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

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## Revision History

<table>
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<tr>
<th>Publication #</th>
<th>Revision</th>
<th>Date</th>
<th>Description</th>
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<tr>
<td>21016900</td>
<td>01</td>
<td>02/28/89</td>
<td>Preliminary, Class ‘B’ Manual</td>
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<tr>
<td>21016901</td>
<td>01</td>
<td>04/25/89</td>
<td>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.</td>
</tr>
<tr>
<td>21016902</td>
<td>01</td>
<td>06/27/89</td>
<td>Revision incorporates new <code>tar</code> command parameters for reading 1/4&quot; tape and removal of restrictions regarding the use of greater than 1024 cylinders.</td>
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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.

™ Sun-3, Sun-4, and SMD4 are trademarks of Sun Microsystems.
Section 1 - Introduction

To simplify installation and conversion, the Rimfire 3223/3224 controller has an I/O connector scheme and physical dimensions corresponding to Sun's SMD 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.
Section 1 - Introduction

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 I 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 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 = Øx20000) or second (address = Øx30000) 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 ØxEE40.

- The SMD Boot Emulation controllers must be located at address ØxEE40. 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:

<table>
<thead>
<tr>
<th>Emulation Address</th>
<th>Rimfire Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Rimfire:</td>
<td>ØxEE40</td>
</tr>
<tr>
<td>2nd Rimfire:</td>
<td>Øx20000</td>
</tr>
</tbody>
</table>

**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:

<table>
<thead>
<tr>
<th>Emulation Address</th>
<th>Rimfire Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rimfire Controller</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Øx20000</td>
</tr>
</tbody>
</table>
Section 2 - Bootable Controller Installation

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
Section 2 - Bootable Controller Installation

**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 your particular system).

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

![Diagram of drive cable connections](image)

**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.
Section 2 - Bootable Controller Installation

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 \texttt{b st()} for 1/4 inch drives and press \texttt{Enter}. (For 1/2 inch tape drives, consult your Sun manual.)

3. After the \texttt{boot:} prompt appears on the screen, remove the SunOS release tape.

Loading and Configuring the \texttt{Standalone rfutil}

1. Insert the Ciproco \textit{Utility and Installation} tape into the tape drive.

\begin{itemize}
\item \textbf{NOTE:} For 1/2 inch tape drives, a density of 1600 bytes per inch is required to read the Ciproco Utility and Installation tape.
\end{itemize}

2. Load the \texttt{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 1/4 inch tape are as follows:

\begin{itemize}
\item \texttt{st(0,0,1)} \textit{for 68020 based Sun3 systems}
\item \texttt{st(0,0,2)} \textit{for SPARC based Sun4 systems}
\item \texttt{st(0,0,3)} \textit{for 68030 based Sun3 systems}
\end{itemize}

\begin{itemize}
\item \textbf{NOTE:} (For 1/2 inch tape drives, consult your Sun manual.)
\end{itemize}

Enter the appropriate characters for the media you are using and press the \texttt{Enter key}.

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3. After the Standalone rfunil 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 20000 for the first controller and 30000 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 tvi9206
   vt52  vt100

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 rfunil 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.
Section 2 - Bootable Controller Installation

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

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 \( \emptyset \) 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 \( \emptyset \) (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).
Section 2 - Bootable Controller Installation

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 Ciprho) 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 $rfsutil$ 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.
Section 2 - Bootable Controller Installation

6. Select the $f$ (Format the Drive) command from the main menu. The $r$util 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 $r$util 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 $0$ (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 $r$util 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 $r$util 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 minisroot. Since the standard Sun filesystem tuning command (tunefs) does not exist in the minisroot, Ciprico provides a program (tunef) 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.

   \[\textbf{NOTE:} \textit{For 1/2 inch tape drives, the drive density select switch may need to be changed.}\]

2. Boot and load the minisroot 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 "\textit{Loading the Minisroot}" section.
   - If you are using SUNINSTALL, refer to the "\textit{Loading the Mini UNIX}" section.

   \[\textbf{NOTE:} \textit{Always refer to the Ciprico board as xy during the installation.}\]

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

   \[
   \text{tar xvf /dev/rst0 rf/tunef.xxx}
   \]

   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):

   \[
   \text{newfs /dev/rxyab}
   \]
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5. For each filesystem to be tuned, execute the `tunef` program by entering the following command:

   `tunef /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.

