd7          10. xd8      11. xd9      12. xd1Ø
13. xd11        14. xd12     15. xd13     16. xd14
17. xd15        18. xy2      19. xy3      20. sdØ
21. sd1         22. sd2      23. sd3      24. sd4
25. sd6         26. sdØ      27. sd1      28. sd2
29. sd3         30. sd4      31. sd6      32. sdØ
33. sd1         34. sd2      35. sd3      36. rfØ
37. rf1         38. rf2      39. rf3
Select "generic" for determining the primary swap device at boot time.
You may specify ONLY ONE primary swap device in SunOS 4.X.
```

```
Enter the number of the disk to be used as the primary swap device. (1/2/3/4/5
/6/7/8/9/10/11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26/27/28/29/30/31/32
/33/34/35/36/37/38/39)
```

25. Enter *36* to specify *rfØ* as the primary swap disk. The following message is displayed:

```
Swap specification is now: rfØ. OK? (y/n)
```

26. Enter *y* to confirm your selection. The following information is shown:

```
+ Successful edit of root and swap specification in /sys/sunX/conf/RIMFIRE.

[The next step is mandatory for driver installation]

About to modify /sys/sunX/conf/devices. OK? (y/n)
```

27. Enter *y* to modify the */sys/sunX/conf/devices* file and create a backup file called */sys/sunX/conf/devices.norf*. The following text appears on the screen:

```
+ Beginning to add rf entry to /sys/sunX/conf/devices.
+ Making backup copy of /sys/sunX/conf/devices as /sys/sunX/conf/devices.norf.
+ Adding line to /sys/sunX/conf/devices.
+ Checking for new entry in /sys/sunX/conf/devices.

+ Successful rf device addition to /sys/sunX/conf/devices

[The next step is required if rf disks are to be root or swap disks]
[Although not required in other cases, it is still strongly recommended]

About to modify /sys/sun/swapgeneric.c. OK? (y/n)
```

28. Enter *y* to modify the */sys/sun/swapgeneric.c* file and create a backup file called */sys/sun/swapgeneric.c.norf*. The following information is displayed:

```
+ Beginning to add rf entries to /sys/sun/swapgeneric.c.
+ Making backup copy of /sys/sun/swapgeneric.c as /sys/sun/swapgeneric.c.norf.
+ Adding defines to /sys/sun/swapgeneric.c.
+ Checking for new entries in /sys/sun/swapgeneric.c.

+ Successful rf device description addition to /sys/sun/swapgeneric.c

[The next step is required for driver installation]

About to modify /dev/MAKEDEV. OK? (y/n)
```

29. Enter *y* to modify the */dev/MAKEDEV* file and create a backup file called */dev/MAKEDEV.norf*. The following text is displayed on the screen:

```
+ Beginning to add rf entries to /dev/MAKEDEV.
+ Making backup copy of /dev/MAKEDEV as /dev/MAKEDEV.norf.
+ Adding description line to /dev/MAKEDEV.
+ Adding mknod lines to /dev/MAKEDEV.
+ Checking for new entries in /dev/MAKEDEV.

Successful rf device addition to /dev/MAKEDEV

[The next step can be done later, but recommended to do it now]

Make device nodes for unit Ø of rf? (y/n/q)
```

30. You can create device nodes for up to four devices (units Ø-3). If you enter *y*, a device node is created for the unit, followed by a request asking if you want to make a device node for the next consecutive unit.

    If you enter *n*, no device node is created for the unit and you are asked if you want to create a device node for the next consecutive unit.

    If you enter *q*, no device node is created for the unit, the procedure for creating device nodes is terminated, and the *Installation Script* prepares to make and install *rfutil*.

➽ *NOTE: If you elect to make device nodes for a unit with existing nodes, a prompt appears, asking if you want to delete the existing nodes. To insure correct nodes are created for the unit, enter "y" to delete the existing nodes and create new nodes.*

For example, suppose you want to create device nodes for units Ø and 1. Enter *y* to create the device nodes for Unit Ø. The following lines are displayed:

```
+ sh MAKEDEV rfØ

[The next step can be done later, but recommended to do it now]

Make device nodes for unit 1 of rf? (y/n/q)
```

Enter *y* to make device nodes for unit 1. The following lines are displayed:

```
+ sh MAKEDEV rf1

[The next step can be done later, but recommended to do it now]

Make device nodes for unit 2 of rf? (y/n/q)
```

Enter *q* to quit making device nodes. The procedure for making device nodes is terminated and the *Installation Script* prepares to make and install *rfutil*. The following lines are displayed on the screen:

```
[Next step is optional, but strongly recommended]


+ cd ../rfutil
+ make DFLAGS=-DSunOS4 install
Install -s rfutil /etc

[The next step can be done later, but is recommended to do now]

Run the config program on RIMFIRE? (y/n)
```

31. Enter *y* to configure the *RIMFIRE* file. The following lines are displayed:

```
+ cd /sys/sunX/conf
+ config RIMFIRE
Doing a "make depend"

[The next step can be done later, but it is recommended to do it now]

Run the make program to build a new vmunix? (y/n)
```

32. Enter *y* to run the *make* program. This will build a new *vmunix* kernel. Lines, similar to the following, are displayed during the building process:

```
+ cd /sys/sunX/RIMFIRE
+ make
cc -m68020 -fsoft -c -O -DsunX -DRIMFIRE -DSUNX_E -DSUNX_60 -DSUNX_110
 -DSUNX_260 -DSUNX_50 -DSUNX_160 -DCRYPT -DTCPDEBUG -DIPCSHMEM
 -DIPCSEMAPHORE -DIPCMESSAGE -DSYSAUDIT -DSYSSACCT -DLOFS -DNFSSERVER
 -DNFSCLIENT -DUFS -DQUOTA -DINET -DKERNEL -I. -I.. -I../.. ../.
./netinet/in_proto.c
```

Once the building process is complete, the following lines are displayed:

```
confvmunix.c
loading vmunix
rearranging symbols
68112Ø  127112  236952  1Ø45184  ff2cØ

[The next step can be done later]

Save old vmunix and copy /sys/sunX/RIMFIRE/vmunix to /vmunix? (y/n)
```

➳ *NOTE: To boot the new vmunix kernel, /sys/sunX/RIMFIRE/vmunix must be copied to /vmunix at this time.*

33. Enter *y* to save the old *vmunix* and copy */sys/sunX/RIMFIRE/vmunix* to */vmunix*. The following lines appear on your screen:

```
+ cp /vmunix /vmunix.norf
+ cp /sys/sunX/RIMFIRE/vmunix /vmunix

[The next step can be done later]

Reboot the system? (y/n)
```

34. Enter *y* to exit the *Installation Script* and reboot the system. A message will appear indicating the system is shutting down.

➳ *NOTE: You will need to make and tune filesystems on all partitions created during installation of the driver. See page 2-27 for further details.*

Adding Controllers to the System

The Installation Script will only add one controller and up to four drives to the Sun System Configuration file. Additional controllers and drives can be added using the following steps. If you do not need to add additional controllers and drives, skip these steps.

➳ *NOTE: The following example will add two controllers, with two drives, each to the system configuration.*

1. Enter one of the following commands to change to the */conf* directory:

`cd /sys/sun3/conf`	***for 68Ø2Ø based Sun3 systems***
`cd /sys/sun3X/conf`	***for 68Ø3Ø based Sun3 systems***
`cd /sys/sun4/conf`	***for SPARC based Sun4 systems***

2. Locate the current system configuration file (this should now be named *RIMFIRE*). Copy this file to *RIMFIRE2* (to indicate multiple controllers) by entering the following command:

```
cp RIMFIRE RIMFIRE2
```

3. Use your editor to enter the file and find the Rimfire 3200 controller lines. (This example will use *vi*, the standard Unix editor.) For example, enter the following command:

```
vi RIMFIRE2
```

4. When the system finishes reading the *RIMFIRE2* file, enter the following characters to search for *rfcØ*:

```
/rfcØ
```

5. The cursor will come to rest on the first character of the string *rfcØ*. Add the following lines for a second and third controller:

```
controller rfc1 at vme16d32 ? csr Øx3ØØØ priority 2 vector rfintr ØxF4
controller rfc2 at vme16d32 ? csr Øx4ØØØ priority 2 vector rfintr ØxF6
```

   The previous lines show that there is a second controller at address *3ØØØH*, interrupt *F4*, and a third controller at *4ØØØH*, interrupt *F6*.

6. Move the cursor to the bottom of the list of disks and add in the new drives as follows:

```
disk      rf4 at rfc1 drive Ø flags 1
disk      rf5 at rfc1 drive 1 flags 1
disk      rf6 at rfc2 drive Ø flags 1
disk      rf7 at rfc2 drive 1 flags 1
```

➽ *NOTE: The "rfX" number is additive from controller to controller. The "drives" number is unique to the controller.*

7. Enter the following characters to write the changes to the *RIMFIRE2* file and exit the editor:

```
:wq!
```

8. Configure the modified system configuration file (*RIMFIRE2*) by entering the following command:

```
config RIMFIRE2
```

This will create a new subdirectory and place the appropriate header, *.c* files, etc. in the directory. After a few seconds, the system will respond with the following message:

```
Doing a "make depend"
```

9. Enter the following command to revert one level and switch to the new system directory (*RIMFIRE2*):

```
cd ../RIMFIRE2
```

10. Enter the following *make* command to create a new *vmunix* with the added controller and drives.

```
make
```

11. After compilation is completed, copy the new *vmunix* to the root directory. For safety and testing purposes, copy the new *vmunix* to a different name by entering the following command: (This will preserve the original booting UNIX.)

```
cp vmunix /rimfire2
```

After the new kernel has been fully tested, it can be copied to *vmunix* and used for booting. Enter the following line to copy the new kernel (*rimfire2*) to *vmunix* and erase the *rimfire2* file:

```
mv /rimfire2 /vmunix
```

➽ *NOTE: Perform the mv command ONLY after testing the new UNIX kernel for proper operation.*

12. Change to the */dev* directory by entering the following command:

```
cd /dev
```

13. Use the *MAKEDEV* command to create communications nodes for the new devices. For example, the following lines would create device nodes for four devices (units 4-7):

```
MAKEDEV rf4
MAKEDEV rf5
MAKEDEV rf6
MAKEDEV rf7
```

14. Shutdown UNIX. The following shutdown procedure is recommended for multiuser systems:

    - Enter *who* to find out if anyone else is on the system. A list of others currently using the system is displayed.
    - If the list indicates other system users, tell them you are shutting down the system. When all other users have been notified, enter *shutdown -h X*, where *X* represents the number of minutes in which to shut down the system.
    - If no others are using the system, enter *shutdown -h now* to shut down the system immediately.

    The system will shut down and return to the monitor prompt.

15. After the system has returned to the monitor prompt, reboot with the new UNIX by entering the following command:

```
b xy()rimfire2
```

16. Once the system has rebooted you will need to use *rfutil* to prepare the new drives for use. run *rfutil* by entering the following command and then pressing *Enter*:

```
rfutil
```

    Refer to *"Formatting and Verifying Drives"* (page 2-7) for procedures for preparing drives.

➽ *HINT: "Sunview" can be used to open multiple windows for use of more than one copy of rfutil at a time. This will allow simultaneous formatting of multiple drives.*

Making and Tuning Filesystems

You will need to make and tune filesystems on any newly created partitions that were not tuned with the *tunerf* program. Newly created partitions include the following partitions:

- All partitions created during installation of the Ciprico driver (manually or with the *Installation Script*) that were not tuned with the *tunefs* program.
- All partitions created during installation of additional controllers and drives.

Make file systems only on newly created partitions using the following procedures:

➽ *NOTE: Partitions must be unmounted to be tuned with the following procedures.*

1. Make filesystems on new partitions by entering the following for each partition you created:

```
newfs -n /dev/rrfab
```

In the above example, *a* represents the chosen drive (Ø, 1, 2, or 3) and *b* represents the chosen partition (a, d, e, f, g, or h).

➽ *NOTE: Do not make or tune a filesystem on the swap partition (b) or on the "master" partition (c), which includes all other partitions.*

2. To tune the filesystem for faster data I/O, enter the following for each file system made:

```
tunefs -a 4Ø -d ø /dev/rrfab
```

As in the previous example, *a* represents the chosen drive (Ø, 1, 2, or 3) and *b* represents the chosen partition (a, d, e, f, g, or h).

Section 3 - Non-Bootable Controller Installation

This section describes procedures for installing non-bootable Rimfire 3200/3400 series controllers in a Sun Microsystems' workstation. Some of the information in this section may vary with the particular Sun Workstation and version of SunOS you are using.

Throughout this section, there are references and file names reflecting the Sun system and version of SunOS you are using (for example *sunX* or *4.X*). These references are dependent on the Sun system and version of SunOS you are using. In such cases, *X* should be replaced by the version number for your software or hardware.

The examples in this section include values and file names that may differ from those displayed on your screen, due to variation in system configuration. Throughout this section, **bold** print is used to indicate system dependent variables.

Throughout this section, you are instructed to press the *Enter* key. On some keyboards this key is marked *Return* rather than *Enter*.

Hardware Installation Procedures

This section describes installation of a non-bootable Rimfire 3200/3400 series controller in Sun Microsystems' workstations. Installation procedures are dependent on the model of Sun workstation.

Required Equipment:

- Sun 3 or Sun 4 Workstation
- Rimfire 3200/3400 series VMEbus SMD controller

To perform hardware installation, UNIX must be shut down and the Sun system powered off. As an added precaution, disconnect the power cord from the system.

Board Configuration

Figures F-2 thru F-4 illustrate jumper locations and their factory settings for the Rimfire 3200/3400 controllers. Inspect your Rimfire controller for proper jumper settings.

Controller Installation

1. VME card slots on the Sun workstation are covered by metal plates. Inside each slot, are EMI plates. Select an unused slot and remove the two hex head screws holding the cover plate on the rear of the system. Remove the cover plate and slide the EMI plate out of the slot.

2. Insert the Rimfire 3200/3400 controller into the slot, pressing it firmly into the connectors. Sun sized controller boards will fit directly into the card cage.

   Non Sun sized boards require an adapter frame to hold the board in place in the card cage. Installation is as follows:

   - Fit the controller into the adapter frame and connect any internal cables.
   - Insert the controller and attached adapter frame into the desired slot. Press the adapter frame firmly into the connectors.

3. Fasten the controller into place with the hex head screws from the rear cover plate.

4. Remove the front cover plate from the workstation to allow access to the backplane. On some Sun Workstations, you will also need to move the power supply to access the backplane. If so, remove the four screws holding the power supply cover and tilt open the power supply. Others may have a small removable panel allowing access to just the jumper area of the backplane.

5. Locate the slot being used. (The number is to the right of the connector.) Remove the *BUS GRANT 3* and *IACK* jumpers (it is a good idea to simply move the jumpers down one pin so they are available, if needed). Figure 3- 1 illustrates the *BUS GRANT* and *IACK* jumpers for a given slot.

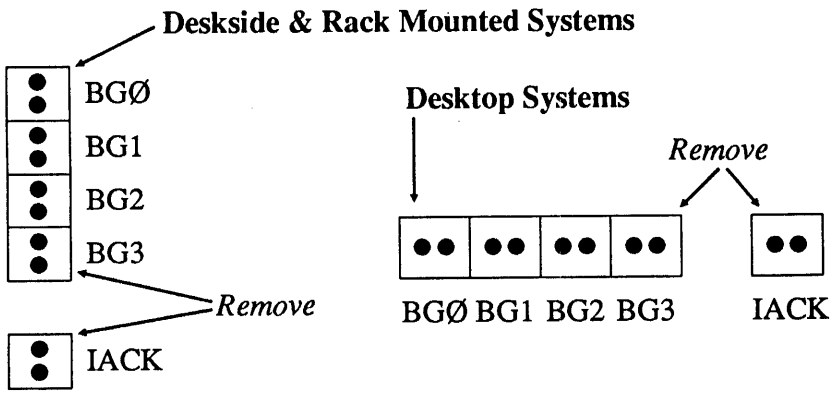


Figure 3-1 BUS GRANT and IACK Jumpers

➽ *NOTE: The BUS GRANT 3 and IACK jumpers must be removed for the Rimfire 3200/3400 controller to operate properly.*

6. If you moved the power supply to access the backplane, tilt the power supply back to its original position and refasten the power supply cover.

7. Replace the front cover plate (if there is one on you particular system).

8. Connect the drive cables.

9. Check the drives to ensure that drive parameters (addressing, terminators, sector switches, etc.) are correct. Appendix G lists suggested parameters for drives qualified (by Ciprico) for use with Rimfire 3200/3400 controllers. For drive(s) not listed, consult the drive manufacturer's manual.

   Ensure that the sector switches on the drive match the drive configuration settings.

10. Power on the new drive(s) and wait until they are ready for operation.

11. Power the Sun system on and check for proper operation. If the board is operating correctly, the Fail and Busy lights will flash on and then turn off.

Software Installation

The remainder of this section describes steps for installing *SunOS* and the Rimfire driver.

The examples and procedures shown assume you are using 1/4 inch tape and installing the Rimfire 3200/3400 controller as a non-bootable controller.

References:

- Sun Microsystems' documentation and reference manuals for the appropriate Sun Workstation
- The appropriate drive manufacturer's reference manual

Required Equipment:

- Sun 3 or Sun 4 Workstation with 1/4 inch or 1/2 inch tape drive, or access (via a network) to a 1/4 inch or 1/2 inch tape drive
- Rimfire 3200/3400 controller
- SunOS distribution tapes
- Ciprico's *Utility and Installation* tape (includes the Ciprico driver)

➳ *NOTE: For 1/2 inch tape drives, a density of 1600 bytes per inch is required to read the Ciprico 'Utility and Installation' tape.*

Installing the Ciprico Driver

The Ciprico driver can be installed manually or by using the *Installation Script* that is included on the distribution tape. If you select to manually install the Ciprico driver, refer to Appendix C for further details.

Using the Installation Script

The *Installation Script* is included on Ciprico's *Utility and Installation Tape.* It is an interactive utility that steps you through the procedures for installing the Ciprico driver.

➳ *NOTE: In the following procedures, you are asked if it is OK to copy files to existing directories. To avoid overwriting existing files, filenames are automatically assigned a .norf extension.*

Throughout the following procedures, there are messages indicating whether the particular step is mandatory to driver installation. Steps noted as mandatory must be performed for successful driver installation.

Due to system variations, the information displayed on your screen (file names, software and hardware references, device counts, etc.) may differ from examples in this manual.

1. Create a directory (called *CIPRICO*) for the files on Ciprico's *Utility and Installation* tape. Enter the following line:

```
mkdir /sys/CIPRICO
```

2. Enter the following command to change to the directory you just created:

```
cd /sys/CIPRICO
```

3. Insert the Ciprico *Utility and Installation* Tape. If you are using 1/4 inch tape, read the tape by entering the following command:

```
tar xvbf 126 /dev/rst8
```

If you are using 1/2 inch tape, enter the following command:

```
tar xvbf 2Ø /dev/rmtØ
```

4. Enter the following command to switch to the */install* directory:

```
cd rf/install
```

5. Start the Install script by entering the following command:

```
doinstall rf
```

The following information is displayed:

```
(C)  C O P Y R I G H T   1 9 8 9

Ciprico, Inc.
2955 Xenium Lane
Plymouth, MN   55441
(612) 559-2034

All Rights Reserved.

+ Determining CPU architecture... CPU is a sunX
+ Determining hostname... Hostname is RIMFIRE
+ Checking for mount of /usr... /usr is mounted
+ You are running SunOS release 4.X
+ Your system configuration directory should be RIMFIRE
```

➽ *NOTE: The Hostname (indicated by RIMFIRE) will be the system name assigned during SunOS installation.*

The *Installation Script* searches for a config file with the same name as the Hostname. If no config file with the Hostname is found, the following responses and options are displayed:

```
>>>> I can't find the configuration file /sys/sunX/conf/RIMFIRE <<<<

>>>> One possibility is that you build kernels for RIMFIRE
>>>> on another machine.  If this is the case, you will need
>>>> to abort the installation here, read in the software on the
>>>> other machine, and then restart the procedure there.

>>>> Several options are available at this point:
>>>>    1. Copy the GENERIC configuration file to RIMFIRE
>>>>       and use it.
>>>>    2. Suspend this program, create an initial configuration
>>>>       file /sys/sunX/conf/RIMFIRE manually
>>>>       and then resume at this point.
>>>>    3. Use and modify the GENERIC configuration file.
>>>>    4. Tell me the name of the configuration file to use.
>>>>    5. Abort the installation (and do it on another machine).

Please enter the number corresponding to your decision: (1/2/3/4/5)
```

6. Enter *1* to copy the *GENERIC* configuration file to *RIMFIRE* and then use the *RIMFIRE* file. The following message will appear:

```
Copy GENERIC to RIMFIRE. OK? (y/n)
```

7. Enter *y* to confirm your selection. The following lines will appear:

```
+ Checking /sys/sunX/conf/RIMFIRE

+ Successful creation of /sys/sunX/conf/RIMFIRE

+ Retrying...

+ Your system configuration directory should be RIMFIRE
+ System configuration file is /sys/sunX/conf/RIMFIRE

[The next step is mandatory for driver installation]

About to copy rf device driver files
to /sys/sundev and /sys/sunX/OBJ. OK? (y/n)
```

8. Enter *y* to copy the *rf* device driver files. The following lines will appear:

```
+ cp ../sundev/md1.h /sys.sundev/md1.h
+ cp ../sundev/md1.h /usr/include/sundev/md1.h
+ cp ../sundev/rf.c /sys/sundev/rf.c
+ cp ../sundev/rferr.h /sys/sundev/rferr.h
+ cp ../sundev/rferr.h /usr/include/sundev/rferr.h
+ cp ../sundev/rfioctl.h /sys/sundev/rfioctl.h
+ cp ../sundev/rfioctl.h /usr/include/sundev/rfioctl.h
+ cp ../sundev/rfparam.h /sys/sundev/rfparam.h
+ cp ../sundev/rfparam.h /usr/include/sundev/rfparam.h
+ cp ../sundev/rfreg.h /sys/sundev/rfreg.h
+ cp ../sundev/rfreg.h /usr/include/sundev/rfreg.h
+ Copy of rf driver files done.

About to modify /sys/sun/conf.c. OK? (y/n)
```

9. Enter *y* to modify the */sys/sun/conf.c* file. The following lines appear:

```
+ Beginning to add rf entries to /sys/sun/conf.c.
+ Making backup copy of /sys/sun/conf.c as /sys/sun/conf.c.norf.
+ Adding defines to /sys/sun/conf.c.
+ Counting block device entries...22 found.
+ Counting character device entries...63 found.
+ Adding bdevsw entry to /sys/sun/conf.c.
+ Adding cdevsw entry to /sys/sun/conf.c.
+ Checking for new entries in /sys/sun/conf.c.

+ Successful rf device description addition to /sys/sun/conf.c

[The next step is mandatory for driver installation]

About to modify /sys/sunX/conf/files. OK? (y/n)
```

10. Enter *y* to modify the */sys/sunX/conf/files* file. The modifications will be made and a backup copy (*files.norf*) will be written. The following lines will appear:

```
+ Beginning to add rf entries to /sys/sunX/conf/files.
+ Making backup copy of /sys/sunX/conf/files as /sys/sunX/conf/files.norf.
+ Adding configuration lines to /sys/sunX/conf/files.
+ Checking for new entries in /sys/sunX/conf/files.