<table>
<thead>
<tr>
<th>PARTITION</th>
<th>START_CYL</th>
<th>BLOCKS</th>
<th>SIZE</th>
<th>MOUNT PT</th>
<th>PRESERVE (Y/N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>Ø</td>
<td>15884</td>
<td>7</td>
<td>/</td>
<td>y</td>
</tr>
<tr>
<td>b</td>
<td>XX</td>
<td>33440</td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>Ø</td>
<td>140624</td>
<td>68</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>Ø</td>
<td>Ø</td>
<td>Ø</td>
<td>Ø</td>
<td></td>
</tr>
<tr>
<td>e</td>
<td>Ø</td>
<td>Ø</td>
<td>Ø</td>
<td>Ø</td>
<td></td>
</tr>
<tr>
<td>f</td>
<td>Ø</td>
<td>Ø</td>
<td>Ø</td>
<td>Ø</td>
<td></td>
</tr>
<tr>
<td>g</td>
<td>XX</td>
<td>91256</td>
<td>44</td>
<td>/usr</td>
<td>y</td>
</tr>
<tr>
<td>h</td>
<td>Ø</td>
<td>Ø</td>
<td>Ø</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   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 20 /dev/rmt0
   ```

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) COPYRIGHT 1989
   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 I 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)
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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/rfloclt1.h /sys/sundev/rfloclt1.h
+ cp ../sundev/rfloclt1.h /usr/include/sundev/rfloclt1.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.nor.
+ 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)
Section 2 - Bootable Controller Installation

10. Enter y to modify the /sys/sunX/conf/files file. The modifications will be made and a backup copy (files.nor) 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.nor.
+ 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.nor) will be made. The following lines will appear:

+ Making backup copy of /sys/sunX/conf/RIMFIRE as /sys/sunX/conf/RIMFIRE.nor.
+ Extracting controller information from /sys/sunX/conf/RIMFIRE...done.
+ No rf controllers currently installed.
+ Adding controller rf0 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 hexadecimal number with "0x"]

VME address of controller? [0x2000]

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 hexadecimal form and preceded by 0x, as illustrated in the following example:

0x2000

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

VME interrupt vector of controller? [0xf2]

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 hexadecimal form and preceded by $\text{\texttt{0x}}$, as illustrated in the following example:

\texttt{0xf2}

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

Add controller rfc0 at address 0x2000 vector 0xf2 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 rfc0.
+ Extracting device information from /sys/sunX/conf/RIMFIRE...done.
+ No rf devices configured in system.

Configure device rfc0 at controller rfc0? (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 rf0 MUST NOT conflict with]
[any other disks attached to rfc0 shown above.]
Use default drive number of 0? (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)
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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 Øxe40? (y/n)

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

+ Successful removal of xyØ 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)
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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. xd0  3. xd1  4. xd2
5. xd3  6. xd4  7. xd5  8. xd6
9. xd7  10. xd8  11. xd9  12. xd10
17. xd15  18. xy2  19. xy3  20. sd0
21. sd1  22. sd2  23. sd3  24. sd4
25. sd5  26. sd0  27. sd1  28. sd2
29. sd3  30. sd4  31. sd6  32. sd8
33. sd1  34. sd2  35. sd3  36. rf0
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 rf0 as the root disk. The following message is displayed:

Root disk is now: rf0. 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. xd0  3. xd1  4. xd2
5. xd3  6. xd4  7. xd5  8. xd6
9. xd7  10. xd8  11. xd9  12. xd10
17. xd15  18. xy2  19. xy3  20. sd0
21. sd1  22. sd2  23. sd3  24. sd4
25. sd6  26. sd0  27. sd1  28. sd2
29. sd3  30. sd4  31. sd6  32. sd8
33. sd1  34. sd2  35. sd3  36. rf0
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.

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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.
+ 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 0 of rf? (y/n/q)

30. You can create device nodes for up to four devices (units 0-3). 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 0 and 1. Enter y to create the device nodes for Unit 0. The following lines are displayed:

+ sh MAKEDEV rf0

[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:
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+ sh MAKEDEV rfl

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

Make device nodes for unit 2 of rfl? (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 -fsalt -c -O -DsunX -DRIMFIRE -DSUNX_F -DSUNX_60 -DSUNX_110
-DSUNX_260 -DSUNX_50 -DSUNX_160 -DCRYPT -DTCPEDEBUG -DPICSHMEM
-DPCSEMAPHORE -DPCMESSAGE -DSYSAUDIT -DSYSSACCT -DLCP -DNFSSERVER
-DNFSCLIENT -DUPS -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
681120 127112 236952 1045194 ff2c8

[The next step can be done later]

Save old vmunix and copy /sys/sunX/RIMFIRE/vmunix to /vmunix? (y/n)
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**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 68020 based Sun3 systems  
  cd /sys/sun3X/conf for 68030 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:
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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 rfc\0:

    /rfc\0

5. The cursor will come to rest on the first character of the string rfc\0. Add the following lines for a second and third controller:

    controller rfc1 at vme16d32 ? csr 0x3000 priority 2 vector rfintr 0xF4
    controller rfc2 at vme16d32 ? csr 0x4000 priority 2 vector rfintr 0xF6

    The previous lines show that there is a second controller at address 3000H, interrupt F4, and a third controller at 4000H, 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 0 flags 1
    disk       rf5 at rfc1 drive 1 flags 1
    disk       rf6 at rfc2 drive 0 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
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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
Section 2 - Bootable Controller Installation

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:

```
boot 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 tunefs 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 filesystem made:

   tunefs -a 40 -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*.
Section 3 - Non-Bootable Controller Installation

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.

![Diagram of BUS GRANT and IACK Jumpers]

**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.
Section 3 - Non-Bootable Controller Installation

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/rst0

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

   tar xvbf 20 /dev/rmt0
Section 3 - Non-Bootable Controller Installation

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) COPYRIGHT 1989

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 4.2
+ 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)
Section 3 - Non-Bootable Controller Installation

6. Enter l 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/rfc
    + cp ..sundev/rfcerr.h /sys/sundev/rfcerr.h
    + cp ..sundev/rfcerr.h /usr/include/sundev/rfcerr.h
    + cp ..sundev/rfioctl.h /sys/sundev/rfcioctl.h
    + cp ..sundev/rfcioctl.h /usr/include/sundev/rfcioctl.h
    + cp ..sundev/rfcparam.h /sys/sundev/rfcparam.h
    + cp ..sundev/rfcparam.h /usr/include/sundev/rfcparam.h
    + cp ..sundev/rfcreg.h /sys/sundev/rfcreg.h
    + cp ..sundev/rfcreg.h /usr/include/sundev/rfcreg.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.nor.
    + 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 cddevsw 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)
Section 3 - Non-Bootable Controller Installation

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 rfc0 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 hexadecimal number with "0x"]

VME address of controller? [0x2000]

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 hexadecimal form and preceded by Øx, as illustrated in the following example:

Øx2000

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 hexadecimal form and preceded by \( \text{0x} \), as illustrated in the following example:

\( \text{0xf2} \)

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

Add controller rfc0 at address 0x2000 vector 0xf2 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 rfc0.
+ Extracting device information from /sys/sunX/conf/RIMFIRE...done.
+ No rf devices configured in system.