Successful rf device addition to /sys/sunX/conf/files

[The next step is mandatory for driver installation]

About to modify /sys/sunX/conf/RIMFIRE. OK? (y/n)
```

11. Enter *y* to modify */sys/sunX/conf/**RIMFIRE***. A backup copy (*/sys/sunX/conf/**RIMFIRE**.norf*) will be made. The following lines will appear:

```
+ Making backup copy of /sys/sunX/conf/RIMFIRE as /sys/sunX/conf/RIMFIRE.norf.
+ Extracting controller information from /sys/sunX/conf/RIMFIRE...done.
+ No rfc controllers currently installed.
+ Adding controller rfcØ to /sys/sunX/conf/RIMFIRE

[Note: Controller address MUST NOT be the same or overlap]
[any existing devices specified in file /sys/sunX/conf/RIMFIRE.]
[Default value is displayed in braces below]
[Please be sure to preface hexidecimal number with "Øx"]

VME address of controller? [Øx2ØØØ]
```

12. If the last line on your screen displays the correct VME address for the Rimfire controller, press *Enter* to accept the current VME address.

    If the VME address is incorrect, enter the correct value and press the *Enter* key. Values must be entered in hexidecimal form and preceded by *Øx*, as illustrated in the following example:

    ```
    ØX2ØØØ
    ```

    After the VME address is entered, the following line is displayed:

    ```
    VME interrupt vector of controller?  [Øxf2]
    ```

13. If the line on your screen displays the correct VME interrupt vector, press *Enter* to accept the current VME interrupt vector.

If the VME interrupt vector is incorrect, enter the correct value and press the *Enter* key. Values must be entered in hexidecimal form and preceded by *Øx*, as illustrated in the following example:

```
Øxf2
```

After the VME interrupt vector is entered, the following line is displayed:

```
Add controller rfcØ at address Øx2ØØØ vector Øxf2 to /sys/sunX/conf/RIMFIRE? (y/n)
```

14. Enter *y* to add the Rimfire controller (at the specified VME address and VME interrupt vector) to the */sys/sunX/conf/RIMFIRE* file. Your screen will display the following lines:

```
Successful rfc device addition to /sys/sunX/conf/RIMFIRE

[The next step is mandatory for driver installation]

About to modify /sys/sunX/conf/RIMFIRE for device addition. OK? (y/n)
```

15. Enter *y* and the program will begin modifying the */sys/sunX/conf/RIMFIRE* for device addition. The following lines are displayed during the modification process:

```
+ Backup copy of /sys/sunX/conf/RIMFIRE already exists.
+ Extracting controller information from /sys/sunX/conf/RIMFIRE...done.
+ No devices attached to controller rfcØ.
+ Extracting device information from /sys/sunX/conf/RIMFIRE...done.
+ No rf devices configured in system.

Configure device rfØ at controller rfcØ? (y/n)
```

16. In this phase of the *Installation Script*, you are allowed to add drives (identified by *rf* prefixed device unit numbers) to the Rimfire controller configuration. If you enter *y*, the drive is added to the configuration and the following lines are displayed:

```
[Drive unit number of rfØ MUST NOT conflict with]
[any other disks attached to rfcØ shown above.]
Use default drive number of Ø? (y/n)
```

For each drive you add to the configuration, you are asked if you wish to use a specified default drive number. Enter *y* if you wish to use the default drive number.

If you do not wish to add the drive to the configuration enter *n*. The following prompt will appear:

```
Done configuring rf units?  (y/n)
```

If you enter *n*, you will be asked if you wish to add the next consecutive drive (identified by the next consecutive device unit number) to your configuration.

If you are finished adding drives to your configuration, enter *y*. The following lines will appear:

```
+ Successful addition of rf device(s) to /sys/sunX/conf/RIMFIRE

[Next step required for Ciprico boards ONLY with Xylogics 451 emulation jumper installed]
[Should NOT be performed when installing any other controllers]

Remove entries for device XYCØ at CSR address Øxee4Ø? (y/n)
```

17. Since you are not installing the 3200/3400 controller as a bootable controller, you do not need to remove the Xylogics 451 entry. Enter *n*. The following lines are displayed:

```
+ Making backup copy of /etc/fstab as /etc/fstab.norf.
Change mounting for disk xyØ in /etc/fstab to be on rf disk (y/n)
```

18. Enter *n*. The system will copy and modify the *devices.sunX* file and display the following prompt.

```
About to modify /sys/sun/swapgeneric.c OK? (y/n)
```

19. Enter *y* or *n* to the previous prompt, since the Rimfire disks are not used by the system as boot or swap disks. The installation program will switch to the */dev* directory and copy and modify the *MAKEDEV* file. The following request is then displayed:

```
Make device nodes for unit Ø of rf?  (y/n/q)
```

20. You can create device nodes for up to four devices (units Ø-3). If you enter *y*, a device node is created for the unit, followed by a request asking if you want to make a device node for the next consecutive unit.

    If you enter *n*, no device node is created for the unit and you are asked if you want to create a device node for the next consecutive unit.

    If you enter *q*, no device node is created for the unit, the procedure for making device nodes is terminated, and the *Installation Script* prepares to make and install *rfutil*.

    For example, suppose you want to create device nodes for units Ø and 1. Enter *y* to create the device nodes for Unit Ø. The following lines are displayed:

```
+ sh MAKEDEV rfØ

[The next step can be done later, but recommended to do it now]

Make device nodes for unit 1 of rf? (y/n/q)
```

Enter *y* to make device nodes for unit 1. The following lines are displayed:

```
+ sh MAKEDEV rf1

[The next step can be done later, but recommended to do it now]

Make device nodes for unit 2 of rf? (y/n/q)
```

Enter *q* to quit making device nodes. The procedure for making device nodes is terminated and the *Installation Script* prepares to make and install *rfutil*. The following lines are displayed on the screen:

```
[Next step is optional, but strongly recommended]


+ cd ../rfutil
+ make DFLAGS=-DSunOS4 install
Install -s rfutil /etc

[The next step can be done later, but is recommended to do now]

Run the config program on RIMFIRE? (y/n)
```

21. Enter *y* to configure the *RIMFIRE* file. The following lines are displayed:

```
+ cd /sys/sunX/conf
+ config RIMFIRE
Doing a "make depend"

[The next step can be done later, but it is recommended to do it now]

Run the make program to build a new vmunix? (y/n)
```

22. Enter *y* to run the *make* program. This will build a new *vmunix* kernel. Lines, similar to the following, are displayed during the building process:

```
+ cd /sys/sunX/RIMFIRE
+ make
cc -m68Ø2Ø -fsoft -c -O -DsunX -DRIMFIRE -DSUNX_E -DSUNX_6Ø -DSUNX_11Ø
 -DSUNX_26Ø -DSUNX_5Ø -DSUNX_16Ø -DCRYPT -DTCPDEBUG -DIPCSHMEM
 -DIPCSEMAPHORE -DIPCMESSAGE -DSYSAUDIT -DSYSSACCT -DLOFS -DNFSSERVER
 -DNFSCLIENT -DUFS -DQUOTA -DINET -DKERNEL -I. -I.. -I../.. ../.
./netinet/in_proto.c
```

Once the building process is complete, the following lines are displayed:

```
confvmunix.c
loading vmunix
rearranging symbols
68112Ø  127112  236952  1Ø45184  ff2cØ

[The next step can be done later]

Save old vmunix and copy /sys/sunX/RIMFIRE/vmunix to /vmunix? (y/n)
```

23. Enter *y* to save the old *vmunix* and copy */sys/sunX/RIMFIRE/vmunix* to */vmunix*. The following lines appear on your screen:

```
+ cp /vmunix /vmunix.norf
+ cp /sys/sunX/RIMFIRE/vmunix /vmunix

[The next step can be done later, but is strongly recommended now]

Reboot the system? (y/n)
```

24. If the controller and drives are already installed, enter *y* to exit the *Installation Script* and reboot the system. The system will reboot, reading the new *vmunix* in as part of the boot process.

    If the controller and drives are not installed, enter *n*. The system will exit the *Installation Program* and return to the system prompt. The system can then be shut down and the controller and drives installed.

➽ *NOTE: You will need to make and tune filesystems on all partitions created during installation of the driver. See page 3-16 for instructions for making and tuning filesystems.*

Adding Controllers to the System

The Installation Script will only add one controller and up to four drives to the Sun System Configuration file. Additional controllers and drives can be added using the following steps:

➽ *NOTE: The following example will add two controllers, with two drives, each to the system configuration.*

1. Enter one of the following commands to change to the */conf* directory:

```
cd /sys/sun3/conf      for 68Ø2Ø based Sun3 systems
cd /sys/sun3X/conf     for 68Ø3Ø based Sun3 systems
cd /sys/sun4/conf      for SPARC based Sun4 systems
```

2. Locate the current system configuration file (this should now be named *RIMFIRE*). Copy this file to *RIMFIRE2* (to indicate multiple controllers) by entering the following command:

```
cp RIMFIRE RIMFIRE2
```

3. Use your editor to enter the file and find the Rimfire controller lines. (This example will use vi, the standard Unix editor.) For example, enter the following command:

```
vi RIMFIRE2
```

4. When the system finishes reading the *RIMFIRE2* file, enter the following characters to search for *rfcØ*:

```
/rfcØ
```

5. The cursor will come to rest on the first character of the string *rfcØ*. Add the following lines for a second and third controller:

```
controller rfc1 at vme16d32 ? csr Øx3ØØØ priority 2 vector rfintr ØxF4
controller rfc2 at vme16d32 ? csr Øx4ØØØ priority 2 vector rfintr ØxF6
```

   The previous lines show that there is a second controller at address *3ØØØH*, interrupt *F4*, and a third controller at *4ØØØH*, interrupt *F6*.

6. Move the cursor to the bottom of the list of disks and add in the new drives as follows:

```
disk      rf4 at rfc1 drive Ø flags 1
disk      rf5 at rfc1 drive 1 flags 1
disk      rf6 at rfc2 drive Ø flags 1
disk      rf7 at rfc2 drive 1 flags 1
```

➳ *NOTE: The 'rfX' number is additive from controller to controller. The 'drives' number is unique to the controller.*

7. Enter the following characters to write the changes to the *RIMFIRE2* file and exit the editor:

```
:wq!
```

8. Configure the modified system configuration file (*RIMFIRE2*) by entering the following command:

```
config RIMFIRE2
```

This will create a new subdirectory and place the appropriate header, *.c* files, etc. in the directory. After a few seconds, the system will respond with the following message:

```
Doing a "make depend"
```

9. Enter the following command to revert one level and switch to the new system directory (*RIMFIRE2*):

```
cd ../RIMFIRE2
```

10. Enter the following *make* command to create a new *vmunix* with the added controller and drives.

```
make
```

11. After compilation is completed, copy the new *vmunix* to the root directory. For safety and testing purposes, copy the new *vmunix* to a different name by entering the following command. This will preserve the original booting UNIX.

```
cp vmunix /rimfire2
```

After the new kernel has been fully tested, it can be copied to *vmunix* and used for booting. Enter the following line to copy the new kernel (*rimfire2*) to *vmunix* and erase the *rimfire2* file:

```
mv /rimfire2 /vmunix
```

➽ *NOTE: Perform the mv command ONLY after testing the new UNIX kernel for proper operation.*

12. Change to the */dev* directory by entering the following command:

```
cd /dev
```

13. Use the *MAKEDEV* command to create communications nodes for the new devices. For example, the following lines would create device nodes for four devices (units 4-7):

```
MAKEDEV rf4
MAKEDEV rf5
MAKEDEV rf6
MAKEDEV rf7
```

14. Shutdown UNIX. The following shutdown procedure is recommended for multiuser systems:

    - Enter *who* to find out if anyone else is on the system. A list of others currently using the system is displayed.
    - If the list indicates other system users, tell them you are shutting down the system. When all other users have been notified, enter *shutdown -h X*, where *X* represents the number of minutes in which to shut down the system.
    - If no others are using the system, enter *shutdown -h now* to shut down the system immediately.

    The system will shut down and return to the monitor prompt.

15. After the system has returned to the monitor prompt, reboot with the new UNIX by entering the following command:

```
b xy()rimfire2
```

16. Once the system has rebooted you will need to use *rfutil* to prepare the new drives for use. run *rfutil* by entering the following command and then pressing *Enter*:

```
rfutil
```

    Refer to *"Formatting and Verifying Drives"* (page 2-7) for procedures for preparing drives.

➽ *HINT: 'Sunview' can be used to open multiple windows for use of more than one copy of rfutil at a time. This will allow simultaneous formatting of multiple drives.*

Making and Tuning Filesystems

You will need to make and tune filesystems on any newly created partitions that were not tuned with the *tunerf* program. Newly created partitions include the following partitions:

- All partitions created during installation of the Ciprico driver (manually or with the *Installation Script*) that were not tuned with the *tunefs* program.
- All partitions created during installation of additional controllers and drives.

Make file systems only on newly created partitions using the following procedures:

➽ *NOTE: Partitions must be unmounted to be tuned with the following procedures.*

1. Make filesystems on new partitions by entering the following for each partition you created:

   ```
   newfs -n /dev/rrfab
   ```

   where *a* represents the chosen drive (Ø, 1, 2, or 3) and *b* represents the chosen partition (a, d, e, f, g, or h).

➽ *NOTE: Do not make or tune a filesystem on the swap partition (b) or on the "master" partition (c), which includes all other partitions.*

2. To tune the filesystem for faster data I/O, enter the following for each file system made:

   ```
   tunefs -a 4Ø -d ø /dev/rrfab
   ```

   As in the previous example, *a* represents the chosen drive (Ø, 1, 2, or 3) and *b* represents the chosen partition (a, d, e, f, g, or h).

Section 4 - Driver Upgrades

In the event of a new release of the Ciprico 3200/3400 SunOS distribution tape, the procedures in this section can be used to upgrade your existing Ciprico 3200/3400 SunOS driver. Driver upgrades can be performed manually or with the aid of the *Installation Script.*

➳ *NOTE: The procedures in this section assume you installed your existing Ciprico 3200/3400 SunOS driver using directory and subdirectory names that are consistent with those used by the "Installation Script".*

Installation Script Method

1. Enter the following command to inspect your system's time/date information:

   ```
   date
   ```

   Your system will display the time and date. If the time and date are incorrect, enter the correct time and date as follows:

   ```
   date yymmddhhmm.ss
   ```

   Substitute the following parameters for the characters illustrated:

yy	The current year
mm	The current month
dd	The current day
hhmm.ss	The current time in hours, minutes, and seconds. (Hours should be specified using 24-hour format.)

2. Enter the following command to change to the */sys/CIPRICO/rf/sundev* directory

   ```
   cd /sys/CIPRICO/rf/sundev
   ```

3. Enter the appropriate *tar* command to copy in the new driver files. For a ¼ inch tape, enter the following command:

```
tar xvbf 126 /dev/rstx
```

where the *x* in the device name (*rstx*) is replaced by the designation for the tape unit.

For a ½ inch tape, enter the following command:

```
tar xvbf 2Ø /dev/rmtx
```

Where the *x* in the device name (*rmtx*) is replaced by the designation for the tape unit.

4. Enter the following command to change to the */sys/CIPRICO/rf/install* directory:

```
cd /sys/CIPRICO/rf/install
```

5. To begin the Upgrade program, type in the following command:

```
doupgrade rf
```

The following information is displayed:

```
(C)  C O P Y R I G H T   1 9 8 9

Ciprico, Inc.
2955 Xenium Lane
Plymouth, MN   55441
(612) 559-2034

All Rights Reserved.

+ Determining CPU architecture... CPU is a sunX
+ Determining hostname... Hostname is RIMFIRE
+ Checking for mount of /usr... /usr is mounted
+ You are running SunOS release 4.X
+ Your system configuration directory should be RIMFIRE

About to copy rf device driver files
to /sys/sundev and /sys/sunX/OBJ.  OK?  (y/n)
```

➽ *NOTE: The Hostname (indicated by RIMFIRE) will be the system name assigned during SunOS installation.*

6. Enter *y* to copy the driver files. The following lines are displayed:

```
+ Copy of rf driver files done.

About to make and install rfutil.  OK?  (y/n)
```

7. Enter *y* to compile *rfutil.* The following text appears:

```
+ cd ../rfutil
+ make DFLAGS=-DSunOS4 install
cc -O -DSunOS4 -sun3 -c rfutil.c
Loading rfutil ... done
Installing rfutil in /usr/etc

[The next step can be done later, but is recommended to do now]

Run the config program on RIMFIRE? (y/n)
```

8. Enter *y* to configure the *RIMFIRE* file. The following lines are displayed:

```
+ cd /sys/sunX/conf
+ config RIMFIRE
Doing a "make depend"

[The next step can be done later, but recommended to do it now]

Run the make program to build a new vmunix? (y/n)
```

9. Enter *y* to run the *make* program. This will build a new *vmunix* kernel. Lines, similar to the following, are displayed during the building process:

```
+ cd /sys/sunX/RIMFIRE
+ make
cc -m68Ø2Ø -fsoft -c -O -DsunX -DRIMFIRE -DSUNX_E -DSUNX_6Ø -DSUNX_11Ø
 -DSUNX_26Ø -DSUNX_5Ø -DSUNX_16Ø -DCRYPT -DTCPDEBUG -DIPCSHMEM
 -DIPCSEMAPHORE -DIPCMESSAGE -DSYSAUDIT -DSYSSACCT -DLOFS -DNFSSERVER
 -DNFSCLIENT -DUFS -DQUOTA -DINET -DKERNEL -I. -I.. -I../.. ../.
./netinet/in_proto.c
```

Once the building process is complete, the following lines are displayed:

```
confvmunix.c
loading vmunix
rearranging symbols
text    data    bss     dec     hex
6477Ø4  121728  161592  931Ø24  e34dØ

[The next step can be done later, but is strongly recommended now]

Save old vmunix and copy /sys/sunX/RIMFIRE/vmunix to /vmunix? (y/n)
```

10. Enter *y* to save the old *vmunix* and copy */sys/sunX/RIMFIRE/vmunix* to */vmunix*. The following lines are displayed:

```
+ cp /vmunix /vmunix.???
+ cp /sys/sunX/RIMFIRE/vmunix /vmunix

[The next step can be done later, but recommended to do it now]
Reboot the system?  (y/n)
```

11. Enter *y* to exit the Upgrade program and reboot the system. A message appears indicating the system is shutting down.

Manual Method

1. Enter the following command to inspect your system's time/date information:

```
date
```

Your system will display the time and date. If the time and date are incorrect, enter the correct time and date as follows:

```
date yymmddhhmm.ss
```

Substitute the following parameters for the characters illustrated:

yy	The current year
mm	The current month
dd	The current day
hhmm.ss	The current time in hours, minutes, and seconds. (Hours should be specified using 24-hour format.)

2. Enter the following command to change to the */sys/CIPRICO/rf/sundev* directory

```
cd /sys/CIPRICO/rf/sundev
```

3. Enter the appropriate *tar* command to copy in the new driver files. For a ¼ inch tape, enter the following command:

```
tar xvbf 126 /dev/rstx
```

where the ***x*** in the device name (*rstx*) is replaced by the designation for the tape unit.

For a ½ inch tape, enter the following command:

```
tar xvbf 2Ø /dev/rmtx
```

Where the *x* in the device name (*rmtx*) is replaced by the designation for the tape unit.

4. Enter the following command to copy the files to the */sys/sundev* directory:

```
cp * /sys/sundev/*
```

5. Change to the */conf* directory by entering one of the following commands:

```
cd /sys/sun3/conf      for 68Ø2Ø based Sun3 systems
cd /sys/sun3X/conf     for 68Ø3Ø based Sun3 systems
cd /sys/sun4/conf      for SPARC based Sun4 systems
```

6. Type the following *touch* command to insure the system configuration file is updated and is correct:

```
touch RIMFIRE
```

7. Enter the following *config* command to update the configuration directory:

```
config RIMFIRE
```

The system responds with the following line:

```
Doing a "make depend"
```

8. Once the system prompt is displayed, enter the following command to change to the configuration directory:

```
cd ../RIMFIRE
```

9. Enter the following *make* command to create a new *vmunix.*

```
make
```

The system will display lines similar to the following:

```
+ cd /sys/sunX/RIMFIRE
+ make
cc -m68Ø2Ø -fsoft -c -O -DsunX -DRIMFIRE -DSUNX_E -DSUNX_6Ø -DSUNX_11Ø
 -DSUNX_26Ø -DSUNX_5Ø -DSUNX_16Ø -DCRYPT -DTCPDEBUG -DIPCSHMEM
 -DIPCSEMAPHORE -DIPCMESSAGE -DSYSAUDIT -DSYSSACCT -DLOFS -DNFSSERVER
 -DNFSCLIENT -DUFS -DQUOTA -DINET -DKERNEL -I. -I.. -I../.. ../.
./netinet/in_proto.c
```

Once the building process is complete, the following lines are displayed:

```
confvmunix.c
loading vmunix
rearranging symbols
text    data    bss     dec     hex
6477Ø4  121728  161592  931Ø24  e34dØ
```

10. After completion of the building process, the new *vmunix* can be copied to the root directory. It is suggested that the original *vmunix* be saved and the new *vmunix* be tested before erasing the original. While still in the */sys/sunX/RIMFIRE* files, enter the following commands to copy the old *vmunix* to a backup directory (*/vmunix.oldrev*) and copy the new *vmunix* to the root directory:

```
cp /vmunix /vmunix.oldrev
cp vmunix /vmunix
```

11. Enter the following commands to switch to the */sys/sundev* directory and create a backup copy of the original *rfutil*:

```
cd /sys/sundev
cp rfutil rfutil.oldrev
```

12. Compile the new version of *rfutil* by entering the following command:

```
cc -O -o rfutil rfutil.c -lcurses -ltermlib
```

13. After the compilation is completed, test the new version of *rfutil*. If it works properly, copy the new *rfutil* to the */etc* directory by entering the following command:

```
cp rfutil /etc/rfutil
```

Section 5 - Replacement of SBK and 3200 Controllers

This section describes the replacement of the Sun Boot Kit (SBK) and non-bootable Rimfire 3200 controllers with bootable Rimfire 3223/3224 controllers, and the required software changes.

Software Changes

This section describes software installation for SunOS version 3.5 and earlier, and SunOS version 4.0 and later.

SunOS 3.5 and Earlier

1. Enter this command to dismount the drive (if it is mounted):

```
umount /rf0a
```

2. If necessary, enter this command to create a temporary mount point in the root directory:

```
mkdir /mnt
```

   If it is not necessary, enter this command to mount the partition temporarily:

```
mount /dev/rrf0a /mnt
```

3. Enter this command to change to the */usr/mdec* directory:

```
cd /usr/mdec
```

4. Enter the following command to load a new boot block to the disk:

```
installboot /mnt/boot bootxy /dev/rrf0a
```

5. Enter one of the following commands to change to the */conf* directory:

`cd /sys/sun3/conf`	***for 68Ø2Ø based Sun3 systems***
`cd /sys/sun3X/conf`	***for 68Ø3Ø based Sun3 systems***
`cd /sys/sun4/conf`	***for SPARC based Sun4 systems***

6. Edit the current system configuration file (RIMFIRE, for example) and comment out the first Xylogics 451 controller and drive reference by inserting a # symbol at the start of the line:

```
# controller        xyc0 at vme16d16.......
  controller        xyc1 at vme16d16.......
# disk              xy0 at xyc0 drive 0
# disk              xy1 at xyc0 drive 1
  disk              xy2 at xyc1 drive 0
  disk              xy3 at xyc1 drive 1
```

   The Rimfire 3223/3224 controller must have the emulation jumpers set to *0xEE40*, and the Rimfire jumpers must be set to *0x2000*. The *JSUN* jumper must be in. Write the changed file back out.

7. Use the config command to configure the changed system configuration, for example:

```
config RIMFIRE
```

8. When the config command completes, enter this command to change to the system configuration directory:

```
cd ../RIMFIRE
```

9. Enter the make command to compile a new vmunix kernel:

```
make
```

10. When the program has completed, enter this command to copy the new vmunix to the root directory:

```
cp /sys/RIMFIRE/vmunix /vmunix
```

11. Perform a system shutdown and proceed to the hardware installation.

STOP

This concludes the software changes for SunOS 3.5 or earlier. Proceed to the hardware installation section on page 5-5.

SunOS 4.0 and Later

1. Enter this command to dismount the drive (if it is mounted):

```
umount /rf0a
```

2. If necessary, enter this command to create a temporary mount point in the root directory:

```
mkdir /mnt
```

   If it is not necessary to create a mount point, enter this command to mount the partition temporarily:

```
mount /dev/rrf0a /mnt
```

3. Enter this command to change to the */usr/mdec* directory:

```
cd /usr/mdec
```

4. Enter the following command to load a new boot block on the disk:

```
installboot /mnt/boot bootxy /dev/rrf0a
```

5. Enter one of the followings commands to change to the */conf* directory:

`cd /sys/sun3/conf`	***for 68Ø2Ø based Sun3 systems***
`cd /sys/sun3X/conf`	***for 68Ø3Ø based Sun3 systems***
`cd /sys/sun4/conf`	***for SPARC based Sun4 systems***

6. Edit the current system configuration file (for example, RIMFIRE) and comment out the first Xylogics 451 controller and drive reference by inserting a # symbol at the start of the line:

```
# controller        xyc0 at vme16d16.......
  controller        xyc1 at vme16d16.......
# disk              xy0 at xyc0 drive 0
# disk              xy1 at xyc0 drive 1
  disk              xy2 at xyc1 drive 0
  disk              xy3 at xyc1 drive 1
```

   The Rimfire 3223/3224 controller must have the emulation jumpers set to *0xEE40,* and the Rimfire jumpers must be set to *0x2000.* The *JSUN* jumper must be in. Write the changed file back out.

7. Enter the config command to configure the changed system configuration, for example, RIMFIRE:

```
config RIMFIRE
```

8. When the config command completes, enter this command to change to the system configuration directory:

```
cd ../RIMFIRE
```

9. Enter the make command to compile a new vmunix kernel:

```
make
```

10. When the program completes, enter this command to copy the new vmunix to the root directory:

```
cp /sys/sunX/RIMFIRE/vmunix /vmunix
```

Where *sunX* is system dependent and designation are as follows:

`sun3`	***for 68Ø2Ø based Sun3 systems***
`sun3X`	***for 68Ø3Ø based Sun3 systems***
`sun4`	***for SPARC based Sun4 systems***

11. Perform a system shutdown and proceed to the hardware installation.

STOP

This concludes the software changes for SunOS 4.0 or later. Proceed to the hardware installation section on page 5-5.

Hardware Installation

1. Turn off the power to the system.
2. Disconnect and label the SMD cables from the original Rimfire 3200 controller.
3. **Observing ESD precautions**, remove the SBK or Rimfire 3200 controller and place it in a protective container or static bag.
4. **Observing ESD precautions**, remove the new Rimfire 3223/3224 controller from its container and check that the jumpers are correct.
5. Install the Rimfire 3223/3224 controller in the system.
6. Reconnect the drive A and drive B cables to the appropriate ports.
7. **Observing ESD precautions**, remove the CPU board and place it on a static-protected work surface.
8. Carefully remove the CIPRICO autoload prom and replace it with the original Sun autoload prom.
9. Replace the CPU in the system.
10. Turn on the power to the system and check for proper boot operation. The boot should respond to the xy(0,0,0) boot.

Appendices

Appendix A - Specifications

Table A-1 lists Rimfire 3200 controller Specifications. Table A-2 lists Rimfire 3400 controller Specifications.

Table A-1 Rimfire 3200 Controller Specifications

Physical	3202:	Double height VME (160 mm x 233.35 mm)
	3223:	Triple height, full depth VME (400 mm x 366.66 mm)
	3224:	Triple height, full depth VME (400 mm x 366.66 mm)
	3231:	Double height VME (160 mm x 233.35 mm)
Electrical	Voltage:	+ 5 Vdc at 5.0 A typical – 12 Vdc at 0.5 A typical
Capacity	3202: two SMD-E or SMD hard disk drives	
	3223, 3224, and 3231: four SMD-E or SMD hard disk drives	
Transfer Rate	Disk data rate to 24 MHz	
MTBF	Approximately 51,550 hours	
Environmental	0° C - 55° C ambient temperature	
Bus Interface	VMEbus Standard Revision C	

➳ *NOTE: For trouble-free operation of the Rimfire 3200 controller, a cooling air flow of at least 200 linear feet per minute must be maintained over the board's surface. Consult Ciprico for additional information on the operating environment.*

When applying power, the main system should be powered up before the drives. When powering down, the drives should be turned off first, then the remainder of the system.

Table A-2 Rimfire 3400 Controller Specifications

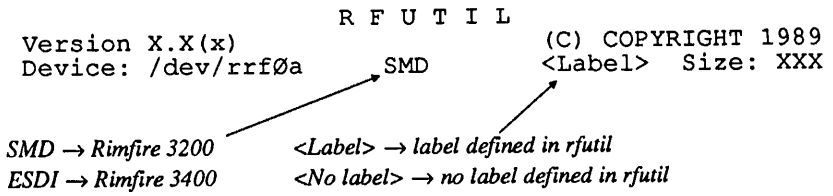
Physical	Double height Eurocard form factor VME (160 mm x 233.35 mm)	
Electrical	Voltage:	4.75 Vdc to 5.25 Vdc
	Current:	5.0 A typical (at +5 Vdc)
Capacity	Up to four ESDI drives	
Transfer Rate	Disk serial data rate of 20 MHz VMEbus burst transfer rate of 20 MBytes/second and 30 MBytes/second burst rate using block mode transfers, both assuming minimum memory response time	
Environmental	Operating:	
	Temperature:	0° C to 55° C
	Air Flow:	200 linear feet per minute
	Humidity:	10% to 80% non-condensing
	Elevation:	0 to 10,000 feet
	Non-Operational:	
	Temperature:	– 40° C to 85° C
	Humidity:	10% to 95% non-condensing
	Elevation:	0 to 40,000 feet
Bus Interface	VMEbus Standard Revision C	
Disk Interface	Enhanced Small Device Interface (ESDI) Specification, Revision F.3	

Appendix B - *rfutil* Program

The *rfutil* program is a menu-driven program designed to format, verify, and tune the disks used by the Ciprico Rimfire 3200/3400 series disk controllers.

Written in C, *rfutil* is a user utility that interacts with the device driver for the Rimfire 3200/3400 disk controllers. *Superuser* status is required for its operations.

When rfutil is loaded, it displays a program header similar to the following example:



When *rfutil* begins operation, it opens the default disk partition (*/dev/rrfØa*). If this fails for any reason (drive not available, drive not connected, etc.), *rfutil* quits. To circumvent this problem, rfutil versions of 1.15 or greater permit specification of a default drive in the command line (*e.g., rfutil /dev/rrf2a*).

Notes and Tips for Using *rfutil*

To redraw the screen at any time, press the *CTL* and *L* or *CTL* and *R* keys simultaneously.

Operations in *rfutil* may be aborted with a *Control-C* sequence. The program will allow you the option of aborting or resuming.

Three labels must match to format and verify the drive. The first of the three is *rfutil*'s label. The second label is part of the driver's data structures in the UNIX kernel. The third is the label on the drive itself.

Superuser permission is required for utility operations.

All driver error messages will go to the system console.

rfutil Commands

Table B-1 shows the commands available through the *rfutil* program and the codes by which they are identified in the *rfutil* main menu.

Table B-1 rfutil Commands

Code	Command
b	Debug control
c	Examine controller identification
d	Examine I/O control groups
e	Enquire disk characteristics
f	Format the drive
i	Slip sector
l	Create or modify a label
m	Map sector or track
n	Change configuration
o	Open a disk device
p	Zero disk resident Bad Block list
q	Quit
r	Read label from the disk
s	Show the current label
t	Show Rimfire 3200/3400 statistics
v	Verify format
w	Write label to the disk
x	Examine Track IDs
z	Write defect map to a file

Command operations are as follows:

Debug Control *(b)*

This command is used to change the debug level of the driver. Entering a value of *ØxFF* turns on a general trace plus a delay and a print of active parameter blocks and status blocks. A value of *ØxØØ* (the default value) turns debug off. The screen will indicate what level of debug is currently in place.

Examine Controller Identification *(c)*

This command displays the Firmware Release Level, Firmware Release Date, and Engineering Revision Level.

Examine I/O Control Groups *(d)*

This command allows the user to inspect and/or modify the cache tuning, data and non-data retries, and recovery operations available with Ciprico controllers.

In the Ciprico Rimfire 3200/3400 driver, disk operations are divided into three I/O control groups. The first group is for physical I/O (any operation that uses the "raw" device). Operations like swapping are physical I/O operations.

The second control group includes any non-raw operation that transfers a multiple of 8 Kbytes.

The last group is similar to the second group, except it handles transfers of sizes other than 8 Kbytes. The driver determines which I/O control group to use for a particular transfer. This helps limit caching of unneeded read ahead into controller cache memory.

➳ *NOTE: Block operations performed through the UNIX file system buffers use I/O control groups 2 and 3.*

Table B-2 lists parameters for each of the I/O control groups.

Table B-2 I/O Control Group Parameters

Group	Cache Control	Read Ahead	Recovery	Data Retry	Non-Data Retry
1	331	255	Ø	3	3
2	131	255	Ø	3	3
3	31	Ø	Ø	3	3

The parameters in Table B-2 are for the default configuration of the driver. The best parameters for your application may vary from the default. General characteristics for each control group are as follows:

Group 1 (physical I/O) is set for read ahead across track and cylinder and to search cache. It has a read ahead length of 255 and has data retries and non-data retries set to 3.

Group 2 has read ahead across track, search cache, and a read ahead length of 255. Data retries and non-data retries are each set to 3.

Group 3 is set to search cache, with no read ahead. Data retries and non-data retries are each set to 3.

All of the control groups allow for *Sort Read* and *Sort Write* commands.

The defaults may be changed temporarily at any time to simplify tuning of the controller.

Permanent changes to defaults must be made in the driver source code. To permanently modify I/O control groups, make your changes in the *rfparam.h* file in the */sys/sundev* directory. Once you have made the desired modifications, make a new kernel.

A chart of the I/O control groups will be displayed, showing the current configuration. Select the I/O control group and the parameter (by number) to modify the parameters shown on the screen.

Read Ahead Priority

Setting the Read Ahead Priority bit forces the controller to read ahead the length set by Read Ahead Length, even if there is another request pending.

Read Ahead Length

This is the number of sectors to read ahead if the board is idle. The default setting is 255 sectors for Groups 1 and 2.

Read Ahead Across Cylinders

This option specifies whether read ahead should cross cylinder boundaries. In an application with very long, sequential files this would be beneficial. This option is used in the default setting for I/O control group 1, but is not used in the default setting for I/O control groups 2 and 3.

Read Ahead Across Tracks

This option specifies whether read ahead should cross track boundaries. This should be left on for most applications as it will help in most transfers. *"Read Ahead Across Tracks"* is the default for I/O control groups 1 and 2.

Sort Read/Write Requests

This option sorts commands by disk address. In a busy random disk access system, the controller can cut down the number of seeks through command sorting. The default setting for all three I/O control groups is *"sorting off"*.

Recovery

Select the data recovery method you prefer. The default method is recovery option Ø, which uses ECC correction.

Data/Non-data Retry Counts

This setting determines the number of times the controller will attempt to recover bad data. The default setting for both data and non-data retries is *3*.

Enquire Disk Characteristics *(e)*

This command supplies on-screen information about the disk characteristics of the device currently open. For SMD drives, it indicates whether the disk is formatted or unformatted. An unformatted SMD drive returns the number of sectors per track and may return the number of cylinders and heads.

If formatted, this command returns the number of physical sectors per track, the number of cylinders and heads, the number of data sectors per track, and indicates whether a short sector is present.

➽ *NOTE: If there are 1024 cylinders on the SMD disk, rfutil displays a quantity of "1024 (possibly)", since the indicators returned to the program could also reflect a failure in the process (i.e., using the wrong method for selecting cylinders beyond 1024).*

ESDI drives return the number of physical sectors per track, the number of physical bytes per sector, the number of physical bytes per track, and total heads and cylinders (both fixed and removable).

Format the Drive *(f)*

This command formats the selected drive using the parameters (see Table B-3) supplied with the *l* (Create or modify a label). The *rfutil* program will attempt to open a defect list for the active drive. If the drive has been formatted, the processed defect list is used. If the drive has not been formatted, the *rfutil* program will read the manufacturer's defect list (if one exists). If no processed or manufacturer's defect list exists, you will need to enter a defect list from an existing file or your keyboard. A list of disk parameters is displayed on the screen.

Table B-3 Disk Parameters

Disk Parameter	Description *(some fields SMD or ESDI unique)*
BYTES/SEC	Bytes per sector
CYLS/DISK	Data cylinders per disk
NSPARES	Number of spare sectors per track
SEC/TRK	Data sectors per track
HEAD/CYL	Heads per cylinder
BASEHEAD	Base head for removable volumes
FLAGS	1H = short sector, 2H = extended address
SEC/DISK	Data sectors per disk
INTERLEAVE	Interleave factor *(typically 1)*
HEADSKEW	Head skew factor *(see Table B-4)*
CYLSKEW	Cylinder skew factor *(see Table B-4)*
RECOVERY	Type of recovery
PREAMBLE	Gap 1 size
DATA PREAMBLE	Gap 2 size

Pressing the Return key without entering a file name causes the automatic slip/map feature to be skipped. If a defect list file is found (using either the default name or a name entered by the operator), the program prompts for the total number of bytes in the physical sector. For ESDI drives, this information is available from the *e* (enquire disk characteristics) command. This information is generally available in the drive manufacturer's manual under the sector switch tables. These tables list the bytes per sector for various sector sizes.

For example, a Fujitsu 2333 set to the default of 67 usable sectors, 1 spare sector, and 1 short sector, would be 69 sectors. The sector table in the drive manual indicates 594 bytes/sector.

Next, the *rfutil* program asks whether to format the entire drive or just part of it. If partial formatting is desired, enter the starting cylinder and track, followed by the ending cylinder and track.

For example:

```
Enter Starting Block or Cylinder/Head  1Ø/Ø
Enter Ending Block or Cylinder/Head  12/9
```

This formats cylinders 10 through 12, assuming there are 10 heads. Please note that numbering for heads and tracks begins with zero.

There are several prompts verifying that you want to format the drive. Answer *Y* to each to begin the format.

If a defect list was provided, *rfutil* requests the number of bytes per physical sector. Reasonable limits for upper and lower bounds are provided on the screen. The lower limit is absolute for data plus overhead. The format operation then automatically performs slips and maps for indicated defective areas of the disk.

Cylinders and tracks are counted on the screen as the format runs. Once formatting starts, it can be aborted with a *Control-C* sequence.

Slip Sector *(i)*

To use this command, the disk drive must have a spare sector available. If a spare sector is not available, the *m* (Map sector or track) command should be used instead.

The Slip Sector command allows you to slip a bad block to the spare sector on that track. If a track has two bad sectors and the disk was formatted for only one spare sector, the second bad sector must be mapped. Refer to the *m* (Map sector or track) command.

The program requests the block number to slip and then asks whether data recovery should be attempted for the sector. If data recovery is selected, the program uses Option 2 of the data recovery options. This option retains as much data as possible. If the user opts to bypass data recovery (Option Ø), the entire sector is lost.

Once the program has the necessary information, it slips the sector, or reports back to the system console. If the program is unable to slip the sector or the spare sector on that track has already been used, this information will be reported back to the system console. If this occurs, the track should be mapped with the *m* command.

Create or Modify the Label *(l)*

This command displays a list of sample drive labels that may be used as they are or modified to fit specific requirements.

The SMD labels will be displayed if the controller is a Rimfire 3200 SMD controller board.

If the drive in use appears in the list, select that label (by entering the corresponding number). Otherwise, select a label with parameters similar to those of the drive and then select Ø (edit current label) to modify the label. If none of the labels have parameters resembling those of the drive, select Ø (edit current label) and then enter the configuration for the drive. After selection of a label, the program returns to the main menu.

If further modifications must be made to the label, select *l* again, select Ø (edit current label), and then press the *Enter* key. The ASCII text portion of the current label will be displayed, bracketed by the "Less Than" (<) and "Greater Than" (>) symbols. If no label exists, only the "Less Than" and "Greater Than" symbols are displayed.

After the ASCII text portion of the current label is displayed, parameters for the label can be viewed by pressing the *Enter* key. Parameters can be changed by specifying the number for the particular parameter and then entering the desired information.

For SMD drives, the geometry listing includes information on extended addressing and short sector options. These may be edited as part of the disk geometry.

For SMD drives with 1Ø25 cylinders or more, Extended Addressing may be required. By default, the Extended Addressing option is disabled. Extended addressing is enabled by adding the following characters to the ASCII text label:

```
/EAD
```

By default, the Short Sector Present option is disabled. This option is used only for SMD drives. Short Sector Present is enabled by adding the following characters to the ASCII text label:

```
/SSP
```

When you are finished editing parameters for the label, you can view partition settings by pressing the *Enter* key. A table of partitions settings is displayed, along with the following prompt:

```
Enter the hog partition  [n<one>]:
```

In the partition table, the presence of an asterisk (*) beside a partition letter indicates that partition is the *hog* partition. The *hog* partition is calculated by the *rfutil* program and is the first available void on the disk. Its intended use is as a *"rest of the disk"* partition. Possible responses to the *hog* partition prompt are as follows:

n<one>	Enter *n* if you do not wish to make a *hog* partition.
Partition Letter	Enter the letter of the partition you wish to designate as the *hog* partition.
Enter	Press the *Enter* key to accept the current *hog* partition setting.

When you respond to the *hog* partition prompt, the following prompt is displayed:

```
Partition to change, <CR> when done:
```

Partitions may be changed by selecting the partition by letter. In which case, the following prompt is displayed:

```
Enter the starting cylinder (Ø-X, n<ext cylinder>, q<uit>):
```

Possible responses are as follows:

Ø-X	Enter the number for the starting cylinder
n<ext cylinder>	Enter *n* to select the *next cylinder* value (displayed in the partition table) as the starting cylinder
q<uit>	Enter *q* to stop changing the partition and return to the *"Partition to change"* prompt

If you enter the number of the starting cylinder or *n*, the following prompt appears:

```
Enter the size in megabytes (Ø-X, r<est of disk>, q<uit>):
```

Possible responses are as follows:

Ø-X	Enter a value indicating the size of the partition in megabytes
r<est of the disk>	Enter r to specify the rest of the disk as the partition area
q<uit>	Enter *q* to stop changing the partition and return to the *"Partition to change"* prompt

If you enter a specific value or *r*, the following prompt is displayed:

```
X blocks (X.X Mbytes) OK (y/+/-/n)?
```

Where *X* and *X.X* represent the number of blocks and size in megabytes respectively.

Possible responses are as follows:

- **y** Enter *y* to accept the displayed values and return to the *"Partition to change"* prompt
- **+** Enter + to advance the partition one cylinder block size
- **–** Enter – to regress the partition one cylinder block size
- **n** Enter *n* to disregard the partition settings and return to the *"Enter the starting cylinder"* prompt. You can then enter new parameters for the partition.

When you are finished changing partitions, press the *Enter* key (at the *"Select partition to change"* prompt) to submit the new settings to the driver.

Map Sector or Track *(m)*

This command maps sectors or tracks to alternate cylinders. After entering *m*,The program requests information on the starting and ending points of the defective location. Defective locations can be specified as tracks or sectors. To map sectors, enter *s* and then enter the starting and ending cylinder or block . To map tracks, enter *t* and then enter the logical block number.

After determining whether the location is a sector or track, the program asks for the alternate location. If a *-1* is entered, *rfutil* allows the controller to select the alternate location.

Change Configuration *(n)*

This command allows changes to the current interleave, head skew, and cylinder skew values. For ESDI drives, it also allows changes to the head group skew. For SMD drives, it permits changes to the vendor unique status, ID, and data preamble (*Gap 1* and *Gap 2*) parameters.

The changes you make are valid only until reboot or until the next *n* command is issued. The permanent copy of this information is in the label. The label must be changed through the *l* (Create or modify a label) command to make the change permanent; however, changing information in the label does not change the current values in the controller. To change parameters from the main menu, select *n*. The current settings will be displayed. The program asks if these parameters should be changed. If changes are to be made, select the parameter to be changed by entering the corresponding number, and enter the new value.

Once desired parameters have been changed, press the *Return* key without a number entry. The program will ask if the drive configuration should be changed to match the new parameters. Answer *Y* to use the new values; otherwise, any changes will be discarded. Finally, press any key to return to the main menu.

Changeable parameters are as follows:

Interleave

The interleave factor specifies the spacing between logical sectors. The Rimfire 3200/3400 controller is designed for high performance operation at an interleave factor of *1*. This is used as the default for the driver.

Head Skew

Head skew is the number of sectors needed to compensate for head switch time. This value can make a noticeable difference in performance. Table B-4 lists suggested head and cylinder skews for drives, assuming 512 byte sectors. The default is *5* (or *1* if the number of sectors is less than five).

Cylinder Skew

Cylinder skew is the amount by which sectors are shifted between the last head of one cylinder and the first head of the next cylinder to compensate for disk seek time. The default value of this parameter is *21* (or *1* if the number of cylinders is less than 19). Refer to Table B-4 for suggested cylinder skews.

Table B-4 Head and Cylinder Skews

Drive Type	Drive Model	Head Skews	Cylinder Skew
SMD Drives	CDC 9766	3	11
	CDC FSD515	4	15
	CDC 9772 XMD-II	7	28
	CDC 9771 XMD	4	15
	Fujitsu 2333	5	21
	Fujitsu 2351	4	15
	Fujitsu 2361	5	21
	Fujitsu 2344	5	21
	NEC 2352A	5	21
	NEC 2268H	5	21
	Toshiba MK-288FC	5	21
ESDI Drives	CDC Wren III	3	11
	Fujitsu 2240E series	3	11
	Maxtor 4175/4280/4380	3	12
	Micropolis 1350 series	3	11
General	10 MHz data rate	3	11
	15 MHz data rate	4	15
	20 MHz data rate	5	21
	24 MHz data rate	7	28

Head Group Skew (ESDI)

Head group skew is the amount by which sectors are shifted when selecting a new head group. Head group skews apply only to ESDI drives with more than 16 heads. The default value is Ø.

Recovery (SMD)

This sets data recovery options. The default value is Ø, enabling ECC correction and retries.

Idpre and Datapre (SMD)

These are the same as *Gap 1* (idpre) and *Gap 2* (datapre). The default value for both parameters is *23* bytes.

Open a Disk Device *(o)*

By default, the Ø disk is opened when *rfutil* is started (*/dev/rrfØa*). To select another drive, select *o* (Open a disk device) from the main menu. Enter the character special device file name of the drive to be opened. Valid responses are incremented by one for each disk configured into your system. For example, file names for the first four disks are */dev/rrfØa*, */dev/rrf1a*, */dev/rrf2a*, and */dev/rrf3a*.

Only one device may be open at any given time. Opening a new device closes the previously selected device. When opening a device, an attempt is made to read the label.

Zero Disk Resident Bad Block List *(p)*

This command clears the processed defect list that is written on the disk.

Quit *(q)*

The Quit command exits the *rfutil* program.

Read Label *(r)*

This command reads and displays the label from the disk.

Show the Current Label *(s)*

Select *s* to show the label information. This command displays the ASCII label of the drive and the status of the error check values (the *checksum* and *magic* numbers). The geometry of the drive and partition information is also listed on the screen.

Show Rimfire 3200/3400 Statistics *(t)*

This command displays the number of read/write commands issued and indicates how many sectors have been read and written. It also calculates the cache hit ratio. Error and alternate seek information is also included in the display.

The *t* command shows the information for all drives. Much of the information given is not drive-specific, but covers all operations of the controller.

The statistics can be checked at any time by entering the *t* command. To clear the statistics, enter *y* when asked to do so.

Verify *(v)*

This command verifies the disk integrity after a format. It is a "read only", non-destructive test. If specified, the command automatically slips or maps bad areas on the disk. The screen information is very similar to that found in the *f* (Format the drive) command.

Five passes of verification are recommended, with mapping/slipping performed at verify time. Once the verify starts, it may be aborted with a *Control-C* sequence. The program asks if you want to abort or continue.

For your reference, execution time for five passes on a Fujitsu 2333, which has 823 cylinders and 10 heads, is typically less than one hour.

Write Label to Disk *(w)*

This command is used to write the label information to the drive after a *format* command.

Examine Track IDs *(x)*

This command displays track/sector information found in the disk's Track ID. When you press the *x* key, the following prompts are displayed:

```
'q' to quit
Enter desired Block or Cylinder/Head:
```

If you enter *q*, the utility will quit the command and return to the main menu.

If you specify the cylinder/head pair or block number to examine, the utility will display the following information:

- The Track Sector Skew
- Whether the track is mapped, an alternate, or bad
- All slipped, alternate, bad, or mapped sectors

Write the Defect Map to a File *(z)*

This command reads the processed defect list from the drive and places it into a file. A default file name is provided by *rfutil* (using the base name of the open device and a *.dfl* suffix) or a file name may be supplied by the user.

Formatting and Verifying with *rfutil*

Install the driver and controller board as instructed in the installation information.

The program is executed by typing *rfutil* at the system prompt. Any driver error messages will go to the system console.

The main menu will appear on the terminal. Select the desired command by pressing the corresponding letter. Formatting and verifying procedures are dependent on whether the drive is unformatted or formatted.

Unformatted Drives

The following procedure should be used on an unformatted disk, or any disk not previously formatted on the Ciprico Rimfire 3200/3400 controller.

1. The *rfutil* program opens partition "a" of the first disk as a default. To format a drive other than the first drive on a Ciprico controller, the desired drive must be opened. Select *o* (Open a disk device) from the main menu. The program will ask for the new device.

   To open the second device, enter */dev/rrf1a*.

2. Press *l* at the main menu to show the list of preset labels. Select the appropriate label from the list.

   If the drive being used does not show up in the list of default drives, modify one that is similar or select *Ø* (edit current label) from the list and enter the configuration of the drive. The *Gap 1* and *Gap 2* sizes vary with the drives. To leave a sector available for slipping, be certain to include a number of spares per cylinder or track in the configuration information. A few cylinders should be reserved, at the end of your disk, for mapping sectors and tracks.

3. After selecting an initial configuration, select *l* from the main menu and then select *Ø* (edit the current label). The drive's configuration will be displayed on the screen.

   Verify the number of heads, cylinders, and ASCII label for the drive. When determining the total physical sectors per track setting for the drive, use the number of data sectors per track plus the spare data sector and the short sector (for SMD). Some drives will not need a short sector when set to the desired sector size.

➽ *NOTE: Each disk drive has a unique way of setting short sector. Check the drive manufacturer's manual for details.*

4. Press the *Return* key to advance to the partition information. Partitions may be changed by selecting the partition by letter and entering the new partition information. Refer to the *Create or Modify the Label* command (see Page B-8) for details on modifying partition information.

   When you finish modifying the label a prompt appears, asking whether to write the label to the kernel. Answer *Y* to set the label in the kernel driver.

   Before proceeding with the next step check the following items:

   - Make sure that the cables are connected to the drive properly.
   - Make sure the sector switches on the disk drive match the settings in the drive configuration. If a default configuration was used, the spare sector and the short sector need to be added to the sector count on the drive.

5. If necessary, change the head and cylinder skews. Tuning these may improve disk performance. Select the *n* command from the main menu. A list of changeable parameters is displayed on the screen. Select the corresponding number of the parameter and enter the new number. Refer to Table B-4 for suggested head and cylinder skews. After modifying the parameters, press the *Return* key. A prompt is displayed, inquiring whether the modifications should be added to the configuration. A *Y* response will update the kernel with the new parameters.

6. Format the drive by selecting the *f* (Format the drive) command from the main menu. The parameters for the drive are displayed on the screen. Verify that they are correct. If the parameters are incorrect, do not continue formatting. Abort the format and change any incorrect parameters.

   Select the option to format the entire disk (not partial format). There are several prompts for verifying that the entire drive is to be formatted; answer *Y* to all of these.

   The program will read the defect list and begin formatting the drive. The cylinders and heads are counted on the screen as they are completed. If the drive reports an error, check the error in Appendix D.

   After a successful format operation, the program will map out the defects and ask if you want to write the label to the disk. Enter *y* to write the label to the disk and return to the main menu.

   If the format does not complete correctly, any problems must be corrected and the drive successfully formatted before continuing.

7. Select the *v* (Verify format) command to verify the disk integrity. Five verification passes are suggested. Answer *Y* to the question of whether *rfutil* and the controller should slip and map bad sectors. Generally, the entire disk should be verified. (Refer to the *v* command description for more detail.)

   There are several verification steps before the verify starts. A *Control-C* key combination allows you to abort the sequence or to return to the verify operation.

8. Once the verify has finished, exit the *rfutil* program and make and tune file systems on the partitions. Refer to the Sun documentation on *newfs* and *tunefs* for details regarding creation and tuning of file systems on partitions

Formatted Drives

The following example illustrates how to modify the label or partition table on a formatted drive.

➽ *NOTE: Due to Ciprico's use of a proprietary 48-bit Error Correction Code, the disk formats of other controllers are not compatible with Ciprico controllers. If the drive intended for use has been formatted with a controller from another vendor, it must be reformatted with a Ciprico Rimfire 3200/3400 controller.*

1. Select the *s* (Show the current label) command from the main menu. This will display the current label of the device.

➽ *NOTE: By default, rfutil opens the first device. To open another, use the **o** (Open a disk device) command. For more details, refer to "Unformatted Drives" (Page B-15) or to the **o** command description (Page B-13).*

2. After reading and showing the label information, select the *l* (Create or modify a label) command from the main menu and then Ø (edit the current label). This allows changes to the label information, including the ASCII label and the drive partition information. See the *l* command (Page B-8) for more information.

3. Write the new label to the disk. Select the *w* (Write label to the disk) command from the main menu and answer *Y* to the question regarding writing the label to the device.

➽ *NOTE: If you have changed the partition information, you may have to remake and tune the file system on the drive.*

Appendix C - Manually Installing the Ciprico Driver

Before beginning the software installation procedure, be sure you have a CURRENT backup of the system files. Make a backup copy of the current *vmunix* kernel as well.

The driver for the Ciprico Rimfire 3200/3400 controller is distributed on the *Utility and Installation* tape. Contained on the tape are a number of driver files: *rf.c, rfreg.h, rfparam.h, rfioctl.h, rferr.h, rfutil.c,* and *README.RF.*

The following steps give procedures for manually installing the Ciprico Rimfire 3200/3400 driver.

➽ *NOTE: In the following installation procedures, you are instructed to perform operations (search, add, write, etc.) on various files. The commands and procedures required to perform these operations may vary with the text editor you are using. For further details, consult the manual(s) for the text editor you are using.*

BEFORE PROCEEDING

Please note that driver installation procedures will vary with the version of SunOS you are using. If you are using Version 3.5 or earlier, proceed to the section in this chapter entitled "Driver Installation - SunOS 3.5 or Earlier". If you are using Version 4.0 or later, proceed to the section entitled "Driver Installation - SunOS 4.0 or Later".

Driver Installation - SunOS 3.5 or Earlier

1. Enter the following command to change directories to */sys*:

```
cd /sys
```

2. Create a new directory, *CIPRICO*, by entering the following command:

```
mkdir CIPRICO
```

3. Enter the following to change to the *CIPRICO* directory:

```
cd CIPRICO
```

4. Insert the Ciprico *Utility and Installation* tape. Use the appropriate *tar* command to copy files from the tape.

   For 1/4" tape, enter the following *tar* command:

```
tar xvbf 126 /dev/rst8
```

   For 1/2" tape, enter the following *tar* command:

```
tar xvbf 2Ø /dev/rmtØ
```

5. Enter the following command to switch to the */sys/CIPRICO/rf/sundev* directory:

```
cd  /sys/CIPRICO/rf/sundev
```

   Use your text editor to search the *rfreg.h* file for the following lines:

```
/*#define SunOS3 /* define for SunOS 3.2, 3.4, and 3.5 systems */
/*#define SunOS4 /* define for SunOS 4.0 systems */
```

   Remove the first two characters (/*) from the line specifying the SunOS level you are using.

   For example, if you are using SunOS 3.5, the first line of the above example should be modified to read as follows:

```
#define SunOS3 /* define for SunOS 3.2, 3.4, and 3.5 systems */
```

Enter the following command to copy Rimfire driver files to the */sys/sundev* directory:

```
cp  rf*  /sys/sundev
```

6. Enter one of the following commands to change to the */conf* directory:

```
cd /sys/sun3/conf      for 68Ø2Ø based Sun3 systems
cd /sys/sun3X/conf     for 68Ø3Ø based Sun3 systems
cd /sys/sun4/conf      for SPARC based Sun4 systems
```

Make a copy of the current system configuration file. If this is a new installation, the file will be called *GENERIC*; otherwise, consult the System Administrator for the current configuration file name.

Enter a command resembling the following to copy the configuration file to the new file name (*RIMFIRE*):

```
cp GENERIC RIMFIRE
```

7. Using your editor, search the *RIMFIRE* file for a line starting with the characters *ident.* For proper operation, *ident* cannot be set to *GENERIC*. Change the name in the *ident* line to any name other than *GENERIC*. For example, the system name assigned during SunOS installation.

Search the *RIMFIRE* file for the following *config* line:

```
config vmunix swap generic
```

You have the option of specifying the root and swap devices at this time or leaving the setting at *generic*, allowing root and swap device specification at boot time.

If the new Rimfire controlled disk will be used as the root and swap device, edit the config line to appear as follows:

```
config vmunix root on rfØ swap on rfØ
```

➽ *NOTE: If the driver was previously installed with different root and swap locations, consult with your system administrator before changing root and swap locations.*

8. For each controller installed, you will need to add a controller line to the *RIMFIRE* file. The following example illustrates a typical controller line:

```
controller rfc# at vmel6d32 ? csr Øx#### priority 2 vector rfintr ØxF#
```

Variables specifying your particular system configuration (indicated in **bold** print) are as follows:

- ***rfc#*** indicates the Rimfire controller to which the controller line refers. This variable is incremented for each controller in the system. *rfc#* entries and their respective controller distinctions are as follows:

Controller	*rfc#*
1st	rfcØ
2nd	rfc1
3rd	rfc2
4th	rfc3

- ***Øx####*** indicates the Rimfire 3200/3400 address. During Hardware Installation procedures (see Section 2), you were instructed to check the address jumper settings for proper addressing. Enter the Rimfire 3200/3400 address currently set on the J13 jumper block.
- ***ØxF#*** indicates the interrupt vector. The interrupt vector can be assigned any unique, single byte value. Typically, *0xF2* is used for the first Rimfire controller in the system and *0xF4* is used for the second Rimfire controller in the system.

For example, suppose you are installing two Rimfire controllers. The *J13* address jumpers (*A9-A15*) on the first Rimfire controller are set for an address of *Øx2ØØØ*. The *J13* address jumpers (*A9-A15*) on the second Rimfire controller are set for an address of *Øx3ØØØ*. The following controller lines would be added to the *RIMFIRE* file:

```
controller rfcØ at vmel6d32 ? csr Øx2ØØØ priority 2 vector rfintr ØxF2
controller rfc1 at vmel6d32 ? csr Øx3ØØØ priority 2 vector rfintr ØxF4
```

9. For each Rimfire controller installed in the previous step, add a reference line for each disk drive physically connected to the controller. The following example illustrates a typical disk drive reference:

```
disk        rf# at rfc# drive # flags #
```

Variables specifying your particular system configuration (indicated in **bold** print) are as follows:

- ***rf#*** represents the logical unit value to assign to the drive and corresponds to the minor device number. The *rf#* reference is strictly sequential.
- ***rfc#*** indicates the controller to which the drive is attached. This variable is incremented for each controller in the system. **rfc#** entries and their respective controller distinctions are as follows:

Controller	*rfc#*
1st	rfcØ
2nd	rfc1
3rd	rfc2
4th	rfc3

- ***drive #*** is incremented for each drive attached to a controller and should correspond to the Drive Unit Select setting on the drive itself. *drive #* entries and their respective drive distinctions are as follows:

Drive	*drive #*
1st	drive Ø
2nd	drive 1
3rd	drive 2
4th	drive 3

- ***flags #*** indicates the drive volume and is *flags 1* for a single volume drive. For multi-volume drives, *flags 1* indicates the fixed volume and *flags 2* indicates the removable volume.

For example, the following lines would be used for a four drive system with one controller:

```
disk        rfØ at rfcØ drive Ø flags 1
disk        rf1 at rfcØ drive 1 flags 1
disk        rf2 at rfcØ drive 2 flags 1
disk        rf3 at rfcØ drive 3 flags 1
```

While the following reference lines would be used for an eight drive system with two controllers:

```
disk        rfØ at rfcØ drive Ø flags 1
disk        rf1 at rfcØ drive 1 flags 1
disk        rf2 at rfcØ drive 2 flags 1
disk        rf3 at rfcØ drive 3 flags 1
disk        rf4 at rfc1 drive Ø flags 1
disk        rf5 at rfc1 drive 1 flags 1
disk        rf6 at rfc1 drive 2 flags 1
disk        rf7 at rfc1 drive 3 flags 1
```

10. Move the cursor to the Xylogics 451 entries. The Xylogics 451 entries will be similar to the following lines:

```
controller xycØ at vmel6d16 ? csr ØxEE4Ø priority 2 vector xyintr Øx48
controller xyc1 at vmel6d16 ? csr ØxEE48 priority 2 vector xyintr Øx49
```

The SMD Boot Emulation controller must be addressed at *ØxEE4Ø*. Other controllers can not be present at this address. You will need to comment out any Xylogics 451 entry with a *csr* address of *ØxEE4Ø*. This is done by adding the comment symbol (#) to the start of the desired line.

For example, suppose you are installing the Rimfire 3200/3400 controller as the primary boot controller. The SMD Boot Emulation address for the controller will be *ØxEE4Ø* and you will need to comment out the first Xylogics 451 entry (*xycØ*). Use your editor to add the comment symbol (#), as illustrated in the following example:

```
#controller xycØ at vmel6d16 ? csr ØxEE4Ø priority 2 vector xyintr Øx48
```

11. Write any changes made to your file and confirm the write operation to avoid later troubleshooting problems.

12. Enter the following command to copy the *files.sun3* file to *files.sun3.norf*:

```
cp  files.sun3   files.sun3.norf
```

This allows for later use of the *Upgrade* and *Deinstallation* programs, if needed.

13. Search the *files.sun3* file for the *'xy'* reference. Below the *'xy'* reference, add the following reference for the optional *rf device-driver*:

```
sundev/rf.c          optional rf device-driver
```

Write the changes to the *files.sun3* file.

14. Enter the following command to change to the */sys/sun* directory:

```
cd  /sys/sun
```

Use the following command to copy the *conf.c* file to *conf.c.norf*:

```
cp  conf.c   conf.c.norf
```

This allows for later use of the *Upgrade* and *Deinstallation* programs, if needed.

Using your editor, edit the *conf.c* file. Add the following references for *rf* to the include section of the *conf.c* file. This can be done by copying existing non-Rimfire include lines, then substituting *rf* references in the appropriate places.

```
#include "rf.h"
#if NRF > Ø
extern int rfopen(), rfstrategy(), rfread(), rfwrite();
extern int rfdump(), rfioctl(), rfsize();
#else
#define rfopen          nodev
#define rfstrategy      nodev
#define rfread          nodev
#define rfwrite         nodev
#define rfdump          nodev
#define rfioctl         nodev
#define rfsize          Ø
#endif
```

While still in the *conf.c* file, locate the *bdevsw* structure. Add the following reference to the end of the *bdevsw* structure, incrementing the reference number (represented by *XX*). Make note of the incremented reference number for later use.

```
{   rfopen,    nulldev,    rfstrategy,    rfdump,    /*XX*/
    rfsize,    Ø },
```

Locate the *cdevsw* structure. Add the following reference to the end of the *cdevsw* structure, incrementing the reference number (represented by *YY*). Make a note of the incremented reference number for later use.

```
{
    rfopen,     nulldev,     rfread,     rfwrite,     /*YY*/
    rfioctl,    nodev,       nulldev,    Ø,
    seltrue,    Ø,           Ø,
},
```

Write the changes to the *conf.c* file.

15. Change directories to */conf* by entering one of the following commands:

```
cd /sys/sun3/conf      for 68Ø2Ø based Sun3 systems
cd /sys/sun3X/conf     for 68Ø3Ø based Sun3 systems
cd /sys/sun4/conf      for SPARC based Sun4 systems
```

Enter the following command to copy the *devices.sun3* file to *devices.sun3.norf*:

```
cp  devices.sun3   devices.sun3.norf
```

This allows for later use of the *Upgrade* and *Deinstallation* programs, if needed.

Using your editor, add the following reference line for the Rimfire controller. Use the new number from the *bdevsw* structure as the reference number (represented by *XX*).

```
rf     XX
```

Write the changes to the *devices.sun3* file.

16. Enter the following command to change to the */usr/sys/machine* directory.

```
cd /sys/sun
```

Copy the *swapgeneric.c* file to *swapgeneric.c.norf* by entering the following command:

```
cp  swapgeneric.c   swapgeneric.c.norf
```

This allows for later use of the *Upgrade* and *Deinstallation* programs, if needed.

In the *swapgeneric.c* file, locate the following lines for the *xy.h* controller:

```
#include "xy.h"
#if NXY > Ø
extern struct mb_driver xycdriver;
#endif
```

Add the following lines after the xy.h controller lines:

```
#include "rf.h"
#if NRF > Ø
extern struct mb_driver rfcdriver;
#endif
```

Locate the following lines; where *XX* represents the block device major number assigned in the *bdevsw* structure in the *conf.c* file:

```
#if NXY > Ø
        "xy", &xycdriver, makedev (XX,Ø),
#endif
```

Add the following lines after the above lines:

```
#if NRF > Ø
        "rf", &rfcdriver, makedev (XX, Ø),
#endif
```

➳ *NOTE: In the previous example, the characters* **XX** *refer to the block device major number assigned in the* **bdevsw** *structure in the* **conf.c** *file.*

17. Enter the following command to change to the */etc* directory:

```
cd  /etc
```

Use the following command to copy the *fstab* file to *fstab.norf*:

```
cp  fstab   fstab.norf
```

This allows for later use of the *Upgrade* and *Deinstallation* programs, if needed.

If the controller you are installing will be used for booting, use your editor to search the *fstab* file for any *xyØ* references. Replace the *xy* in each reference with *rf*.

When you are through making changes, write the file back to disk.

18. Enter one of the following commands to switch to the */conf* directory:

```
cd /sys/sun3/conf      for 68Ø2Ø based Sun3 systems
cd /sys/sun3X/conf     for 68Ø3Ø based Sun3 systems
cd /sys/sun4/conf      for SPARC based Sun4 systems
```

Use the following *config* command to add the new devices in the configuration:

```
config RIMFIRE
```

This will create a new subdirectory with the same name as the new configuration file. It will also place the object and header files and a makefile in the new subdirectory.

19. Enter the following command to change to your new configuration directory:

```
cd ../RIMFIRE
```

Make a backup copy (*vmunix.org*) of the current UNIX kernel by entering the following command:

```
cp  /vmunix   /vmunix.org
```

Enter the following *make* command:

```
make
```

This will build a new UNIX kernel (including the new controller and drives) that can be used for booting.

When the compilation completes, copy *vmunix* to the root partition by entering the following command:

```
cp  vmunix  /vmunix
```

20. Change to the */dev* directory by entering the following command:

```
cd  /dev
```

Enter the following command to copy the *MAKEDEV* file to *MAKEDEV.norf*:

```
cp  MAKEDEV   MAKEDEV.norf
```

This allows for later use of the *Upgrade* and *Deinstallation* programs, if needed.

Edit the *MAKEDEV* file, adding the Rimfire designation *(rf)* where appropriate.

Edit disk references to appear as follows:

```
#          rf*        Ciprico Rimfire 32ØØ/34ØØ
```

Edit the controller line to appear as follows:

```
ip*|xy*|sd*|rf*)
```

Insert the following line after the line that begins with *sd*)*. Replace the *XX* value with the incremented *bdevsw* number. Replace the *YY* value with the incremented *cdevsw* value.