Configure device rf0 at controller rfc0? (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 rf0 MUST NOT conflict with]
[any other disks attached to rfc0 shown above.]
Use default drive number of 0? (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)
Section 3 - Non-Bootable Controller Installation

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 Clprico boards ONLY with Xyloplcs 451 emulation jumper installed]
[Should NOT be performed when installing any other controllers]

Remove entries for device XYC0 at CSR address 0x0e40? (y/n)
```

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

```
+ Making backup copy of /etc/fstab as /etc/fstab.nor.f.
Change mounting for disk xy0 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 0 of rf? (y/n/q)
```

20. You can create device nodes for up to four devices (units 0-3). 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 0 and 1. Enter \( y \) to create the device nodes for Unit 0. The following lines are displayed:
Section 3 - Non-Bootable Controller Installation

+ sh MAKEDEV rf0

[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 -m68020 -fsoft -c -O -DsunX -DRIMFIRE -DSUNX_E -DSUNX_60 -DSUNX_LI0
-DSUNX_260 -DSUNX_50 -DSUNX_160 -DCRYPT -DTCPDEBUG -DIPCSHMEM
-DIPCSEMAPHORE -DIPCMESSAGE -DSYSAUDIT -DSYSSACCT -DLOFS -DNFSSERVER
./netinet/in_proto.c

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

```plaintext
confvmunix.c
loading vmunix
rearranging symbols
601120 127112 236952 1845104 ff2c0

[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.
Section 3 - Non-Bootable Controller Installation

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

   cd /sys/sun3/conf   for 68020 based Sun3 systems
   cd /sys/sun3X/conf   for 68030 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 rfc0:

   /rfc0

5. The cursor will come to rest on the first character of the string rfc0. Add the following lines for a second and third controller:

   controller rfc1 at vme16d32 ? csr 0x3000 priority 2 vector rfintr 0xF4
   controller rfc2 at vme16d32 ? csr 0x4000 priority 2 vector rfintr 0xF6

   The previous lines show that there is a second controller at address 3000H, interrupt F4, and a third controller at 4000H, 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 0 flags 1
   disk    rf5 at rfc1 drive 1 flags 1
   disk    rf6 at rfc2 drive 0 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.
Section 3 - Non-Bootable Controller Installation

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
Section 3 - Non-Bootable Controller Installation

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.
Section 3 - Non-Bootable Controller Installation

Making and Tuning Filesystems

You will need to make and tune filesystems on any newly created partitions that were not tuned with the `tunefs` 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 filesystem made:

   ```
   tunefs -a 40 -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 yyymmddhhmmm. 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
   ```
Section 4 - Driver Upgrades

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

\[ \text{tar xvbf 126 /dev/rstx} \]

where the \( x \) in the device name (\( \text{rstx} \)) is replaced by the designation for the tape unit.

For a ½ inch tape, enter the following command:

\[ \text{tar xvbf 20 /dev/rmtx} \]

Where the \( x \) in the device name (\( \text{rmtx} \)) is replaced by the designation for the tape unit.

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

\[ \text{cd /sys/CIPRICO/rf/install} \]

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

\[ \text{doupgrade rf} \]

The following information is displayed:

\[ \text{(C) COPYRIGHT 1989} \]

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)

\[ \text{DOUBLE NOTE: The Hostname (indicated by RIMFIRE) will be the system name assigned during SunOS installation.} \]
Section 4 - Driver Upgrades

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 -m68020 -fs5oft -c -O -DSunX -DRIMFIRE -DSUNX_R -DSUNX_60 -DSUNX_110
     -DSUNX_260 -DSUNX_50 -DSUNX_160 -DCRYPT -DTCPDEBUG -DIPCSHMEM
     -DIPCSEMOPHORE -DIPCMESSAGE -DSYSAUDIT -DSYSSACCT -DLOFS -DNFSERVER
     -DNFSCLIENT -DUF5 -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
   647704  121728  161592  931024  e34d0

   [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)
Section 4 - Driver Upgrades

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.
Section 4 - Driver Upgrades

For a 1/2 inch tape, enter the following command:

```
tar xvfb 20 /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 68020 based Sun3 systems
cd /sys/sun3X/conf for 68030 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 -m68020 -fsoft -c -O -DaurX -DRIMFIRE -DSUNX_E -DSUNX_68 -DSUNX_110
-DSUNX_260 -DSUNX_50 -DSUNX_160 -DCRYPT -UTCPDEBUG -DIPCSSMEN
-DIPCSEMAPHORE -DICPMESSAGE -DSYSAUDIT -DSYSSACCT -DLOFS -DNFSSERVER
../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
647704  121728  161592  951024  34360
```

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 -ltermlibc
```

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 68020 based Sun3 systems
   cd /sys/sun3x/conf for 68030 based Sun3 systems
   cd /sys/sun4/conf for SPARC based Sun4 systems
Section 5 - Replacement of SBK and 3200 Controllers

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 68020 based Sun3 systems
   cd /sys/sun3X/conf  for 68030 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         xycl at vme16d16......
   # disk              xy0 at xyc0 drive 0
   # disk              xy1 at xyc0 drive 1
   disk                xy2 at xycl drive 0
   disk                xy3 at xycl 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.

Rimfire 3223/3224 Installation Guide  5-3
Section 5 - Replacement of SBK and 3200 Controllers

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 68020 based Sun3 systems
    sun3x   for 68030 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.
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Table A-1 lists Rimfire 3200 controller Specifications. Table A-2 lists Rimfire 3400 controller Specifications.

**Table A-1 Rimfire 3200 Controller Specifications**

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

**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

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

```
RFUTIL
Version X.X(x)
Device: /dev/rrf0a
SMD -> Rimfire 3200
ESDI -> Rimfire 3400
(C) COPYRIGHT 1989
<Label> Size: XXX
<Label> -> label defined in rfutil
<No label> -> no label defined in rfutil
```

When rfutil begins operation, it opens the default disk partition (/dev/rrf0a). 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.
Appendix B - rutil Program

rutil Commands

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

Table B-1  rutil Commands

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

Command operations are as follows:

**Debug Control (b)**

This command is used to change the debug level of the driver. Entering a value of 0xFF turns on a general trace plus a delay and a print of active parameter blocks and status blocks. A value of 0x00 (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>
<thead>
<tr>
<th>Group</th>
<th>Cache Control</th>
<th>Read Ahead</th>
<th>Recovery</th>
<th>Data Retry</th>
<th>Non-Data Retry</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>331</td>
<td>255</td>
<td>Ø</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>131</td>
<td>255</td>
<td>Ø</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>31</td>
<td>Ø</td>
<td>Ø</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

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.
Appendix B - rfutil Program

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.
Appendix B - rfutil Program

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).
Appendix B - *rfutil* Program

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*

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

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 10/0
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 (l)**

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.
Appendix B - rfutil Program

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 1025 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
Appendix B - *rfutil* Program

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 partition 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 (0-X, n<ext cylinder>, q<uit>):

Possible responses are as follows:

0-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
Appendix B - rfutil Program

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 -I 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 I (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 I. 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 skew values for drives, assuming 512 byte sectors. The default is 5 (or I if the number of sectors is less than five).
Appendix B - \textit{rfutil} Program

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 2l (or 1 if the number of cylinders is less than 19). Refer to Table B-4 for suggested cylinder skews.

\begin{center}
\textit{Table B-4 Head and Cylinder Skews}
\end{center}

\begin{tabular}{|l|c|c|}
\hline
Drive Type & Drive Model & Head Skews & Cylinder Skew \\
\hline
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 \\
\hline
ESDI Drives & CDC Wren III & 3 & 11 \\
& Fujitsu 2240E series & 3 & 11 \\
& Maxtor 4175/4280/4380 & 3 & 12 \\
& Micropolis 1350 series & 3 & 11 \\
\hline
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 \\
\hline
\end{tabular}

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 \( \emptyset \).

Recovery (SMD)

This sets data recovery options. The default value is \( \emptyset \), 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 rutil 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 rutil 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.
Appendix B - *rfutil* Program

**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.
Appendix B - *rfutil* Program

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/rrfla`.
Appendix B - *rfutil* Program

2. Press `/` 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 `/` 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 skip 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.
Appendix B - \texttt{rfutil} Program

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

\textbf{Formatted Drives}

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

\textbf{\texttt{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 \texttt{s} (Show the current label) command from the main menu. This will display the current label of the device.

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

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

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

\textbf{\texttt{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".
Appendix C - Manually Installing the Ciprico Driver

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 xvfb 126 /dev/rst8

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

   tar xvfb 20 /dev/rmt0

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:

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

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

```bash
cd /sys/sun3/conf        for 68020 based Sun3 systems
cd /sys/sun3x/conf       for 68030 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):

```bash
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:

```bash
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:

```bash
config vmunix root on rf0 swap on rf0
```

**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 \textit{RIMFIRE} file. The following example illustrates a typical controller line:

controller rfc\# at vme16d32 ? csr 0\#x#### priority 2 vector rfintr 0\#xF#

Variables specifying your particular system configuration (indicated in \textbf{bold} print) are as follows:

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

<table>
<thead>
<tr>
<th>Controller</th>
<th>rfc#</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>rfc0</td>
</tr>
<tr>
<td>2nd</td>
<td>rfc1</td>
</tr>
<tr>
<td>3rd</td>
<td>rfc2</td>
</tr>
<tr>
<td>4th</td>
<td>rfc3</td>
</tr>
</tbody>
</table>

- \textit{0\#x####} 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.

- \textit{0\#xF\#} 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.

\textbf{For example}, suppose you are installing two Rimfire controllers. The \textit{J13} address jumpers (A9-A15) on the first Rimfire controller are set for an address of \textit{0x2000}. The \textit{J13} address jumpers (A9-A15) on the second Rimfire controller are set for an address of \textit{0x3000}. The following controller lines would be added to the \textit{RIMFIRE} file:

controller rfc0 at vme16d32 ? csr 0x2000 priority 2 vector rfintr 0xF2
controller rfc1 at vme16d32 ? csr 0x3000 priority 2 vector rfintr 0xF4
Appendix C - Manually Installing the Ciprico Driver

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:

<table>
<thead>
<tr>
<th>Controller</th>
<th>rfc#</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>rfc0</td>
</tr>
<tr>
<td>2nd</td>
<td>rfc1</td>
</tr>
<tr>
<td>3rd</td>
<td>rfc2</td>
</tr>
<tr>
<td>4th</td>
<td>rfc3</td>
</tr>
</tbody>
</table>

- `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:

<table>
<thead>
<tr>
<th>Drive</th>
<th>drive #</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>drive Ø</td>
</tr>
<tr>
<td>2nd</td>
<td>drive 1</td>
</tr>
<tr>
<td>3rd</td>
<td>drive 2</td>
</tr>
<tr>
<td>4th</td>
<td>drive 3</td>
</tr>
</tbody>
</table>

- `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.
Appendix C - Manually Installing the Ciprico Driver

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

```
disk   rf0 at rfc0 drive 0 flags 1
disk   rf1 at rfc0 drive 1 flags 1
disk   rf2 at rfc0 drive 2 flags 1
disk   rf3 at rfc0 drive 3 flags 1
```

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

```
disk   rf0 at rfc0 drive 0 flags 1
disk   rf1 at rfc0 drive 1 flags 1
disk   rf2 at rfc0 drive 2 flags 1
disk   rf3 at rfc0 drive 3 flags 1
disk   rf4 at rfc1 drive 0 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 xyc0 at vmel6d16 ? csr 0xEE40 priority 2 vector xyintr 0x48
controller xycl at vmel6d16 ? csr 0xEE40 priority 2 vector xyintr 0x49
```

The SMD Boot Emulation controller must be addressed at 0xEE40. Other controllers cannot be present at this address. You will need to comment out any Xylogics 451 entry with a csr address of 0xEE40. 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 0xEE40 and you will need to comment out the first Xylogics 451 entry (xyc0). Use your editor to add the comment symbol (#), as illustrated in the following example:

```
#controller xyc0 at vmel6d16 ? csr 0xEE40 priority 2 vector xyintr 0x48
```

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.
Appendix C - Manually Installing the Ciprico Driver

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(), rfiocl(), rfsize();
    #else
    #define rfopen    nodev
    #define rfstrategy nodev
    #define rfread    nodev
    #define rfwrite   nodev
    #define rfdump    nodev
    #define rfiocl    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 },
Appendix C - Manually Installing the Ciprico Driver