```
rf*) name=rf; blk=XX; chr=YY;;
```

Write the changes to the *MAKEDEV* file.

21. Use the following *MAKEDEV* command to create the appropriate nodes for communication with the driver:

```
MAKEDEV rfX
```

In the above command, *X* indicates the disk for which you are creating nodes. If you are using a multiple disk system, enter a *MAKEDEV* command for each Rimfire controlled disk in the system. Disks and their respective *MAKEDEV* commands are as follows:

Disk	*MAKEDEV rfX*
1st	MAKEDEV rfØ
2nd	MAKEDEV rf1
3rd	MAKEDEV rf2
4th	MAKEDEV rf3

22. Shut the system down and then reboot using the new UNIX kernel. Verify that the new kernel works correctly.

23. When the new kernel is proven to work correctly, *rfutil* can be compiled for later use.

    Enter the following command to change to the *sys/CIPRICO/rf/rfutil* directory.

    ```
    cd /sys/CIPRICO/rf/rfutil
    ```

    Manually compile *rfutil* by entering the following command:

    ```
    cc -O -o rfutil rfutil.c -lcurses -ltermlib
    ```

    or, type *make* to use the *make* file in *rfutil.*

    After the utility has been compiled, use the following command to copy *rfutil* to the */etc* directory:

    ```
    cp  rfutil  /etc/rfutil
    ```

    This will allow access to the utility from anywhere in the system, not just from the original directory; although, "Superuser" privileges are required for some *rfutil* operations.

➽ *NOTE: Appendix B contains further information regarding the use of rfutil. Page C-24 gives procedures for making and tuning filesystems.*

Driver Installation - SunOS 4.0 or Later

Enter the following command to change directories to */sys*:

```
cd /sys
```

1. Create a new directory, *CIPRICO*, by entering the following command:

```
mkdir CIPRICO
```

2. Enter the following command to change to the *CIPRICO* directory:

```
cd CIPRICO
```

3. Insert the Ciprico *Utility and Installation* tape. Use the appropriate *tar* command to copy files to the */sundev* directory.

   For 1/4" tape, enter the following *tar* command:

```
tar xvbf 126 /dev/rst8
```

   For 1/2" tape, enter the following *tar* command:

```
tar xvbf 2Ø /dev/rmtØ
```

4. Enter the following command to switch to the */sys/CIPRICO/rf/sundev* directory:

```
cd  /sys/CIPRICO/rf/sundev
```

   Search the *rfreg.h* file for the following lines:

```
/*#define SunOS3 /* define for SunOS 3.2, 3.4, and 3.5 systems */
/*#define SunOS4 /* define for SunOS 4.0 systems */
```

   Remove the first two characters (/*) from the line specifying the SunOS level you are using.

   For example, if you are using SunOS 4.0, the second line of the above example should be modified to read as follows:

```
#define SunOS4 /* define for SunOS 4.0 systems */
```

   Enter the following command to copy Rimfire driver files to */sys/Sundev*:

```
cp  rf*  /sys/sundev
```

5. Enter the following command to change to the */sys/sunX/conf* directory. In the following example, *X* represents the Sun system you are using.

```
cd /sys/sunX/conf
```

Make a copy of the current system configuration file. If this is a new installation, the file will be called *GENERIC*; otherwise, consult the System Administrator for the correct file name.

Enter the following command to copy the configuration file to the new file name (*RIMFIRE*):

```
cp GENERIC RIMFIRE
```

Using your editor, search the *RIMFIRE* file for a line starting with the characters *ident.* For proper operation, *ident* cannot be set to *GENERIC*. Change the name in the *ident* line to any name other than *GENERIC*; for example, the system name assigned during SunOS installation.

6. Search the *RIMFIRE* file for the following *config* line:

```
config vmunix swap generic
```

You have the option of specifying the root and swap devices or leaving the setting at *generic*, allowing root and swap device specification at boot time.

If the new Rimfire controlled disk will be used as the root and swap device, edit the config line to appear as follows:

```
config vmunix root on rfØ swap on rfØ
```

➳ *NOTE: If the driver was previously installed with different root and swap locations, consult with your system administrator before changing root and swap locations.*

7. For each controller you are installing, you will need to add a controller line, similar to the following, to the *RIMFIRE* file:

```
controller rfc# at vmel6d32 ? csr Øx#### priority 2 vector rfintr ØxF#
```

Variables, specifying your particular system configuration (indicated in **bold** print), are as follows:

- *rfc#* indicates the controller to which the controller line refers. This variable is incremented for each controller in the system. *rfc#* entries and their respective controller distinctions are as follows:

Controller	*rfc#*
1st	rfcØ
2nd	rfc1
3rd	rfc2
4th	rfc3

- *Øx####* indicates the Rimfire 3200/3400 address. During Hardware Installation procedures (see Section 2), you were instructed to check the address jumper settings for proper addressing. Enter the Rimfire 3200/3400 address currently set on the J13 jumper block.
- *ØxF#* indicates the interrupt vector. The interrupt vector can be assigned any unique, single byte value. Typically, *0xF2* is used for the first Rimfire controller in the system and *0xF4* is used for the second Rimfire controller in the system.

For example, suppose you are installing two Rimfire controllers. The *J13* address jumpers (*A9-A15*) on the first Rimfire controller are set for an address of *Øx2ØØØ*. The *J13* address jumpers (*A9-A15*) on the second Rimfire controller are set for an address of *Øx3ØØØ*. The following *controller* lines would be added to the *RIMFIRE* file:

```
controller rfcØ at vmel6d32 ? csr Øx2ØØØ priority 2 vector rfintr ØxF2
controller rfcl at vmel6d32 ? csr Øx3ØØØ priority 2 vector rfintr ØxF4
```

8. For each Rimfire controller installed in the previous step, add a reference line for each disk drive physically connected to the controller. The following example illustrates a typical disk drive reference:

```
disk        rf# at rfc# drive # flags #
```

Variables specifying your particular system configuration (indicated in **bold** print) are as follows:

- *rf#* represents the logical unit value to assign to the drive and corresponds to the minor device number. The *rf#* reference is strictly sequential.
- *rfc#* indicates the controller to which the drive is attached. This variable is incremented for each controller in the system. **rfc#** entries and their respective controller distinctions are as follows:

Controller	*rfc#*
1st	rfcØ
2nd	rfc1
3rd	rfc2
4th	rfc3

- ***drive #*** is incremented for each drive attached to a controller and should correspond to the Drive Unit Select setting on the drive itself. *drive #* entries and their respective drive distinctions are as follows:

Controller	***drive #***
1st	drive Ø
2nd	drive 1
3rd	drive 2
4th	drive 3

- ***flags #*** indicates the drive volume and is *flags 1* for a single volume drive. For multi-volume drives, *flags 1* indicates the fixed volume and *flags 2* indicates the removable volume.

For example, the following lines would be used for a four drive system with one controller:

```
disk        rfØ at rfcØ drive Ø flags 1
disk        rf1 at rfcØ drive 1 flags 1
disk        rf2 at rfcØ drive 2 flags 1
disk        rf3 at rfcØ drive 3 flags 1
```

While the following reference lines would be used for an eight drive system with two controllers:

```
disk        rfØ at rfcØ drive Ø flags 1
disk        rf1 at rfcØ drive 1 flags 1
disk        rf2 at rfcØ drive 2 flags 1
disk        rf3 at rfcØ drive 3 flags 1
disk        rf4 at rfc1 drive Ø flags 1
disk        rf5 at rfc1 drive 1 flags 1
disk        rf6 at rfc1 drive 2 flags 1
disk        rf7 at rfc1 drive 3 flags 1
```

9. Move the cursor to the Xylogics 451 entries. The Xylogics 451 entries will be similar to the following lines:

```
controller xycØ at vmel6dl6 ? csr ØxEE4Ø priority 2 vector xyintr Øx48
controller xyc1 at vmel6dl6 ? csr ØxEE48 priority 2 vector xyintr Øx49
```

The SMD Boot Emulation controller must be addressed at *ØxEE4Ø*. Other controllers can not be present at thIS address. You will need to comment out any Xylogics 451 entry with a *csr* address of *ØxEE4Ø*. This is done by adding the comment symbol (#) to the beginning of the desired line.

For example, suppose you are installing the Rimfire 3200/3400 controller as the primary boot controller. The SMD Boot Emulation address for the controller will be *ØxEE4Ø*. In which case, you will need to comment out the first Xylogics 451 entry (*xycØ*). Use your editor to add the comment symbol (#), as illustrated in the following example:

```
#controller xycØ at vmel6dl6 ? csr ØxEE4Ø priority 2 vector xyintr Øx48
```

10. Write any changes made to your file and confirm the write operation to avoid later troubleshooting problems.

11. Enter the following command to copy the *files* file to *files.norf*:

```
cp  files   files.norf
```

This allows for later use of the *Upgrade* and *Deinstallation* programs, if needed.

12. Search the *files* file for the *'xy'* reference. Below the *'xy'* reference, add the following reference for the optional *rf device-driver*:

```
sundev/rf.c          optional rf device-driver
```

Write the changes to the *files* file.

13. Enter the following command to change to the */usr/share/sys/sun* directory:

```
cd  /usr/share/sys/sun
```

Use the following command to copy the *conf.c* file to *conf.c.norf*:

```
cp  conf.c   conf.c.norf
```

This allows for later use of the *Upgrade* and *Deinstallation* programs, if needed.

Using your editor, edit the *conf.c* file. Add the following references for *rf* to the include section of the *conf.c* file. This can be done by copying existing non-Rimfire include lines, then substituting *rf* references in the appropriate places:

```
#include "rf.h"
#if NRF > Ø
extern int rfopen(), rfstrategy(), rfread(), rfwrite();
extern int rfdump(), rfioctl(), rfsize();
#else
#define rfopen          nodev
#define rfstrategy      nodev
#define rfread          nodev
#define rfwrite         nodev
#define rfdump          nodev
#define rfioctl         nodev
#define rfsize          Ø
#endif
```

While still in the *conf.c* file, locate the *bdevsw* structure. Add the following reference to the end of the *bdevsw* structure, incrementing the reference number (represented by *XX*). Make note of the incremented reference number for later use.

```
{   rfopen,    nulldev,    rfstrategy,    rfdump,    /*XX*/
    rfsize,    Ø },
```

Locate the *cdevsw* structure. Add the following reference to the end of *cdevsw* structure, incrementing the reference number (represented by *YY*). Make a note of the incremented reference number for later use.

```
{
    rfopen,     nulldev,     rfread,     rfwrite,     /*YY*/
    rfioctl,    nulldev,     seltrue,    Ø,
    Ø,
},
```

Write the changes to the *conf.c* file.

14. Enter the following command to change to the */sys/sun* directory.

```
cd /sys/sun
```

Copy the *swapgeneric.c* file to *swapgeneric.c.norf* by entering the following command:

```
cp  swapgeneric.c   swapgeneric.c.norf
```

This allows for later use of the *Upgrade* and *Deinstallation* programs, if needed.

In the *swapgeneric.c* file, locate the following lines for the *xd.h* controller:

```
#include "xd.h"
#if NXD > Ø
extern struct mb_driver xdcdriver;
#endif
```

Add the following line after the *xd.h* controller lines:

```
#include "rf.h"
#if NRF > Ø
extern struct mb_driver rfcdriver;
#endif
```

Locate the following lines (where *XX* represents the block device major number assigned in the *bdevsw* structure in the *conf.c* file):

```
#if NXD > Ø
    {"xd", &xdcdriver, makedev (XX, Ø)},
#endif
```

Add the following lines after the above lines:

```
#if NRF > Ø
    {"rf", &rfcdriver, makedev (XX, Ø)},
#endif
```

Then, locate the following lines: (Where *XX* represents the block device major number and *YY* represents the character device major number.)

```
#if NXD > Ø
     {"xd", &xdcdriver, makedev (YY, Ø), makedev (XX, Ø)},
#endif
```

Add the following lines after the above lines:

```
#if NRF > Ø
     {"rf", &rfcdriver, makedev (YY, Ø), makedev (XX, Ø)},
#endif
```

➽ *NOTE: In the previous examples,* **XX** *represents the block device major number in the bdevsw structure.* **YY** *represents the character device major number in the cdevsw structure. Both structures are in the conf.c file.*

15. Switch to the */conf* directory by entering one of the following commands:

```
cd /sys/sun3/conf      for 68Ø2Ø based Sun3 systems
cd /sys/sun3X/conf     for 68Ø3Ø based Sun3 systems
cd /sys/sun4/conf      for SPARC based Sun4 systems
```

Enter the following command to copy the *devices* file to *devices.norf*:

```
cp  devices   devices.norf
```

This allows for later use of the *Upgrade* and *Deinstallation* programs, if needed.

Using your editor, add the following reference line for the Rimfire controller: (Use the new number from the *bdevsw* structure as the reference number, represented by *XX*).

```
rf  XX
```

Write the changes to the *devices* file.

16. Enter the following command to change to the */etc* directory:

```
cd  /etc
```

Use the following command to copy the *fstab* file to *fstab.norf*:

```
cp  fstab   fstab.norf
```

This allows for later use of the *Upgrade* and *Deinstallation* programs, if needed.

If the controller you are installing will be used for booting, use your editor to search the *fstab* file for any *xyØ* references. Replace the *xy* in each reference with *rf*.

When you are through making changes, write the file back to disk.

17. Enter one of the following commands to switch to the */conf* directory:

`cd /sys/sun3/conf`	***for 68Ø2Ø based Sun3 systems***
`cd /sys/sun3X/conf`	***for 68Ø3Ø based Sun3 systems***
`cd /sys/sun4/conf`	***for SPARC based Sun4 systems***

Use the following *config* command to add the new devices in the configuration:

```
config RIMFIRE
```

This will create a new subdirectory with the same name as the new configuration file. It will also place the object files, header files, and makefile in the new subdirectory.

18. Enter the following command to change to your new configuration directory:

```
cd ../RIMFIRE
```

Make a backup copy (*vmunix.org*) of the current UNIX kernel by entering the following command:

```
cp  /vmunix   /vmunix.org
```

Enter the following *make* command:

```
make
```

This will build a new UNIX kernel (including the new controller and drives) that can be used for booting.

When the compilation is completed, copy *vmunix* to the root partition by entering the following command:

```
cp  vmunix  /vmunix
```

19. Change to the */dev* directory by entering the following command:

```
cd  /dev
```

Enter the following command to copy the *MAKEDEV* file to *MAKEDEV.norf*:

```
cp  MAKEDEV   MAKEDEV.norf
```

This allows for later use of the *Upgrade* and *Deinstallation* programs, if needed.

Edit the *MAKEDEV* file, adding the Rimfire designation *(rf)* where appropriate.

Edit disk references to appear as follows:

```
#          rf*        Ciprico Rimfire 32ØØ/34ØØ
```

Edit the controller line to appear as follows:

```
xd*|xy*|sd*|rf*)
```

Insert the following line after the line that begins with *sd*)*. Replace the *XX* value with the incremented *bdevsw* number. Replace the *YY* value with the incremented *cdevsw* value.

```
rf*) name=rf; blk=XX; chr=YY;;
```

Write the changes to the *MAKEDEV* file.

20. Use the following *MAKEDEV* command to create the appropriate nodes for communication with the driver:

```
MAKEDEV rfX
```

In the above command, *X* indicates the disk for which you are creating nodes. If you are using a multiple disk system, enter a *MAKEDEV* command for each Rimfire controlled disk in the system. Disks and their respective *MAKEDEV* commands are as follows:

Disk	*MAKEDEV rfX*
1st	MAKEDEV rfØ
2nd	MAKEDEV rf1
3rd	MAKEDEV rf2
4th	MAKEDEV rf3

21. Shut the system down and then reboot using the new UNIX kernel. Verify that the new kernel works correctly.

22. When the new kernel is proven to work correctly, *rfutil* can be compiled for later use.

    Enter the following command to change to the *sys/CIPRICO/rf/rfutil* directory.

    ```
    cd /sys/CIPRICO/rf/rfutil
    ```

    Manually compile *rfutil* by entering the following command:

    ```
    cc -O -o rfutil rfutil.c -lcurses -ltermlib
    ```

    or type *make* to use the *make* file in *rfutil*.

23. After the utility is compiled, use the following command to copy *rfutil* to the */etc* directory:

    ```
    cp  rfutil  /etc/rfutil
    ```

    This will allow access to the utility from anywhere in the system, not just from the original directory; although, "Superuser" privileges are required for some *rfutil* operations.

➽ *NOTE: Appendix B contains further information regarding the use of rfutil.*

Making and Tuning Filesystems

You will need to make and tune filesystems on any newly created partitions that were not tuned with the *tunerf* program. Newly created partitions include the following partitions:

- All partitions created during installation of the Ciprico driver (manually or with the *Installation Script*) that were not tuned with the *tunefs* program.
- All partitions created during installation of additional controllers and drives.

Make file systems only on newly created partitions using the following procedures:

➽ *NOTE: Partitions must be unmounted to be tuned with the following procedures.*

1. Make filesystems on new partitions by entering the following for each partition you created:

   ```
   newfs -n /dev/rrfab
   ```

   In the above example, *a* represents the chosen drive (Ø, 1, 2, or 3) and *b* represents the chosen partition (a, d, e, f, g, or h).

➽ *NOTE: Do not make or tune a filesystem on the swap partition (b) or on the "master" partition (c), which includes all other partitions.*

2. To tune the filesystem for faster data I/O, enter the following for each file system made:

   ```
   tunefs -a 4Ø -d ø /dev/rrfab
   ```

   As in the previous example, *a* represents the chosen drive (Ø, 1, 2, or 3) and *b* represents the chosen partition (a, d, e, f, g, or h).

Appendix D - Error Codes

This section defines SMD Emulation errors (for Rimfire 3223/3224 controllers), Rimfire 3200 errors, and Rimfire 3400 errors.

SMD Emulation Errors

Error codes used by the Rimfire 3223/3224 controller depend on whether the *JSUN* jumper has a Rimfire (jumper out) or SMD Boot Emulation (jumper in) setting. The following table lists Rimfire error codes and their corresponding SMD Boot Emulation error codes.

Rimfire Error		Emulation Error	
00H	Successful completion	00H	Successful completion
01H	Invalid command	03H	Busy conflict
02H	Bad Unit number	04H	Operation timeout
03H	Bad Unit type	04H	Operation timeout
04H	Drive not configured	04H	Operation timeout
05H	Not used	01H	Interrupt pending
06H	Bad Logical Sector number	0AH	Sector Address error
07H	Bad number of sectors	0AH	Sector Address error
08H	Bad track starting sector	0AH	Sector Address error
09H	Bad number of sectors for track wide operation	0AH	Sector Address error
0AH	Bad Tag Number Issue tag	18H	Drive faulted
0BH	Field not zero	03H	Busy conflict
0CH	Bad number of Scatter/Gather headers specified	03H	Busy conflict
0DH	Bad length of Scatter/Gather table	03H	Busy conflict
0EH	Not used	01H	Interrupt Pending
0FH	Bad Command List size	03H	Busy conflict
10H	Bad Command List number	03H	Busy conflict
11H	Command List cannot be started/stopped	03H	Busy conflict
12H	Not used	01H	Interrupt pending
13H	Bus error	0EH	Memory Address error
14H	Drive won't select or drive not present	04H	Operation timeout

Rimfire Error		Emulation Error	
15H	Drive not ready	16H	Drive not ready
16H	Not used	01H	Interrupt pending
17H	Not used	01H	Interrupt pending
18H	Not used	01H	Interrupt pending
19H	Not used	01H	Interrupt pending
1AH	Not used	01H	Interrupt pending
1BH	Not used	01H	Interrupt pending
1CH	Drive reported seek error	25H	Seek error
1DH	Not used	01H	Interrupt pending
1EH	Fault detected	18H	Drive faulted
1FH	Not used	01H	Interrupt pending
20H	Not used	01H	Interrupt pending
21H	Not used	01H	Interrupt pending
22H	Sectors per track don't match disk	0DH	Last sector too small
23H	Sector to short/Overrun error	0DH	Last sector too small
24H	Data error, no correction done	1EH	Soft ECC error
25H	ID Sync error (sector not found)	1EH	Soft ECC error
26H	ID CRC error	1EH	Soft ECC error
27H	No data synchronization	1EH	Soft ECC error
28H	Seek timeout	04H	Operation timeout
29H	SMD data operation timeout	04H	Operation timeout
2AH	SMD misseek/Bad disk format	00H	IGNORE THIS ERROR
2BH	Error reading SMD Sector ID	1FH	Read fixed ECC error
2CH	Direct access to bad track or sector	25H	Seek error
2DH	ECC correction performed	1FH	Read fixed, fixed ECC error
2EH	ECC correction failed	1EH	Soft ECC error
2FH	Not used	01H	Interrupt pending
30H	Not used	01H	Interrupt pending
31H	Not used	01H	Interrupt pending
32H	Sectors/track bad or greater than physical size	19H	Illegal sector size
33H	Not used	01H	Interrupt pending
34H	Preamble too long	19H	Illegal sector size
35H	Not used	01H	Interrupt pending
36H	Not used	01H	Interrupt pending
37H	Bad parameter in configuration	03H	Busy conflict
38H	Not used	01H	Interrupt pending
39H	Attempt to initialize I/O Control Group 0	03H	Busy conflict

Rimfire Error		Emulation Error	
3AH	Bad source in defect mapping	03H	Busy conflict
3BH	Bad destination in defect mapping	03H	Busy conflict
3CH	No spares left on track	03H	Busy conflict
3DH	Bad recovery field in mapping command	03H	Busy conflict
3EH	SMD emulation not supported	02H	Reserved code

➳ *NOTE: For SMD Boot Emulation errors (on Rimfire 3223/3224 controllers), consult the corresponding Rimfire 3200 error.*

Rimfire 3200 Errors

The following error codes are for Rimfire 3200 errors.

01H Invalid command *(Rimfire 3200 error)*

The host issued an invalid command number.

02H Bad unit number specified *(Rimfire 3200 error)*

The host specified a unit number greater than eight.

03H Bad unit type for this command *(Rimfire 3200 error)*

The host specified a unit number which is not valid for the command used.

04H Drive not configured *(Rimfire 3200 error)*

The host attempted to access a disk drive for which a *Configure* command has not been executed.

05H Memory transfer alignment error *(Rimfire 3200 error)*

A memory transfer was attempted with either an odd system memory address or an odd length. All memory addresses and transfer lengths must be an even number of bytes.

06H Bad logical sector number specified ***(Rimfire 3200 error)***

The host specified a logical sector number larger than the disk size when accessing a disk drive. Correct the sector size to be less than or equal to the disk size.

07H Bad number of sectors specified ***(Rimfire 3200 error)***

The requested operation exceeds the size of the disk (for example, asking to read five sectors starting with the last sector on the disk).

08H Bad track starting sector ***(Rimfire 3200 error)***

Commands which operate on track-wide structures (i.e. *Format*) must specify a logical sector number which is a multiple of the number of sectors per track. The sector number specified was not a multiple of the number of sectors per track.

09H Bad number of sectors for track-wide operation ***(Rimfire 3200 error)***

Commands which operate on tracks (i.e. *Format*) must specify a sector count which is a multiple of the number of sectors per track. The sector count specified in the parameter block was not a multiple of the number of sectors per track.

0AH Bad tag number, Issue Tag/Return Status ***(Rimfire 3200 error)***

The tag number specified in the *Issue Tag/Return Status* command was not one of 4, 5, or 6.

0BH Field not zero ***(Rimfire 3200 error)***

A *Reserved* field in the parameter block is non-zero. In order to ensure expandability, the Rimfire 3223/3224 series of controllers requires that *Reserved* fields be set to zero.

0CH Bad number of scatter/gather headers specified ***(Rimfire 3200 error)***

In a *Scatter Read* or *Gather Write* command, the number of headers was either 0 or greater than 255. This field should be corrected before the command is reissued.

0DH Bad length of scatter/gather table ***(Rimfire 3200 error)***

A Scatter/Gather Descriptor Table entry was found to have a length of less than four bytes. The table should be corrected and the command reissued.

0EH Command list stopped ***(Rimfire 3200 error)***

The controller has finished all processing on this command list. This is the last status block returned to a command list after it is stopped. It reports a status, not an error.

0FH Bad command list size field ***(Rimfire 3200 error)***

The size of one of the circular buffers in a command list is less than two elements long, or the command list is greater than 65,535 bytes long.

10H Bad command list number specified ***(Rimfire 3200 error)***

The *LIST #* specified in a *Setup Command List* or *Stop Command List* command is not between 1 and 7.

11H Command list cannot be started/stopped ***(Rimfire 3200 error)***

If this error is returned from a *Setup Command List* command, the specified command list is already active, and therefore cannot be started. If this error is returned from a *Stop Command List* command, the specified command list is not active, and therefore, cannot be stopped.

12H Software bus timeout error ***(Rimfire 3200 error)***

No activity was seen on the VMEbus and the memory transfer timed out.

13H VMEbus error *(Rimfire 3200 error)*

A VMEbus access error was detected during a memory access. Causes for this condition include:

1. Invalid memory address: The specified address does not point to read memory.
2. Invalid address modifier
3. Quad byte (32-bit) transfer attempted with memory which does not support quad byte accesses.
4. Improper jumpering of the bus request/bus grant lines on the controller assembly.
5. Improper jumpering of the VMEbus backplane bus request/bus grant lines.

14H Drive won't select or not present *(Rimfire 3200 error)*

The specified SMD disk drive will not return "Selected" status on the B cable. This error is returned if:

1. The disk drive is not plugged into the controller.
2. The disk drive is not turned on.
3. The disk drive B cable is plugged into the wrong drive connector.
4. The disk drive is not set to the proper unit number.

15H Drive not ready *(Rimfire 3200 error)*

The READY line from the specified SMD drive is not active. The READY line signifies that the drive spindle motor is up to speed and the drive is ready to read or write. This error is only reported for commands requiring a spinning drive.

16H Drive busy *(Rimfire 3200 error)*

The drive is busy due to activity on the other port. The controller has tried to select the drive at least three times (waiting for the other drive to release each time) and failed. Possible solutions are as follows:

1. Release the drive on the other port. The other port may not be releasing or deselecting the drive or may be executing a command (i.e., *format* or *verify*) that takes a long time.

2. If the other port may have failed, use the *Priority Select* command to take control of the other port.

1CH Drive reported seek error *(Rimfire 3200 error)*

The drive detected an error during the seek process or an attempt was made to seek to an invalid cylinder.

1EH Fault detected *(Rimfire 3200 error)*

A fault condition occurred in the drive. This error indicates either a broken drive, an error in the controller, or a drive which is not fully compatible with the controller.

23H Sector too short/overrun error *(Rimfire 3200 error)*

A sector pulse was detected before the end of a sector. Possible causes for this error include:

1. The drive was configured for more bytes per sector than are physically available.

2. An unstable read or reference clock from the drive.

3. A noisy cable connection to the drive.

4. A hardware problem in the drive or controller.

24H Data error, no correction done *(Rimfire 3200 error)*

Data read from the drive is in error. As a retry, this is a soft error that did not recur when the controller reread the data. As a command error, the controller encountered a data error on the disk for which correction was not attempted. When this error is returned, error correction is not attempted. Possible causes of this error are as follows:

1. If the data error is repeating, it is probably a defect on the disk. Use one of the defect mapping commands to mark the sector as flawed.

2. If errors occur randomly during read/verify, the data preamble length is too short. Reformat the drive with a longer data preamble.

25H ID sync error (sector not found) *(Rimfire 3200 error)*

Possible causes of this error are as follows:

1. If the Sync error is repeating, it is probably a defect in the sector header. The track must be mapped to an alternate using the *Map Track* command (24H).

2. If random Sync errors occur during read/verify, the ID preamble length is too short. Reformat the drive with a longer ID preamble.

3. If random Sync errors occur during write operations, the postamble length is probably too short. Increase the physical sector size used by the drive to increase the space available for the postamble.

4. The drive is formatted for a different number of sectors per track then currently configured (the sector switches on the drive may have been changed).

5. The drive has not been formatted.

26H Header CRC error *(Rimfire 3200 error)*

A CRC error was detected while reading the header of the desired sector. It implies an error in the sector ID of the sector being read or written. Possible causes of this error are as follows:

1. If the CRC error is repeating, it is probably a defect in the sector header. The track must be mapped to an alternate using the *Map Track* command (24H).

2. If random ID CRC errors occur during read/verify, the ID preamble length is too short. Reformat the drive with a longer ID preamble.

3. If random ID CRC errors occur during write operations, the postamble length is probably too short. Increase the physical sector size used by the drive to increase the space available for the postamble.

27H No data synchronization error *(Rimfire 3200 error)*

Possible causes of this error are as follows:

1. If the data error is repeating, it is probably a defect on the disk. Use one of the defect mapping commands to mark the sector as flawed.

2. If errors occur randomly during read/verify, the data preamble length is too short. Reformat the drive with a longer data preamble.

28H Seek timeout *(Rimfire 3200 error)*

A seek or rezero did not complete within three seconds. This error normally means the drive is not operating correctly.

29H SMD data operation timeout *(Rimfire 3200 error)*

The drive is not returning read/reference clock pulses, or the drive is not returning index pulses.

2AH SMD misseek/direct access to an alternate *(Rimfire 3200 error)*

This error is returned when any of the following situations occur:

1. An attempt was made to directly read an alternate track or alternate sector. Alternate tracks and sectors must be accessed via the defective track or sector that points to the alternate.

2. The disk drive performed a seek to the wrong track without detecting the error. The controller detects this via a bad sector ID value.

3. The disk format is corrupted in such a way that a defective track does not point to the proper alternate track. In this situation, the invalid track or sector must be reformatted.

Most errors relating to invalid track IDs are classified under this error number. When retried, the retry process starts with the sector for which the original search took place. This ensures that all seek-related errors during defective track/sector processing are properly retried.

2BH Error reading SMD sector ID *(Rimfire 3200 error)*

A soft error occurred while reading a sector ID, but the CRC was correct. This error is normally seen only as a retry, since it implies the ID was read a second time without error.

2CH Direct access to bad track or sector *(Rimfire 3200 error)*

An attempt was made to directly access a track or sector marked as bad. Possible causes for this error include:

1. The host attempted to access the wrong sector.

2. The disk format is corrupted. The proper tracks or sectors should be reformatted.

2DH ECC correction performed *(Rimfire 3200 error)*

This error is only returned when ECC correction of an error has completed successfully. It specifies that an error occurred which the ECC algorithm corrected. Possible causes of this error are as follows:

1. If the data error is repeating, it is probably a defect on the disk. Use one of the defect mapping commands to mark the sector as flawed.

2. If errors occur randomly during read/verify, the data preamble length is too short. Reformat the drive with a longer data preamble.

2EH ECC correction failed *(Rimfire 3200 error)*

A data error could not be corrected using the ECC algorithm. As a retry error, this error means that the ECC algorithm could not correct the error and the data is being read again. As a command error, it means the data errors are beyond the correction span of the ECC algorithm.

This error may also be returned if the disk was written with a different number of bytes per sector than the value currently configured. Possible causes of this error are as follows:

1. If the data error is repeating, it is probably a defect on the disk. Use one of the defect mapping commands to mark the sector as flawed.

2. If errors occur randomly during read/verify, the data preamble length is too short. Reformat the drive with a longer data preamble.

2FH Sectors per track don't match disk setting *(Rimfire 3200 error)*

During format or mapping commands, the controller found that the number of physical sectors per track on the disk drive was different from the value found by the *Configure* command. To correct, reconfigure the drive with the correct number of sectors per track.

31H Drive write-protected *(Rimfire 3200 error)*

The drive cannot be written to because the write-protect switch or jumper is active.

32H Sectors per track field bad *(Rimfire 3200 error)*

The *Sectors/Track* field is zero or greater than 200.

33H Bytes per sector field bad *(Rimfire 3200 error)*

The *Bytes/Sector* field is less than 256, greater than 8192, or not a multiple of 16 bytes.

The requested track size (bytes per sector and sectors per track) is larger than the physical drive capacity.

Request a smaller sector size or fewer sectors per track.

34H Preamble too long *(Rimfire 3200 error)*

One of the drive preambles exceeds permissible limits. Use the *Return Configuration* command to determine the various field sizes. When using the *Define SMD Parameters* command, the controller preamble limitations are as follows:

1. ID preamble length must be less than or equal to 54 bytes.
2. Data preamble length must be less than or equal to 62 bytes.

37H Configuration parameter inconsistent *(Rimfire 3200 error)*

One of the fields in the *Configure* or *Define SMD Parameters* commands is inconsistent. Any of the following conditions cause this error:

1. The interleave or skew factor is greater than or equal to the number of sectors per track.
2. The number of cylinders per disk or heads per cylinder is Ø.
3. There is an invalid tag number in the data recovery field.

39H Attempt to initialize I/O Control Group 0 *(Rimfire 3200 error)*

An attempt was made to change I/O Control Group 0. This I/O Control Group may not be changed.

3AH Bad source in defect mapping command *(Rimfire 3200 error)*

This error is generated by the *Slip Sector*, *Map Track*, and *Map Sector* commands. It signifies a problem with the sector or track to be flagged as defective, such as:

1. A *Slip Sector* command was attempted on an alternate or bad track.