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, 0,
select,  0,        0,
},
```

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 68020 based Sun3 systems
cd /sys/sun3X/conf    for 68030 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.
Appendix C - Manually Installing the Ciprico Driver

In the swapgeneric.c file, locate the following lines for the xy.h controller:

```c
#include "xy.h"
#if NXY > 0
    extern struct mb_driver xycdriver;
#endif
```

Add the following lines after the xy.h controller lines:

```c
#include "rf.h"
#if NRF > 0
    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:

```c
#if NXY > 0
    "xy", &xycdriver, makedev (XX, 0),
#endif
```

Add the following lines after the above lines:

```c
#if NRF > 0
    "rf", &rfcdriver, makedev (XX, 0),
#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:

```bash
cd /etc
```

Use the following command to copy the fstab file to fstab.norf:

```bash
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.
Appendix C - Manually Installing the Ciprico Driver

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 68020 based Sun3 systems
   cd /sys/sun3X/conf for 68030 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 MADEDEV file to MADEDEV.norf:
Appendix C - Manually Installing the Ciprico Driver

```
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 3200/3400
```

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:

<table>
<thead>
<tr>
<th>Disk</th>
<th>MAKEDEV</th>
<th>rfX</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>MAKEDEV</td>
<td>rf0</td>
</tr>
<tr>
<td>2nd</td>
<td>MAKEDEV</td>
<td>rf1</td>
</tr>
<tr>
<td>3rd</td>
<td>MAKEDEV</td>
<td>rf2</td>
</tr>
<tr>
<td>4th</td>
<td>MAKEDEV</td>
<td>rf3</td>
</tr>
</tbody>
</table>
Appendix C - Manually Installing the Ciprico Driver

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.

```bash
cd /sys/CIPRICO/rf/rfutil
```

Manually compile rfutil by entering the following command:

```bash
c c -O -o rfutil rfutil.c -l curses -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:

```bash
c p 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 /sundance directory.

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

   ```
tar xvbf 126 /dev/rst0
```

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

   ```
tar xvbf 20 /dev/rmt0
```

4. Enter the following command to switch to the /sys/CIPRICO/rf/sundance directory:

```
cd /sys/CIPRICO/rf/sundance
```

Search the rfgreg.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/sundance:

```
cp rf* /sys/sundance
```
Appendix C - Manually Installing the Ciprico Driver

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 rfc0 swap on rfc0

**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 zfo# at vmel6d32 ? csr 24#### priority 2 vector rfintr 0x3f

Variables, specifying your particular system configuration (indicated in bold print), are as follows:
Appendix C - Manually Installing the Ciprico Driver

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

<table>
<thead>
<tr>
<th>Controller</th>
<th>rfc#</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>rfc\Ø</td>
</tr>
<tr>
<td>2nd</td>
<td>rfc1</td>
</tr>
<tr>
<td>3rd</td>
<td>rfc2</td>
</tr>
<tr>
<td>4th</td>
<td>rfc3</td>
</tr>
</tbody>
</table>

- \textit{0x####} 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.

- \textit{0xF\#} indicates the interrupt vector. The interrupt vector can be assigned any unique, single byte value. Typically, \textit{0xF2} is used for the first Rimfire controller in the system and \textit{0xF4} is used for the second Rimfire controller in the system.

For example, suppose you are installing two Rimfire controllers. The \textit{J13} address jumpers (\textit{A9-A15}) on the first Rimfire controller are set for an address of \textit{0x200\Ø}. The \textit{J13} address jumpers (\textit{A9-A15}) on the second Rimfire controller are set for an address of \textit{0x300\Ø}. The following controller lines would be added to the \textit{RIMFIRE} file:

```
controller rfc\Ø at vme16d32 ? csr 0x200\Ø priority 2 vector rfintr 0xF2
controller rfc1 at vme16d32 ? csr 0x300\Ø priority 2 vector rfintr 0xF4
```

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 \textbf{bold} print) are as follows:
Appendix C - Manually Installing the Ciprico Driver

- *rfs* 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:

<table>
<thead>
<tr>
<th>Controller</th>
<th>rfc#</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>rfc0</td>
</tr>
<tr>
<td>2nd</td>
<td>rfc1</td>
</tr>
<tr>
<td>3rd</td>
<td>rfc2</td>
</tr>
<tr>
<td>4th</td>
<td>rfc3</td>
</tr>
</tbody>
</table>

- *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:

<table>
<thead>
<tr>
<th>Controller</th>
<th>drive #</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>drive 0</td>
</tr>
<tr>
<td>2nd</td>
<td>drive 1</td>
</tr>
<tr>
<td>3rd</td>
<td>drive 2</td>
</tr>
<tr>
<td>4th</td>
<td>drive 3</td>
</tr>
</tbody>
</table>

- *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 rf0 at rfc0 drive 0 flags 1
disk rf1 at rfc0 drive 1 flags 1
disk rf2 at rfc0 drive 2 flags 1
disk rf3 at rfc0 drive 3 flags 1
Appendix C - Manually Installing the Ciprico Driver

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 vmel6d16 ? csr ØxEE4Ø priority 2 vector xynintr Øx48
controller xycl at vmel6d16 ? csr ØxEE48 priority 2 vector xynintr 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 vmel6d16 ? csr ØxEE4Ø priority 2 vector xynintr 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.
Appendix C - Manually Installing the Ciprico Driver

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 > 0
    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 },
Appendix C - Manually Installing the Ciprico Driver

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, nuldev, rfread, rfwrite, /*YY*/
  rfioc1, nuldev, 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:
Appendix C - Manually Installing the Ciprico Driver

```c
#if NRF > 0
    {"rf", &rfcdriver, makedev (XX, 0)},
#endif

Then, locate the following lines: (Where XX represents the block device major number and YY represents the character device major number.)

```c
#if NXD > 0
    {"xd", &xdcdriver, makedev (YY, 0), makedev (XX, 0)},
#endif
```

Add the following lines after the above lines:

```c
#if NRF > 0
    {"rf", &rfcdriver, makedev (YY, 0), makedev (XX, 0)},
#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:

```bash
    cd /sys/sun3/conf for 68020 based Sun3 systems
    cd /sys/sun3X/conf for 68030 based Sun3 systems
    cd /sys/sun4/conf for SPARC based Sun4 systems
```

Enter the following command to copy the devices file to devices.norf:

```bash
    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 6802Ø based Sun3 systems
  cd /sys/sun3X/conf for 6803Ø 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
```
Appendix C - Manually Installing the Ciprico Driver

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 3200/3400
```

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
```
Appendix C - Manually Installing the Ciprico Driver

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:

<table>
<thead>
<tr>
<th>Disk</th>
<th>MAKEDEV</th>
<th>rfX</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>MADEDEV</td>
<td>rf0</td>
</tr>
<tr>
<td>2nd</td>
<td>MADEDEV</td>
<td>rf1</td>
</tr>
<tr>
<td>3rd</td>
<td>MADEDEV</td>
<td>rf2</td>
</tr>
<tr>
<td>4th</td>
<td>MADEDEV</td>
<td>rf3</td>
</tr>
</tbody>
</table>