2. A *Map Track* command was attempted on a track containing alternate sectors or on an alternate or bad track.
3. A *Map Sector* command was attempted on an alternate or bad track, on a mapped track, or on an alternate or bad sector.

3BH Bad destination in defect mapping command *(Rimfire 3200 error)*

This error is generated by the *Map Track* and *Map Sector* commands. It signifies a problem with the alternate address to be mapped to. It will only occur if the host selects the alternate location.

1. For a *Map Track* command, the alternate address is not a normal track. It is already flagged as an alternate, defective or bad track; or it contains alternate, defective, or bad sectors.
2. For a *Map Sector* command, the alternate address is not a normal sector. It is part of an alternate, defective, or bad track; or it is already an alternate, defective, or bad sector.

3CH No spares left on track *(Rimfire 3200 error)*

This error is generated by the *Slip Sector* command. It may be a result of the following:

1. The drive is configured without spare sectors.
2. The track does not contain anymore unused sectors. A *Map Track* or *Map Sector* command must be used to map the defect.

3DH Bad recovery field in defect mapping command *(Rimfire 3200 error)*

The *Recovery* Field value in a *Slip Sector*, *Map Track*, or *Map Sector* command is invalid. Set the field to a valid recovery value and reexecute the command.

3EH SMD Boot Emulation not supported

3FH Driver Error - out of alternate tracks/sectors ***(Rimfire 3200 error)***

60H Rimfire Error - Cache memory diagnostic error ***(Rimfire 3200 error)***

This error will be returned if, during a cache memory test, a byte read from cache differed from the pattern previously written to that location. This is a controller hardware error.

61H Static RAM error ***(Rimfire 3200 error)***

This error indicates that a byte read from the controller's scratchpad RAM differed from the pattern originally written. This is a controller hardware error.

62H PROM checksum error ***(Rimfire 3200 error)***

This error is returned if the firmware EPROMs in the controller have been damaged or were not successfully programmed. Controller firmware must be replaced for correct operation.

63H Undefined diagnostic specified ***(Rimfire 3200 error)***

This error indicates that the diagnostic command set a bit in the *Diagnostic Type* field that did not correspond to a valid diagnostic test. This command may be reattempted after correcting the *Diagnostic Type* field in the parameter block.

Rimfire 3400 Errors

Error Codes for the Rimfire 3400 controller are as follows:

01H Invalid command ***(Rimfire 3400 error)***

The host issued an invalid command number.

02H Bad unit number specified ***(Rimfire 3400 error)***

The host specified a unit number greater than eight.

03H Wrong unit type for this command ***(Rimfire 3400 error)***

The host specified a unit number which is not valid for the command used.

04H Drive not configured ***(Rimfire 3400 error)***

The host attempted to access a disk drive for which a *Configure* command has not been executed.

05H Memory transfer alignment error ***(Rimfire 3400 error)***

A memory transfer was attempted with either an odd system memory address or an odd length. All memory addresses and transfer lengths must be an even number of bytes.

06H Bad logical block number specified ***(Rimfire 3400 error)***

The host specified a logical block number larger than the disk size when accessing an ESDI disk. Correct the block size to be within the disk size.

07H Bad number of blocks specified ***(Rimfire 3400 error)***

The requested operation exceeds the size of the disk (for example, asking to read 5 sectors starting with the last sector on the disk).

08H Bad track starting block ***(Rimfire 3400 error)***

Commands which operate on track-wide structures (i.e. *Format*) must specify a Logical Block Number which is a multiple of the number of sectors per track. The Logical Block Number specified was not a multiple of sectors per track.

09H Bad number of blocks for track-wide operation ***(Rimfire 3400 error)***

Commands which operate on tracks (i.e. *Format*) must specify a Block Count which is a multiple of the number of sectors per track. The Block Count specified in the parameter block was not a multiple of the number of sectors per track.

0AH Bad surface specified for Read Defect Map ***(Rimfire 3400 error)***

In a *Read Defect Map* command, either the *Head Number* or *Cylinder Select* fields are in error. The *Head Number* field must be between 0 and the number of heads less 1. The *Cylinder Select* field must be either 0 or 1.

0BH Reserved field not zero ***(Rimfire 3400 error)***

A *Reserved* field in the parameter block is non- zero. In order to ensure expandability and compatibility, the Rimfire 3400 requires that *Reserved* fields be set to 0.

0CH Bad number of scatter/gather headers ***(Rimfire 3400 error)***

In a *Scatter Read* or *Gather Write* command, the number of headers was either 0 or greater than 255. This field should be corrected before the command is reissued.

0DH Bad length of a scatter/gather header ***(Rimfire 3400 error)***

A Scatter/Gather Descriptor Table entry was found to have a length of less than 4 bytes. The table should be corrected and the command reissued.

0EH Command list stopped ***(Rimfire 3400 error)***

The controller has finished all processing on this command list. This is the last status block returned to a command list after it is stopped. It reports a status, not an error.

0FH Bad command list size field *(Rimfire 3400 error)*

The size of one of the circular buffers in a command list is less than 2 elements long, or the command list is greater than 65,536 bytes long.

10H Bad command list number specified *(Rimfire 3400 error)*

The command list number specified in a *Start Command List* or *Stop Command List* command is not between 1 and 7.

11H Command list cannot be started/stopped *(Rimfire 3400 error)*

If this error is returned from a *Start Command List* command, the specified command list is already active, and therefore cannot be started. If this error is returned from a *Stop Command List* command, the specified command list is not active, and therefore cannot be stopped.

12H Software bus timeout error *(Rimfire 3400 error)*

No activity was seen on the VMEbus and the process timed out.

13H VMEbus error *(Rimfire 3400 error)*

A VMEbus error was detected during a memory access. This error may be caused by one of the following conditions:

1. Invalid memory address - the specified address does not point to read memory.
2. Invalid Address Modifier.
3. Quad byte (32 bit) tranfer attempted with memory which does not support quad byte accesses.
4. Improper jumpering of the *bus request/bus grant* lines of the Rimfire 3400 board.
5. Improper jumpering of the VME backplane *bus request/bus grant* lines.

14H Drive won't select/not present *(Rimfire 3400 error)*

The specified ESDI disk drive will not return "Selected" status on the B cable. This error will be returned if any of the following conditions exist:

1. The disk drive is not plugged into the Rimfire 3400.
2. The disk drive is not turned on.
3. The disk drive data cable is plugged into the wrong drive.
4. The disk drive is not set to the proper unit number.

15H Drive not ready *(Rimfire 3400 error)*

The *READY* line from the specified ESDI drive is not active. The *READY* line signifies that the drive spindle motor is up to speed. This error is only reported for commands requiring a spinning drive. Execute a Start Spindle Motor command or wait for a previously executed Start Spindle Motor command to complete.

16H Parity of received ESDI status bad *(Rimfire 3400 error)*

If returned in a status block without *Command Complete* set, a soft error occurred while requesting status from an ESDI drive.

As a hard error, this may indicate a hardware fault.

17H ESDI bit send timeout without *ATTN* *(Rimfire 3400 error)*

If returned in a Status Block without *Command Complete* set, it indicates a soft error.

An error occurred in the serial command send/status receive process between the controller and the ESDI disk. It indicates a hardware fault exists, or there is an incompatibility between the drive and the controller.

An attention was received from the drive but the drive did not specify a reason when status was read.

This error may also indicate that the drive is not turned on.

18H ESDI attention won't clear *(Rimfire 3400 error)*

The drive signaled attention but the controller could not clear it. This usually indicates an error in the drive. Turn the drive off and on again, and check the cables to the drive. If *ATTN* still won't clear, it is probably a hardware fault in the drive or controller.

19H ESDI drive reported bad parity *(Rimfire 3400 error)*

If returned in a Status block without Command Complete set, this indicates a soft error which the controller will automatically retry.

As a hard error, this may indicate a hardware fault.

1AH ESDI drive reported interface fault *(Rimfire 3400 error)*

Either the drive or the controller did not properly follow the ESDI serial command send/status receive protocol. It may occur as a soft error on a noisy line.

If returned in a Status block without Command Complete set, this indicates a soft error which the controller will automatically retry.

As a hard error, this may indicate a hardware fault.

1BH ESDI drive reported invalid command *(Rimfire 3400 error)*

The host attempted to execute a command which the drive cannot handle (for example, a *Stop Spindle Motor* command). If the command executed is valid, then a hardware fault exists.

1CH ESDI drive reported seek fault *(Rimfire 3400 error)*

The drive detected an error during the seek process. If returned in a Status block without Command Complete set, it is a soft error in the drive.

As a hard error, it normally indicates an error in the drive.

1DH Write gate with track offset (firmware error) *(Rimfire 3400 error)*

This error indicates either a broken drive or an error in the Rimfire 3400 controller.

1EH Write fault detected *(Rimfire 3400 error)*

A write fault condition occurred in the drive. It indicates either a broken drive, an error in the controller, or a drive which is not fully compatible with the Rimfire 3400 controller.

1FH Drive reported power on reset *(Rimfire 3400 error)*

If returned in a Status block without Command Complete set, this tells the host that the specified drive has just been powered on. It may also happen after momentary power outages.

When this error is reported, the drive is unconfigured. A *Configure* command should be executed after seeing this error (unless reported as a retry during a *Configure* command).

If returned as a hard error, the command should be reexecuted.

20H Drive reported spindle motor stopped *(Rimfire 3400 error)*

If returned in a Status block without Command Complete set, this tells the host that the drive stopped spinning. The host should respond by issuing a *Start Spindle Motor* command.

21H Drive reported removable media changed *(Rimfire 3400 error)*

If returned in a Status block without Command Complete set, this tells the host that the removable media of the drive has changed. The controller will automatically ignore any previously cached data for this drive. The host should report this drive change to the operating system.

22H Command complete not active in drive *(Rimfire 3400 error)*

If a drive is powering up, this means the drive is not ready to accept commands. Wait for a short period of time and re-issue the command.

If this error continues for too long, the drive is not powering up properly, there is a problem with the drive cables, or the controller isn't working properly.

If the drive has been operating for a while when this error occurs, power the drive off and on again.

If this error occurs after a *Command Timeout* Error, the last command caused the drive to hang up. If the last command was a *Start Spindle Motor* command, wait and try again (up to the maximum time to start the drive spinning). If command complete still hasn't become true, there is a fault in the drive. Power the drive off and on again.

23H Sector too short/overrun error *(Rimfire 3400 error)*

A sector pulse was detected before the end of a sector. Possible causes for this error include:

1. An unstable read or reference clock from the drive.
2. A noisy cable connection to the drive.
3. A hardware problem in the drive or controller.

24H Data error, no correction done *(Rimfire 3400 error)*

Data read from the drive is in error. As a retry, this was a soft error which was corrected when the controller reread the data. As a command error, the controller encountered a data error on the disk for which correction was not attempted. When this error is returned, error correction was not attempted.

25H ID sync error (sector not found) *(Rimfire 3400 error)*

The controller cannot find the desired sector on the disk. This may be caused by an error in the sector ID for the desired sector, or by an unformatted disk or disk formatted for a different number of sectors per track.

26H Header CRC error *(Rimfire 3400 error)*

An error was detected while reading the header of the desired sector. It implies an error in the sector ID of the sector being read or written.

27H Data sync error *(Rimfire 3400 error)*

This error results from any of the following conditions:

1. A data error exists and the sector should be mapped.
2. The disk is unformatted or formatted for a different number of sectors per track.
3. The data preamble of the desired sector is too short. This implies the drive is returning a preamble size which is too small in the drive configuration.

28H ESDI command timeout *(Rimfire 3400 error)*

An ESDI serial command did not complete within three seconds. It normally means the drive is not operating correctly. In a *Start Spindle Motor* or *Stop Spindle Motor* command, a one minute time delay applies instead of three seconds.

29H ESDI data operation timeout *(Rimfire 3400 error)*

The drive is not returning read/reference clock pulses, or the drive is not returning index pulses.

2AH ESDI misseek/Direct access to alternate *(Rimfire 3400 error)*

This error is returned when any of the following occurs:

1. An attempt was made to directly read an alternate track or alternate sector. Alternate tracks and sectors must be accessed via the defective track or sector which points to this alternate.
2. The disk drive performed a seek to the wrong track without detecting the error. The controller detects this via a bad sector ID value.
3. The disk format is corrupted, so that a defective track does not point to the proper alternate track. In this situation, the invalid track or sector must be reformatted.

Most errors relating to invalid track IDs are classed under this error number. When retried, the retry process starts with the original sector being searched for. This ensures that all seek-related errors during defective track/sector processing are properly retried.

2BH Error reading ESDI sector ID *(Rimfire 3400 error)*

A soft error occurred while reading a sector ID but the CRC was correct. This error will normally be seen only in a Status block without Command Complete set.

2CH Direct access to bad track/sector *(Rimfire 3400 error)*

An attempt was made to directly access a track or sector marked as bad. Possible causes for this error include:

1. The host attempted to access the wrong sector.
2. The disk format is corrupted. The proper tracks or sectors should be reformatted.

2DH ECC correction done *(Rimfire 3400 error)*

This error number is only returned when a successful ECC error correction is done. It specifies that an error occurred which the ECC algorithm corrected.

2EH ECC correction failed

A data error could not be corrected using the ECC algorithm. As a retry, it means that the ECC algorithm could not correct the error and the data is being re-read. As a command error, it means the data errors are beyond the correction span of the ECC algorithm.

31H Drive write-protected *(Rimfire 3400 error)*

The drive cannot be written to because the write-protect switch or jumper is active.

32H Sectors per track bad or greater than physical *(Rimfire 3400 error)*

The *Sectors/Track* field is zero on a soft-sectored ESDI drive. The *Logical Sectors/Track* field is greater than the *Physical Sectors/Track* field.

33H Bytes per sector bad or greater than physical *(Rimfire 3400 error)*

The Bytes/Sector field is less than 256, greater than 8192, or not a multiple of 16 bytes.

The requested track size (bytes/sector and sectors/track) is larger than the physical drive capacity. Either request a smaller sector size or fewer sectors per track.

34H Field too long (preamble/gap) *(Rimfire 3400 error)*

One of the configuration parameters returned from the drive is too large for the controller to handle. Use the *Return Configuration/Status* command to determine the various ESDI field sizes. The limitations are:

1. Preamble length must be less than 30 bytes.
2. Post-index gap length must be less than 30 bytes.
3. The total intersector gap size (ISG plus format speed tolerance gap) must be less than 236 bytes.

If this error occurs, confirm that the drive is reporting the correct field sizes by comparing with the drive manual. If any of the above are true, the controller will not support this ESDI drive.

35H Not ESDI disk drive, can't use *(Rimfire 3400 error)*

A *Configure* command was attempted on an ESDI tape or optical disk drive. The Rimfire 3400 controller does not support these types of drives.

36H Drive can't set requested physical sectors per track *(Rimfire 3400 error)*

If the *Configure* command for a hard sectored ESDI drive requests a different number of physical sectors per track than the drive is currently set to, the controller sends a *Set Unformatted Bytes Per Sector* ESDI command to the drive to attempt to change the physical sectors to confirm to the host's request. If the drive cannot support this feature or the requested number of sectors per track, this error is returned.

37H Configuration parameter inconsistent *(Rimfire 3400 error)*

One of the fields in the *Configure* command or *Define ESDI Parameters* command is inconsistent. This includes an interleave or a skew factor greater than or equal to the number of sectors per track, or the cylinders per disk or heads per cylinder values greater than the physical number.

39H Tried to initialize I/O Control Group 0 *(Rimfire 3400 error)*

An attempt was made to change I/O Control Group 0. This I/O Control Group cannot be changed.

3AH Wrong source sector/track type *(Rimfire 3400 error)*

This error is generated by *Slip Sector*, *Map Track*, and *Map Sector* commands. It signifies a problem with the sector or track to be flagged as defective, such as:

1. A *Slip Sector* command was attempted on an alternate or bad track.
2. A *Map Track* command was attempted on a track containing alternate sectors or on an alternate or bad track.
3. A *Map Sector* command was attempted on an alternate or bad track, on a mapped track, or on an alternate or bad sector.

3BH Wrong alternate sector/track type *(Rimfire 3400 error)*

This error is generated by the *Map Track* and *Map Sector* commands. It signifies a problem with the alternate address to be mapped to. It will only occur if the host selects the alternate location.

1. For a *Map Track* command, the alternate address is not a normal track. It is already flagged as an alternate, defective, or bad track; or it contains alternate, defective, or bad sectors.

2. For a *Map Sector* command, the alternate address is not a normal sector. It is part of an alternate, defective, or bad track; or it is already an alternate, defective, or bad sector.

3CH No spare sectors left for slipping *(Rimfire 3400 error)*

This error is generated by the Slip Sector command. It may mean:

1. The drive is configured without spare sectors.

2. The track does not contain any more spare sectors. A *Map Track* or *Map Sector* command must be used to map the defect.

3DH Bad recovery field in defect mapping command *(Rimfire 3400 error)*

The value in the *Recovery* field in a *Slip Sector*, *Map Track*, or *Map Sector* command is invalid. The *Recovery* field must be set to a valid recovery value and the command reexecuted.