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:

```
c -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.
Appendix C - Manually Installing the Ciprico Driver

Making and Tuning Filesystems

You will need to make and tune filesystems on any newly created partitions that were not tuned with the `tunefs` 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 40 -d a /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.

<table>
<thead>
<tr>
<th>Rimfire Error</th>
<th>Emulation Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>00H Successful completion</td>
<td>00H Successful completion</td>
</tr>
<tr>
<td>01H Invalid command</td>
<td>03H Busy conflict</td>
</tr>
<tr>
<td>02H Bad Unit number</td>
<td>04H Operation timeout</td>
</tr>
<tr>
<td>03H Bad Unit type</td>
<td>04H Operation timeout</td>
</tr>
<tr>
<td>04H Drive not configured</td>
<td>04H Operation timeout</td>
</tr>
<tr>
<td>05H Not used</td>
<td>01H Interrupt pending</td>
</tr>
<tr>
<td>06H Bad Logical Sector number</td>
<td>0AH Sector Address error</td>
</tr>
<tr>
<td>07H Bad number of sectors</td>
<td>0AH Sector Address error</td>
</tr>
<tr>
<td>08H Bad track starting sector</td>
<td>0AH Sector Address error</td>
</tr>
<tr>
<td>09H Bad number of sectors for track wide operation</td>
<td>0AH Sector Address error</td>
</tr>
<tr>
<td>0AH Bad Tag Number Issue tag</td>
<td>18H Drive faulted</td>
</tr>
<tr>
<td>0BH Field not zero</td>
<td>03H Busy conflict</td>
</tr>
<tr>
<td>0CH Bad number of Scatter/Gather headers specified</td>
<td>03H Busy conflict</td>
</tr>
<tr>
<td>0DH Bad length of Scatter/Gather table</td>
<td>03H Busy conflict</td>
</tr>
<tr>
<td>0EH Not used</td>
<td>01H Interrupt Pending</td>
</tr>
<tr>
<td>0FH Bad Command List size</td>
<td>03H Busy conflict</td>
</tr>
<tr>
<td>10H Bad Command List number</td>
<td>03H Busy conflict</td>
</tr>
<tr>
<td>11H Command List cannot be started/stopped</td>
<td>03H Busy conflict</td>
</tr>
<tr>
<td>12H Not used</td>
<td>01H Interrupt pending</td>
</tr>
<tr>
<td>13H Bus error</td>
<td>0EH Memory Address error</td>
</tr>
<tr>
<td>14H Drive won’t select or drive not present</td>
<td>04H Operation timeout</td>
</tr>
</tbody>
</table>

Rimfire 3200/3400 Installation Guide
### Appendix D - Error Codes

<table>
<thead>
<tr>
<th>Rimfire Error</th>
<th>Emulation Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>15H Drive not ready</td>
<td>16H Drive not ready</td>
</tr>
<tr>
<td>16H Not used</td>
<td>01H Interrupt pending</td>
</tr>
<tr>
<td>17H Not used</td>
<td>01H Interrupt pending</td>
</tr>
<tr>
<td>18H Not used</td>
<td>01H Interrupt pending</td>
</tr>
<tr>
<td>19H Not used</td>
<td>01H Interrupt pending</td>
</tr>
<tr>
<td>1AH Not used</td>
<td>01H Interrupt pending</td>
</tr>
<tr>
<td>1BH Not used</td>
<td>01H Interrupt pending</td>
</tr>
<tr>
<td>1CH Drive reported seek error</td>
<td>25H Seek error</td>
</tr>
<tr>
<td>1DH Not used</td>
<td>01H Interrupt pending</td>
</tr>
<tr>
<td>1EH Fault detected</td>
<td>18H Drive faulted</td>
</tr>
<tr>
<td>1FH Not used</td>
<td>01H Interrupt pending</td>
</tr>
<tr>
<td>20H Not used</td>
<td>01H Interrupt pending</td>
</tr>
<tr>
<td>21H Not used</td>
<td>01H Interrupt pending</td>
</tr>
<tr>
<td>22H Sectors per track don’t match disk</td>
<td>0DH Last sector too small</td>
</tr>
<tr>
<td>23H Sector to short/Overrun error</td>
<td>0DH Last sector too small</td>
</tr>
<tr>
<td>24H Data error, no correction done</td>
<td>1EH Soft ECC error</td>
</tr>
<tr>
<td>25H ID Sync error (sector not found)</td>
<td>1EH Soft ECC error</td>
</tr>
<tr>
<td>26H ID CRC error</td>
<td>1EH Soft ECC error</td>
</tr>
<tr>
<td>27H No data synchronization</td>
<td>1EH Soft ECC error</td>
</tr>
<tr>
<td>28H Seek timeout</td>
<td>04H Operation timeout</td>
</tr>
<tr>
<td>29H SMD data operation timeout</td>
<td>04H Operation timeout</td>
</tr>
<tr>
<td>2AH SMD misseek/Bad disk format</td>
<td>00H IGNORE THIS ERROR</td>
</tr>
<tr>
<td>2BH Error reading SMD Sector ID</td>
<td>1FH Read fixed ECC error</td>
</tr>
<tr>
<td>2CH Direct access to bad track or sector</td>
<td>25H Seek error</td>
</tr>
<tr>
<td>2DH ECC correction performed</td>
<td>1FH Read fixed, fixed ECC error</td>
</tr>
<tr>
<td>2EH ECC correction failed</td>
<td>1EH Soft ECC error</td>
</tr>
<tr>
<td>2FH Not used</td>
<td>01H Interrupt pending</td>
</tr>
<tr>
<td>30H Not used</td>
<td>01H Interrupt pending</td>
</tr>
<tr>
<td>31H Not used</td>
<td>01H Interrupt pending</td>
</tr>
<tr>
<td>32H Sectors/track bad or greater than physical size</td>
<td>19H Illegal sector size</td>
</tr>
<tr>
<td>33H Not used</td>
<td>01H Interrupt pending</td>
</tr>
<tr>
<td>34H Preamble too long</td>
<td>19H Illegal sector size</td>
</tr>
<tr>
<td>35H Not used</td>
<td>01H Interrupt pending</td>
</tr>
<tr>
<td>36H Not used</td>
<td>01H Interrupt pending</td>
</tr>
<tr>
<td>37H Bad parameter in configuration</td>
<td>03H Busy conflict</td>
</tr>
<tr>
<td>38H Not used</td>
<td>01H Interrupt pending</td>
</tr>
<tr>
<td>39H Attempt to initialize I/O Control Group 0</td>
<td>03H Busy conflict</td>
</tr>
</tbody>
</table>
Appendix D - Error Codes

<table>
<thead>
<tr>
<th>Rimfire Error</th>
<th>Emulation Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>3AH Bad source in defect mapping</td>
<td>03H Busy conflict</td>
</tr>
<tr>
<td>3BH Bad destination in defect mapping</td>
<td>03H Busy conflict</td>
</tr>
<tr>
<td>3CH No spares left on track</td>
<td>03H Busy conflict</td>
</tr>
<tr>
<td>3DH Bad recovery field in mapping command</td>
<td>03H Busy conflict</td>
</tr>
<tr>
<td>3EH SMD emulation not supported</td>
<td>02H Reserved code</td>
</tr>
</tbody>
</table>

**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.
Appendix D - Error Codes

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.
Appendix D - Error Codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0DH</td>
<td>Bad length of scatter/gather table</td>
<td><em>(Rimfire 3200 error)</em></td>
</tr>
<tr>
<td></td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>0EH</td>
<td>Command list stopped</td>
<td><em>(Rimfire 3200 error)</em></td>
</tr>
<tr>
<td></td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>0FH</td>
<td>Bad command list size field</td>
<td><em>(Rimfire 3200 error)</em></td>
</tr>
<tr>
<td></td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>10H</td>
<td>Bad command list number specified</td>
<td><em>(Rimfire 3200 error)</em></td>
</tr>
<tr>
<td></td>
<td>The LIST # specified in a Setup Command List or Stop Command List command is not between 1 and 7.</td>
<td></td>
</tr>
<tr>
<td>11H</td>
<td>Command list cannot be started/stopped</td>
<td><em>(Rimfire 3200 error)</em></td>
</tr>
<tr>
<td></td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>12H</td>
<td>Software bus timeout error</td>
<td><em>(Rimfire 3200 error)</em></td>
</tr>
<tr>
<td></td>
<td>No activity was seen on the VMEbus and the memory transfer timed out.</td>
<td></td>
</tr>
</tbody>
</table>
Appendix D - Error Codes

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 deselected 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.
Appendix D - Error Codes

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.
Appendix D - Error Codes

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.
Appendix D - Error Codes

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 retryed, 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.
Appendix D - Error Codes

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.
Appendix D - Error Codes

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 $\emptyset$.

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.
Appendix D - Error Codes

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  \textit{(Rimfire 3400 error)}
The host issued an invalid command number.

02H  Bad unit number specified  \textit{(Rimfire 3400 error)}