60H Cache memory diagnostic error *(Rimfire 3400 error)*

During a cache memory test, this error will be returned if a byte read from cache differed from the pattern originally written to that location. This is a hardware error in the controller.

61H Static RAM error *(Rimfire 3400 error)*

This error indicates that a byte read form the controller's scratchpad RAM differed from the pattern originally written. This is a hardware error in the controller.

62H PROM checksum error *(Rimfire 3400 error)*

This error will be returned if the firmware EPROMs in the controller have been damaged or were not successfully programmed. The firmware must be replaced for correct operation.

63H Error - undefined diagnostic specified *(Rimfire 3400 error)*

This error indicates that the *Diagnostic* command set a bit in the *Diagnostic Type* field that did not correspond to a valid diagnostic test. The command may be reattempted after correcting the *Diagnostic Type* field in the parameter block.

Appendix E - Cable Information

The following tables list suggested parts and pin assignments for Rimfire 3200 SMD cables and Rimfire 3400 ESDI cables.

Rimfire 3200 Cables

Tables E-1 through E-4 list suggested parts and pin assignments for Rimfire 3200 SMD cables.

The Rimfire 3202, 3224, and 3231 controllers use standard SMD cables.

The Rimfire 3223 controller uses shielded, twisted pair cables with "D" connectors.

Table E-1 Rimfire 3200 Cable Parts
(Standard Connector)

Cable	Quantity	Description	Suggested Parts
A	2	60 Pin Connector, Socket, With Strain Relief	3M 3334-6060 Burndy FRS60BD-8
	As Required	60 Conductor, Flat Ribbon, Twisted Pair Cable *(Maximum = 100 feet)*	Belden 9V28060
B	2	26 Pin Connector, Socket, With Strain Relief	3M 3334-6060 Burndy FRS60BD
	As Required	26 Conductor, Flat Ribbon Ground Plane Cable, One Drain *(Maximum = 50 feet)*	3M 3476/26

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Table E-2 Rimfire 3223 Cable Parts
("D" Connector)

Cable	Quantity	Description	Suggested Parts
A	As Required	Twisted Pair, Shielded Cable *(Maximum = 100 feet)*	Montrose 5837-30B
	1	62 Pin "D" Connector	AMP 748367-1
	1	62 Pin Shell	AMP 747100-3
	1	60 Pin Ribbon Header	3M 3334-6060 Burndy FRS60BD-8
	60	Densi-D Gold Pins (male)	AMP 748333-7
	As Required	1/2" Heat Shrinkable Tubing	Cole-Flex ST221-1/2"
B	As Required	Twisted Pair, Shielded cable *(Maximum = 50 feet)*	Montrose 5837-13B
	1	50 Pin "D" Connector	AMP 205212-3
	1	50 Pin Shell	AMP 745175-5
	2	26 Pin Ribbon Header	3M 3399-6026 Burndy FRS26BD-8
	50	Contact Pins (male)	AMP 66507-9
	As Required	1/4" Heat Shrinkable Tubing	Cole-Flex ST221-1/4" Alpha FIT-105-1/8"
	As Required	3/4" Heat Shrinkable Tubing	Alpha FIT-105-3/4"

Table E-3 Rimfire 3200 SMD "A" Cable Pin Assignments

Signal	Header Pair		"D" Connector ② (3223)		Standard Connector	
	–	+	–	+	–	+
TAG1	1	31	22	1	1	31
TAG2	2	32	43	23	2	32
TAG3	3	33	2	44	3	33
DATA0	4	34	24	3	4	34
DATA1	5	35	45	25	5	35
DATA2	6	36	4	46	6	36
DATA3	7	37	26	5	7	37
DATA4	8	38	47	27	8	38
DATA5	9	39	6	48	9	39
DATA6	10	40	28	7	10	40
DATA7	11	41	49	29	11	41
DATA8	12	42	8	50	12	42
DATA9	13	43	30	9	13	43
OCD	14	44	51	31	14	44
DATAIN3 (Fault)	15	45	10	52	15	45
DATAIN2 (Fault)	16	46	32	11	16	46
DATAIN1 (On Cylinder)	17	47	53	33	17	47
DATAIN6 (Index)	18	48	12	54	18	48
DATAIN0 (Ready)	19	49	34	13	19	49
DATAIN5 (Address Mark)	20	50	55	35	20	50
BUSY ①	21	51	14	56	21	51
UNITSELTAG	22	52	36	15	22	52
UNITSEL2.0	23	53	57	37	23	53
UNITSEL2.1	24	54	16	58	24	54
DATAIN7 (Sector)	25	55	38	17	25	55
UNITSEL2.2	26	56	59	39	26	56
TAG5	27	57	18	60	27	57
DATAIN4 (Write Protect)	28	58	40	19	28	58
PICK ①	29		61		29	
HOLD ①	59		41		59	
TAG4	30	60	20	62	30	60

① *These signals are not used by Rimfire 3201 and Rimfire 3202 controllers.*

② *Pins 21 and 42 of the "D" connector are not used.*

Table E-4 Rimfire 3200 SMD 'B' Cable Pin Assignments

Signal	Header Pair		"D" Connector (3223)				Standard Connector	
			Drive 0 or 2		Drive 1 or 3			
	–	+	–	+	–	+	–	+
WRITE DATA	8	20	5	38	13	46	8	20
GROUND	7		21		30		7	
WRITE CLOCK	6	19	20	37	29	45	6	19
GROUND	18		4		12		18	
SERVO CLOCK	2	14	1	34	26	42	2	14
GROUND	1		N/C		N/C		1	
READ DATA	3	16	2	35	10	43	3	16
GROUND	15		18		27		15	
READ CLOCK	5	17	3	19	11	28	5	17
GROUND	4		36		44		4	
SEEK END	10	23	23	40	32	48	10	23
UNIT SELECTED	22	9	6	22	14	31	22	9
GROUND	21		39		47		21	
INDEX ①	12	24	8	41	16	49	12	24
GROUND	11		7		33		11	
SECTOR ①	13	26	9	25	17	50	13	26
GROUND	25		24		15		25	

① *"B" cable INDEX and SECTOR signals are not used.*

Rimfire 3400 Cables

Table E-5 through E-7 list suggested parts and pin assignments for Rimfire 3400 ESDI cables.

Table E-5 Rimfire 3400 Cable Parts

Cable	Quantity	Description	Suggested Parts
A	As Required	34 Conductor Flat Ribbon Cable	3M 3431-5302
	1	34 Pin Female Connector	3M 3414-6034
	1	34 Pin Card Edge Connector	3M 3463-0001
B	As Required	20 Conductor Flat Ribbon Cable	3M 3365/20
	1	20 Pin Socket Connector	3M 3421-6020
	1	20 Pin Card Edge Connector	3M 3461-0001

Table E-6 Rimfire 3401 ESDI "A" (Control) Cable (P2 Connection)

Signal	P2 Connection	ESDI
Ground	C21	Pin 1
– Head Select 2(3)	A21	Pin 2
Unused Ground ①	NC	Pin 3
– Head Select 2(2)	C22	Pin 4
Ground	A22	Pin 5
– Write Gate	C23	Pin 6
Unused Ground ①	NC	Pin 7
– Configuration/Status Data	A23	Pin 8
Unused Ground ①	NC	Pin 9
– Transfer Acknowledge	C24	Pin 10
Ground	A24	Pin 11
– Attention	C25	Pin 12
Unused Ground ①	NC	Pin 13
– Head Select 2(0)	A25	Pin 14
Ground	C26	Pin 15
– Sector/Address Mark Found	A26	Pin 16
Unused Ground ①	NC	Pin 17
– Head Select 2(1)	C27	Pin 18
Unused Ground ①	NC	Pin 19
– Index	A27	Pin 20
Ground	C28	Pin 21
– Ready	A28	Pin 22
Unused Ground ①	NC	Pin 23
– Transfer Request	C29	Pin 24
Ground	A29	Pin 25
– Drive Select 2(0)	C30	Pin 26
Unused Ground ①	NC	Pin 27
– Drive Select 1(1)	A30	Pin 28
Unused Ground ①	NC	Pin 29
– Drive Select 2(2)	C31	Pin 30
Ground	A31	Pin 31
– Read Gate	C32	Pin 32
Unused Ground ①	NC	Pin 33
– Command Data	A32	Pin 34

① *To allow all signal lines to fit on rows A and C of the P2 connector, these grounds are not used*

Table E-7 Rimfire 3401 ESDI "B" (Data) Cable (P2 Connection)

Drive	Signal	P2 Connection	ESDI
1	– Drive Selected	C1	Pin 1
	– Sector/Address Mark Found ①	A1	Pin 2
	– Command Complete	C2	Pin 3
	– Address Mark Enable	A2	Pin 4
	Ground	C3	Pin 5
	Ground	A3	Pin 6
	+ Write Clock	C4	Pin 7
	– Write Clock	A4	Pin 8
	Ground	C5	Pin 9
	+ Read Reference Clock	A5	Pin 10
	– Read Reference Clock	C6	Pin 11
	Ground	A6	Pin 12
	+ NRZ Write Data	C7	Pin 13
	– NRZ Write Data	A7	Pin 14
	Ground	C8	Pin 15
	Ground	A8	Pin 16
	+ NRZ Read Data	C9	Pin 17
	– NRZ Read Data	A9	Pin 18
	Ground	C10	Pin 19
	– Index ①	A10	Pin 20
2	– Drive Selected	C11	Pin 1
	– Sector/Address Mark Found ①	A11	Pin 2
	– Command Complete	C12	Pin 3
	– Address Mark Enable	A12	Pin 4
	Ground	C13	Pin 5
	Ground	A13	Pin 6
	+ Write Clock	C14	Pin 7
	– Write Clock	A14	Pin 8
	Ground	C15	Pin 9
	+ Read Reference Clock	A15	Pin 10
	– Read Reference Clock	C16	Pin 11
	Ground	A16	Pin 12
	+ NRZ Write Data	C17	Pin 13
	– NRZ Write Data	A17	Pin 14
	Ground	C18	Pin 15
	Ground	A18	Pin 16
	+ NRZ Read Data	C19	Pin 17
	– NRZ Read Data	A19	Pin 18
	Ground	C20	Pin 19
	– Index ①	A20	Pin 20

① *Not used by Rimfire 3400 controller on "B" cable.*

Appendix F - Jumper Settings

The following diagrams illustrate jumper locations and their settings.

➳ *NOTE: Unless otherwise specified, the jumper settings in this appendix illustrate factory settings.*

Unless otherwise indicated, a jumper is set to Ø if the jumper is in and is set to 1 if the jumper is out.

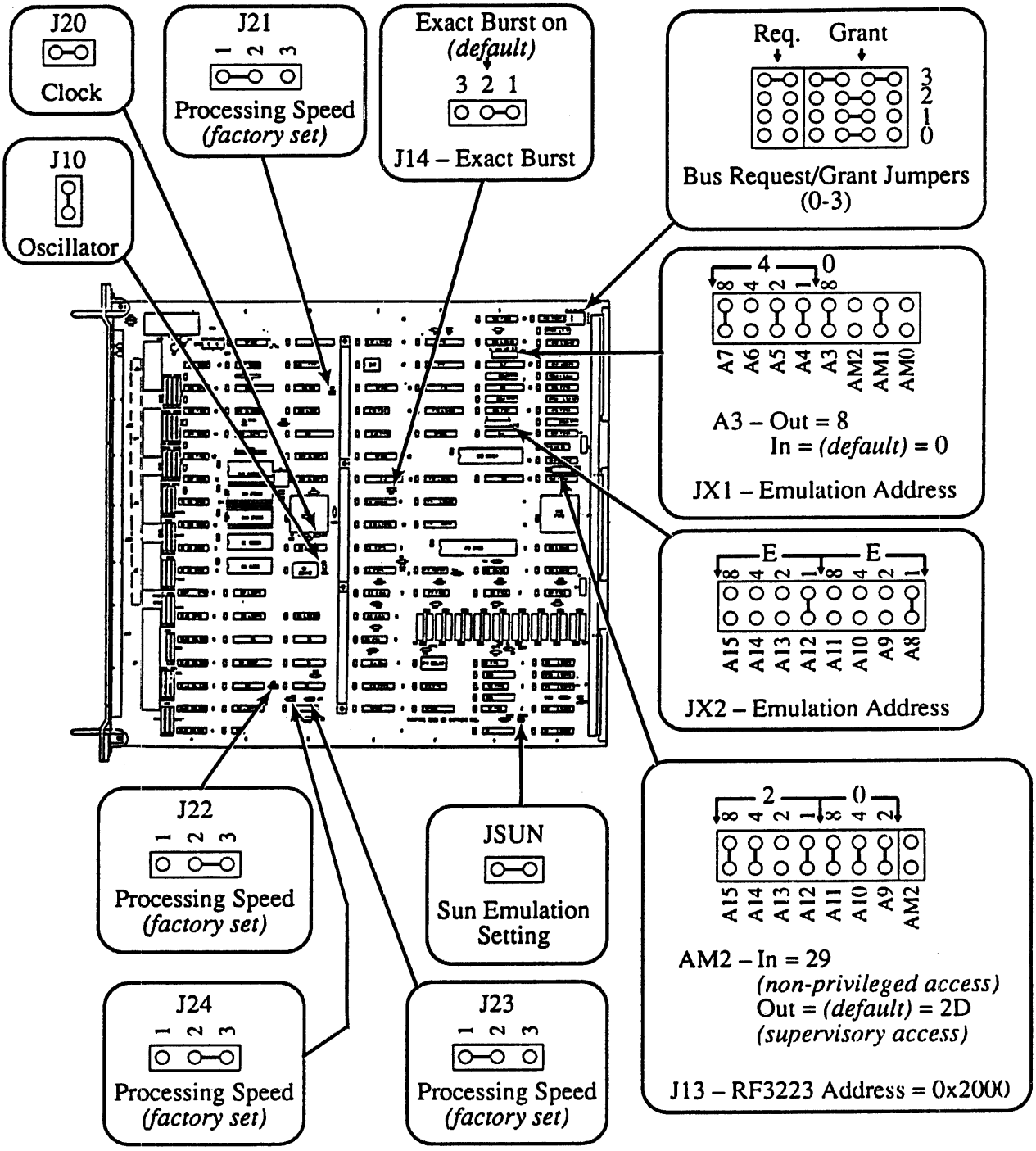

Figure F-1 Rimfire 3223/3224 Jumpers

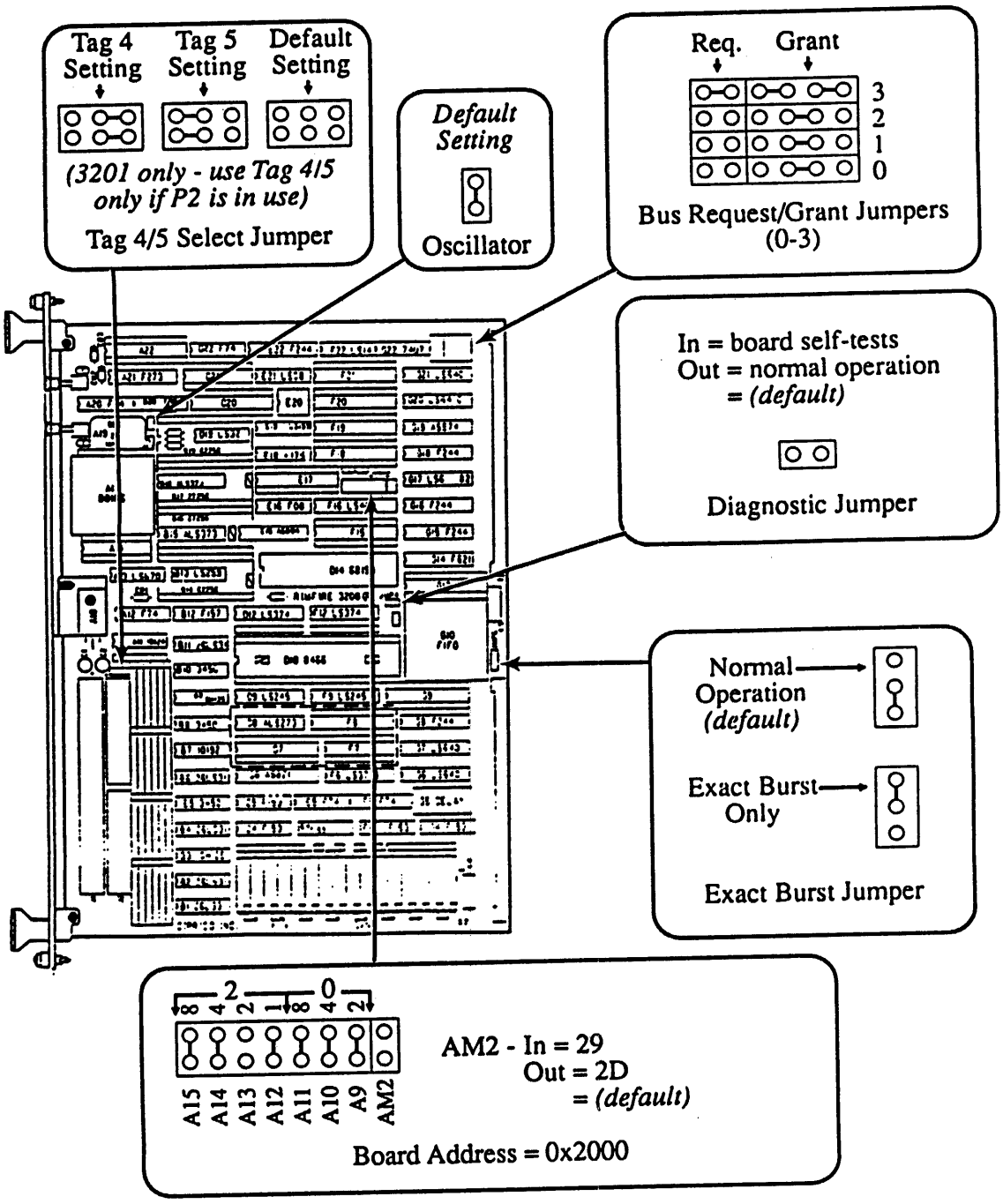

Figure F-2 Rimfire 3202 Jumpers

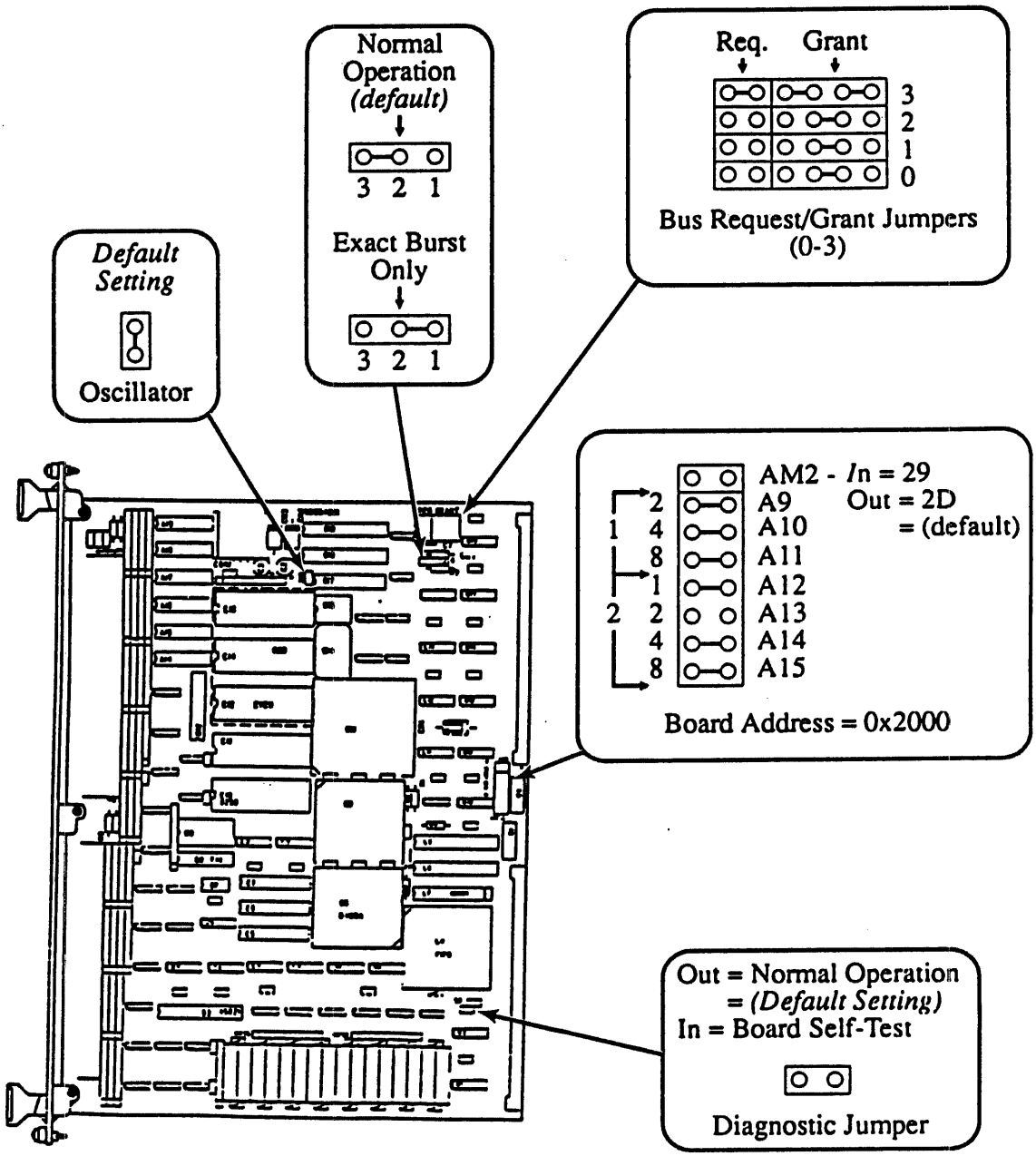

Figure F-3 Rimfire 3231 Jumpers

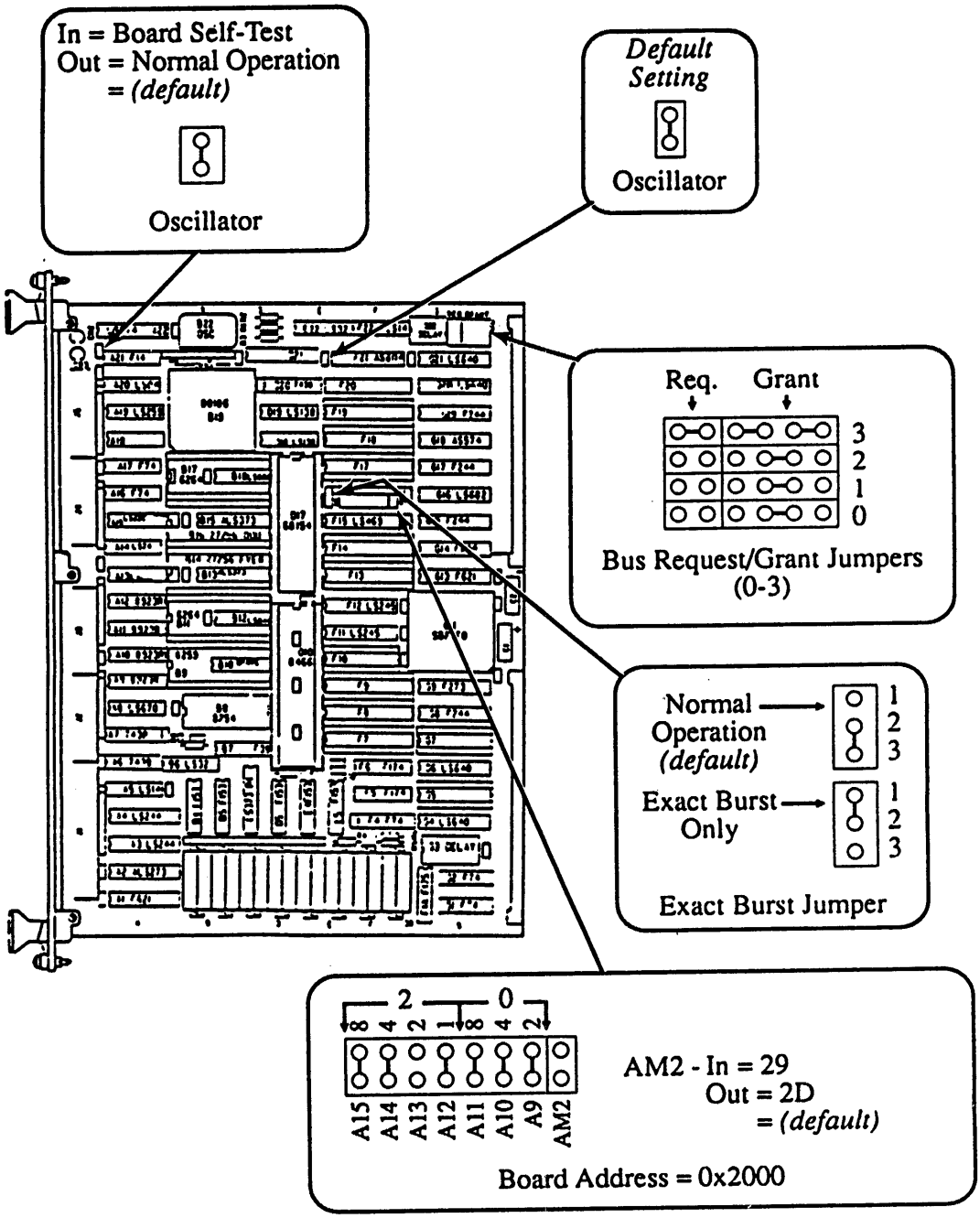

Figure F-4 Rimfire 3400 Jumpers

Appendix G - Disk Drive Parameters

This appendix lists suggested parameters for drives qualified (by Ciprico) for use with Rimfire 3200/3400 controllers.

CDC-9720 Sabre V

RF3200 on Sun with RFUTIL **Latest Update 4/12/89**

Label: CDC-9720-1230 Sabre V cyl 1633 alt 2 hd 15 sec 83 apc 15
Sectors/cylinder: 1245
Bytes/cylinder: 637440
Partitions:

a: 0 17430
b: 14 34860
c: 0 2033085
g: 42 1980795

Configuration:

#alt/cylinder 15
size of gap1 15
size of gap2 15
interleave factor 1
# of data cylinders 1633
# of alt cylinders 2
# of heads 15
# of sectors/track 83
label location 0
physical partition # 0
short sector present (SSP) OFF
extended addressing (EAD) ON

Physical bytes/sector 600
Bytes in last sector 600
Physical sectors/track 84

Switch Settings (1 = Closed, 0 = Open, X = Address):

Switch	1	2	3	4	5	6	7	8	9	10
A213	0	0	1	0	0	0	0	0	0	1
A224	X	X	X	X	X	X	X	X		
Logical Address	X	X	X	X						
B/C					0					
N/WP						1				
Sectors 2-0 thru 2-3							0	0	0	0
Sectors 2-4 thru 2-13	1	1	1	0	0	1	1	1	1	1

Jumper Settings:

Jumper:	RTN	SWP1	SWPD	IDX S	RUNT	FF
	Out	In	Out	Out	Out	N/A

➽ *NOTE: Sectors were set up using table 3-22 in the User's Manual (Pub. #83325710). The 2.016 MHz clock and the round up method were used.*

CDC-9773

RF3200 on Sun with RFUTIL **Latest Update 10/2/88**

Label: CDC-XMD-1350 cyl 1418 alt 2 hd 19 sec 83 apc 19
Sectors/cylinder: 1577
Bytes/cylinder: 807424
Partitions:

a: 0 17347
b: 11 34694
c: 0 2236186
g: 33 2184145

Configuration:

#alt/cylinder 19
size of gap1 19
size of gap2 15
interleave factor 1
# of data cylinders 1418
# of alt cylinders 2
# of heads 19
# of sectors/track 83
label location 0
physical partition # 0
short sector present (SSP) ON
extended addressing (EAD) ON

physical bytes per sector 598
bytes in last sector 168
physical sectors/track 85

Switch Settings (C = On, O = Off):

Switch	1	2	3	4	5	6	7	8	9	10
C503	O	O	O	O	O	O	O	C	C	C
E103	O	O	O	O	O	O	O	O	O	
F556	O	O	O	C	O	O				
F563	O	O	C	O	O	O				

Century Data C2800

RF3200 on Sun with RFUTIL **Latest Update: 9/26/88**

Label: Century C2800 cyl 843 alt 2 hd 24 sec 63 apc 24
Sectors/cylinder: 1512
Bytes/cylinder: 774144
Partitions:

a: 0 16632
b: 11 33264
c: 0 1274616
g: 33 1224720

Configuration:

#alt/cylinder 24
size of gap1 20
size of gap2 20
interleave factor 1
# of data cylinders 843
# of alt cylinders 2
# of heads 24
# of sectors/track 63
label location 0
physical partition # 0
short sector present (SSP) OFF
extended addressing (EAD) OFF

physical bytes per sector 640
physical sectors/track 64

Switch Settings (0 = Closed, 1 = Open):

Switch	1	2	3	4	5	6	7	8
S1	1	1	1	1	1	1	1	1
S2	1	1	1	0	0	0	1	1
S3	1	0	0	0	0	0	0	0
S4	1	0	0	0	0	0	1	0

➽ *NOTE: This drive does not use the write clock, but generates its own write clock, resulting in intermittent formatting problems (i.e., ID CRC errors, etc.).*

Fujitsu 2333

RF3200 on Sun with RFUTIL **Latest Update: 2/9/89**

Label: Fujitsu-2333 Swallow cyl 821 alt 2 hd 10 sec 67 apc 10
Sectors/cylinder: 670
Bytes/cylinder: 343040
Partitions:

a: 0 17420
b: 26 32830
c: 0 550070
g: 75 499820

Configuration:

#alt/cylinder 10
size of gap1 16
size of gap2 19
interleave factor 1
# of data cylinders 821
# of alt cylinders 2
# of heads 10
# of sectors/track 67
label location 0
physical partition #0
short sector present (SSP) ON
extended addressing (EAD) OFF

physical bytes per sector 594
bytes in last sector 568
physical sectors/track 69

Switch Settings (1 = On, 0 = Off, X = Address):

Switch	1	2	3	4	5	6	7	8	9	10
S1	X	X	X	0	1	1	1	1	0	0
S2	0	0	0	1	0	1	0			
S3	0	1	0	0	0	0	0			

Fujitsu 2344

RF3200 on Sun with RFUTIL **Latest Update: 2/9/89**

Label: Fujitsu-2344 Swallow II cyl 622 alt 2 hd 27 sec 67 apc 27
Sectors/cylinder: 1809
Bytes/cylinder: 926208
Partitions:

a: 0 21708
b: 12 34371
c: 0 1125198
g: 31 1069119

Configuration:

#alt/cylinder 27
size of gap1 16
size of gap2 19
interleave factor 1
# of data cylinders 622
# of alt cylinders 2
# of heads 27
# of sectors/track 67
label location 0
physical partition #0
short sector present (SSP) ON
extended addressing (EAD) OFF

physical bytes per sector 594
bytes in last sector 568
physical sectors/track 69

Switch Settings (1 = On, 0 = Off, X = Address):

Switch	1	2	3	4	5	6	7	8
SW1	X	X	X	1	0	0	0	0
SW2	0	0	0	0				
SW3	0	0	0	1	0	1	0	
SW4	0	1	0	0	0	0	0	
SW5	0	0	0	0				

Fujitsu 2372

RF3200 on Sun with RFUTIL **Latest Update: 2/9/89**

Label: Fujitsu-2372 Swallow III cyl 743 alt 2 hd 27 sec 67 apc 27
Sectors/cylinder: 1809
Bytes/cylinder: 926208
Partitions:

a: 0 21708
b: 12 34371
c: 0 1344087
g: 31 1288008

Configuration:

#alt/cylinder 27
size of gap1 20
size of gap2 20
interleave factor 1
# of data cylinders 743
# of alt cylinders 2
# of heads 27
# of sectors/track 67
label location 0
physical partition # 0
short sector present (SSP) ON
extended addressing (EAD) OFF

physical bytes per sector 594
bytes in last sector 568
physical sectors/track 69

Switch Settings (1 = On, 0 = Off, X = Address):

Switch	1	2	3	4	5	6	7	8
SW1	X	X	X	0	0	0	0	0
SW2	0	0	0	0				
SW3	0	0	0	1	0	1	0	
SW4	0	1	0	0	0	0	0	
SW5	0	0	0	0				

Fujitsu 2382

RF3200 on Sun with RFUTIL **Latest Update: 09/18/89**

Label: Fujitsu-2382 Swallow IV cyl 743 alt 2 hd 27 sec 82 apc 27
Sectors/cylinder: 2214
Bytes/cylinder: 1133568
Partitions:

a: 0 22140
b: 10 33210
c: 0 1645002
g: 25 1589652

Configuration:

#alt/cylinder 27
size of gap1 18
size of gap2 20
interleave factor 1
# of data cylinders 743
# of alt cylinders 2
# of heads 27
# of sectors/track 82
label location 0
physical partition # 0
short sector present (SSP) on
extended addressing (EAD) off

physical sectors/track 84
bytes in last sector 177
physical bytes/sector 597

Switch Settings (1 = On, 0 = Off, X = Address):

Switch	1	2	3	4	5	6	7	8
SW1	X	X	X	X	0	0	0	0
SW2	0	1	0	0	0	0	0	0
SW3	0	0	0	0				
SW4	1	1	1	0	0	1	0	
SW5	0	1	0	0	0	0	0	

Fujitsu M2249E

RF3400 on Sun with RFUTIL **Latest Update: 9/26/88**

Label: Fujitsu M2249E cyl 1238 alt 5 hd 15 sec 34 apc 15
Sectors/cylinder: 510
Bytes/cylinder: 2661120
Partitions:

a: 0 20400
b: 40 40800
c: 0 631380
g: 120 570180

Configuration:

#alt/cylinder 15
size of gap1 0
size of gap2 0
interleave factor 1
# of data cylinders 1238
# of alt cylinders 5
# of heads 15
# of sectors/track 34
label location 0
physical partition # 0

physical bytes per sector 596

Jumper Settings:

Jumper	1-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	
CNH5	out	out	out	out	out	out	out	in	
CNH6	in	out	out	out	out	out	out	out	(Unit 1)
CNH7	in	in	out	in	out	in	out	in	

Fujitsu M2322 Swallow

RF3200 on Sun with RFUTIL **Latest Update: 9/1/88**

Label: Fujitsu M2322 Swallow cyl 821 alt 2 hd 10 sec 33 apc 10
Sectors/cylinder: 330
Bytes/cylinder: 168960
Partitions:

a: 0 24750
b: 75 49500
c: 0 270930
g: 225 196680

Configuration:

#alt/cylinder 10
size of gap1 15
size of gap2 17
interleave factor 1
# of data cylinders 821
# of alt cylinders 2
# of heads 10
# of sectors/track 33
label location 0
physical partition # 0
short sector present (SSP) ON
extended addressing (EAD) OFF

physical bytes per sector 586
bytes in last sector 556
physical sectors/track 35

Switch Settings (1 = On, 0 = Off, X = Address):

Switch	1	2	3	4	5	6	7	8
SW1	X	X	X	1	0	0	0	0
SW2	1	0	0	1	0	0	1	
SW3	0	0	1	0	0	0	0	

Fujitsu-M2351 Eagle

RF3200 on Sun with RFUTIL **Latest Update: 7/19/88**

Label: Fujitsu-M2351 Eagle cyl 836 alt 6 hd 20 sec 45 apc 20
Sectors/cylinder: 900
Bytes/cylinder: 460800
Partitions:

a: 0 16200
b: 18 32400
c: 0 752400
g: 54 703800

Configuration:

#alt/cylinder 20
size of gap1 18
size of gap2 20
interleave factor 1
# of data cylinders 836
# of alt cylinders 4
# of heads 20
# of sectors/track 45
label location 0
physical partition # 0
short sector present (SSP) ON
extended addressing (EAD) OFF

physical bytes per sector 600
bytes in last sector 560
physical sectors/track 47

Jumper Settings:

Location	Pins Jumpered			
BC7	2-3	5-6	9-10	13-14
BD7	2-3	6-7	9-10	13-14
BE7	3-4	5-6	10-11	13-14
BF7	3-4	6-7	10-11	13-14

Fujitsu-M2361A

RF3200 on Sun with RFUTIL **Latest Update: 1/19/89**

Label: Fujitsu-M2361A EagleXP cyl 836 alt 6 hd 20 sec 66 apc 20

Partitions:

a: 0 17160
b: 13 34320
c: 0 1103520
g: 39 1052040

Configuration:

#alt/cylinder 20
size of gap1 19 (possibly 18 -- postamble should be 30)
size of gap2 20
interleave factor 1
# of data cylinders 836
# of alt cylinders 6
# of heads 20
# of sectors/track 66
label location 0
physical partition # 0
short sector present (SSP) ON
extended addressing (EAD) OFF

physical bytes per sector 603
bytes in last sector 559
physical sectors/track 68

Switch Settings (1 = On, 0 = Off, X = Address):

Switch	1	2	3	4	5	6	7	8
SWA	0	1	0	1	1	0	1	0
SWB	0	0	0	0	0	0	1	0
ADDR	X	X	X	X				

Hitachi DK815-10

RF3200 on Sun with RFUTIL **Latest Update: 9/02/88**

Label: Hitachi DK815-10 cyl 1735 alt 2 hd 15 sec 67 apc 15
Sectors/cylinder: 1005
Bytes/cylinder: 514560
Partitions:

a: 0 16080
b: 16 32160
c: 0 1743675
g: 48 1695435

Configuration:

#alt/cylinder 15
size of gap1 19
size of gap2 19
interleave factor 1
# of data cylinders 1735
# of alt cylinders 2
# of heads 15
# of sectors/track 67
label location 0
physical partition # 0
short sector present (SSP) OFF
extended addressing (EAD) OFF

physical bytes per sector 600
bytes in last sector 760
physical sectors/track 68

Switch Settings (1 = On, 0 = Off, X = Address):

Switch	1	2	3	4	5	6	7	8
SW28	0	0	0	0	1	0	1	0
SW27	0	0	0	1	1	0	1	0
SW41	0	1	0	0	0	0	0	X

Maxtor XT-8760E

RF3400 on Sun with RFUTIL **Latest Update: 9/26/88**

Label: Maxtor XT-8760E cyl 1622 alt 10 hd 15 sec 50 apc 15
Sectors/cylinder: 750
Bytes/cylinder: 384000
Partitions:

a: 0 18750
b: 25 37500
c: 0 1216500
g: 75 1160250

Configuration:

#alt/cylinder 15
size of gap1 0
size of gap2 0
interleave factor 1
# of data cylinders 1622
# of alt cylinders 10
# of heads 15
# of sectors/track 50
label location 0
physical partition 0

physical bytes per sector 614

Jumper Settings:

Jumper	Setting	Jumper	Setting	Jumper	Setting
JP16	out	JP24	out	JP32	in
JP17	in	JP25	in	JP33	in
JP18	in	JP26	out	JP34	in
JP19	out	JP27	out	JP35	in
JP20	out	JP28	out	JP36	out
JP21	in	JP29	out	JP37	in
JP22	in	JP30	out	JP38	in
JP23	out	JP31	out	JP39	in

Rodime RO8074

RF3200 on Sun with RFUTIL **Latest Update: 7/1/88**

Label: Rodime RO8074 cyl 1636 alt 10 hd 11 sec 63 apc 11
Sectors/cylinder: 693
Bytes/cylinder: 354816
Partitions:

a: 0 16632
b: 24 33264
c: 0 1133748
g: 72 1083852

Configuration:

#alt/cylinder 11
size of gap1 19
size of gap2 19
interleave factor 1
# of data cylinders 1636
# of alt cylinders 10
# of heads 11
# of sectors/track 63
label location 0
physical partition # 0
short sector present (SSP) off
extended addressing (EAD) off

physical bytes per sector 640
physical sectors/track 64

Switch Settings (1 = On, 0 = Off):

Switch	1	2	3	4	5	6	7	8
SW1	1	1	1	1	1	1	1	0
SW2	0	1	0	0	0	0	0	0
SW3	1	1	1	1	1	1	1	1
SW4	1	0	1	1	0	0	0	0
SW5	1	1	1	1	1	1	1	1
SW6	1	1	1	1	1	1	1	1
SW7	0	0	0	0	0	0	0	0

RF1200 (Twiddler station)
Tested with both 32k and 64k versions.

Drive type **0**
11 heads per cylinder
63 sectors per track
1646 cylinders per disk
64 physical sectors
64 usable sectors

Toshiba MK-288FC

RF3200 on Sun with RFUTIL **Latest Update: 9/23/88**

Label: Toshiba MK-288FC cyl 820 alt 3 hd 15 sec 67 apc 15
Sectors/cylinder: 1005
Bytes/cylinder: 514560
Partitions:

a: 0 17085
b: 17 34170
c: 0 824100
g: 51 772845

Configuration:

#alt/cylinder 15
size of gap1 19
size of gap2 19
interleave factor 1
# of data cylinders 820
# of alt cylinders 3
# of heads 15
# of sectors/track 67
label location 0
physical partition # 0
short sector present (SSP) ON
extended addressing (EAD) OFF

physical bytes per sector 607
bytes in last sector 64
physical sectors/track 6

Switch Settings (1 = On, 0 = Off, X = Address):

Switch	1	2	3	4	5	6	7	8	9	10
Control	1	0	0	0						
Address	X	X	X	X						
Model/Options	1	1	1	0	0	1	1	0		
Sector	1	1	0	1	1	1	0	1	1	1

Toshiba MK-388FA

RF3200 on Sun with RFUTIL **Latest Update: 2/9/89**

Label: Toshiba MK-388FA cyl 1160 alt 2 hd 15 sec 68 apc 15
Sectors/cylinder: 1020
Bytes/cylinder: 522240
Partitions:

a: 0 21420
b: 21 33660
c: 0 1183200
g: 54 1128120

Configuration:

#alt/cylinder 15
size of gap1 18
size of gap2 18
interleave factor 1
# of data cylinders 1160
# of alt cylinders 2
# of heads 15
# of sectors/track 68
label location 0
physical partition # 0
short sector present (SSP) OFF
extended addressing (EAD) ON

physical sectors/track 69
physical bytes/sector 599
bytes in last sector 608

Switch Settings (1 = On, 0 = Off, X = Address):

Switch	1	2	3	4	5	6	7	8	9	10
Unit Select	X	X	X	X						
Interface	1	0	0	0						
Options	1	1	1	0	0	0	1	0		
Sector	1	1	0	1	1	1	0	1	1	1

Index