The host specified a unit number greater than eight.

03H  Wrong unit type for this command  \textit{(Rimfire 3400 error)}
The host specified a unit number which is not valid for the command used.

04H  Drive not configured  \textit{(Rimfire 3400 error)}
The host attempted to access a disk drive for which a \textit{Configure} command has not been executed.

05H  Memory transfer alignment error  \textit{(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  \textit{(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  \textit{(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).
Appendix D - Error Codes

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 the number 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.
Appendix D - Error Codes

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) transfer 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.
Appendix D - Error Codes

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.
Appendix D - Error Codes

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.

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Appendix D - Error Codes

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.
Appendix D - Error Codes

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.
Appendix D - Error Codes

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.
Appendix D - Error Codes

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.
Appendix D - Error Codes

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.
Appendix D - Error Codes

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)

<table>
<thead>
<tr>
<th>Cable</th>
<th>Quantity</th>
<th>Description</th>
<th>Suggested Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2</td>
<td>60 Pin Connector, Socket, With Strain Relief</td>
<td>3M 3334-6060</td>
</tr>
<tr>
<td></td>
<td>As Required</td>
<td>60 Conductor, Flat Ribbon, Twisted Pair Cable</td>
<td>Burndy FRS60BD-8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Maximum = 100 feet)</td>
<td>Belden 9V28060</td>
</tr>
<tr>
<td>B</td>
<td>2</td>
<td>26 Pin Connector, Socket, With Strain Relief</td>
<td>3M 3334-6060</td>
</tr>
<tr>
<td></td>
<td>As Required</td>
<td>26 Conductor, Flat Ribbon Ground Plane Cable, One Drain</td>
<td>Burndy FRS60BD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Maximum = 50 feet)</td>
<td>3M 3476/26</td>
</tr>
</tbody>
</table>

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### Table E-2 Rimfire 3223 Cable Parts

(“D” Connector)

<table>
<thead>
<tr>
<th>Cable</th>
<th>Quantity</th>
<th>Description</th>
<th>Suggested Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>As Required</td>
<td>Twisted Pair, Shielded Cable (Max = 100 feet)</td>
<td>Montrose 5837-30B</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>62 Pin “D” Connector</td>
<td>AMP 748367-1</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>62 Pin Shell</td>
<td>AMP 747100-3</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>60 Pin Ribbon Header</td>
<td>3M 3334-6060</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>Densi-D Gold Pins (male)</td>
<td>Burndy FRS60BD-8</td>
</tr>
<tr>
<td></td>
<td>As Required</td>
<td>1/2” Heat Shrinkable Tubing</td>
<td>Cole-Flex ST221-1/2”</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B</th>
<th>As Required</th>
<th>Twisted Pair, Shielded cable (Max = 50 feet)</th>
<th>Montrose 5837-13B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>50 Pin “D” Connector</td>
<td>AMP 205212-3</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>50 Pin Shell</td>
<td>AMP 745175-5</td>
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<td>2</td>
<td>26 Pin Ribbon Header</td>
<td>3M 3399-6026</td>
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<td>50</td>
<td>Contact Pins (male)</td>
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<td>As Required</td>
<td>1/4” Heat Shrinkable Tubing</td>
<td>AMP 66507-9</td>
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<td>As Required</td>
<td>1/4” Heat Shrinkable Tubing</td>
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<td></td>
<td></td>
<td>Alpha FIT-105-1/8”</td>
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<td></td>
<td></td>
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<td>3/4” Heat Shrinkable Tubing</td>
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### Table E-3 Rimfire 3200 SMD “A” Cable Pin Assignments

<table>
<thead>
<tr>
<th>Signal</th>
<th>Header Pair</th>
<th>“D” Connector (3223)</th>
<th>Standard Connector</th>
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<tbody>
<tr>
<td></td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>TAG1</td>
<td>1</td>
<td>31</td>
<td>22</td>
</tr>
<tr>
<td>TAG2</td>
<td>2</td>
<td>32</td>
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</tr>
<tr>
<td>TAG3</td>
<td>3</td>
<td>33</td>
<td>22</td>
</tr>
<tr>
<td>DATA0</td>
<td>4</td>
<td>34</td>
<td>22</td>
</tr>
<tr>
<td>DATA1</td>
<td>5</td>
<td>35</td>
<td>45</td>
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<tr>
<td>DATA2</td>
<td>6</td>
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<td>DATA3</td>
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<td>DATA4</td>
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<td>DATA5</td>
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<td>39</td>
<td>62</td>
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<td>DATA6</td>
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</tr>
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<td>DATA7</td>
<td>11</td>
<td>41</td>
<td>49</td>
</tr>
<tr>
<td>DATA8</td>
<td>12</td>
<td>42</td>
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</tr>
<tr>
<td>DATA9</td>
<td>13</td>
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<tr>
<td>OCD</td>
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<td>51</td>
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<tr>
<td>DATAIN3 (Fault)</td>
<td>15</td>
<td>45</td>
<td>10</td>
</tr>
<tr>
<td>DATAIN2 (Fault)</td>
<td>16</td>
<td>46</td>
<td>32</td>
</tr>
<tr>
<td>DATAIN1 (On Cylinder)</td>
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<td>47</td>
<td>53</td>
</tr>
<tr>
<td>DATAIN6 (Index)</td>
<td>18</td>
<td>48</td>
<td>12</td>
</tr>
<tr>
<td>DATAIN0 (Ready)</td>
<td>19</td>
<td>49</td>
<td>34</td>
</tr>
<tr>
<td>DATAIN5 (Address Mark)</td>
<td>20</td>
<td>50</td>
<td>55</td>
</tr>
<tr>
<td>BUSY</td>
<td>21</td>
<td>51</td>
<td>14</td>
</tr>
<tr>
<td>UNITSELTAG</td>
<td>22</td>
<td>52</td>
<td>36</td>
</tr>
<tr>
<td>UNITSEL2.0</td>
<td>23</td>
<td>53</td>
<td>59</td>
</tr>
<tr>
<td>UNITSEL2.1</td>
<td>24</td>
<td>54</td>
<td>16</td>
</tr>
<tr>
<td>DATAIN7 (Sector)</td>
<td>25</td>
<td>55</td>
<td>38</td>
</tr>
<tr>
<td>UNITSEL2.2</td>
<td>26</td>
<td>56</td>
<td>18</td>
</tr>
<tr>
<td>TAG5</td>
<td>27</td>
<td>57</td>
<td>27</td>
</tr>
<tr>
<td>DATAIN4 (Write Protect)</td>
<td>28</td>
<td>58</td>
<td>40</td>
</tr>
<tr>
<td>PICK</td>
<td>29</td>
<td></td>
<td>61</td>
</tr>
<tr>
<td>HOLD</td>
<td>59</td>
<td></td>
<td>41</td>
</tr>
<tr>
<td>TAG4</td>
<td>30</td>
<td>60</td>
<td>20</td>
</tr>
</tbody>
</table>

© These signals are not used by Rimfire 3201 and Rimfire 3202 controllers.

® Pins 21 and 42 of the “D” connector are not used.
Table E-4 Rimfire 3200 SMD 'B' Cable Pin Assignments

<table>
<thead>
<tr>
<th>Signal</th>
<th>Header Pair</th>
<th>“D” Connector (3223)</th>
<th>Standard Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Drive 0 or 2</td>
<td>Drive 1 or 3</td>
</tr>
<tr>
<td>WRITE DATA</td>
<td>8 20</td>
<td>5 38</td>
<td>13 46</td>
</tr>
<tr>
<td>GROUND</td>
<td>7</td>
<td>21</td>
<td>30</td>
</tr>
<tr>
<td>WRITE CLOCK</td>
<td>6 19</td>
<td>20 37</td>
<td>29 45</td>
</tr>
<tr>
<td>GROUND</td>
<td>18</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>SERVO CLOCK</td>
<td>2 14</td>
<td>1 34</td>
<td>26 42</td>
</tr>
<tr>
<td>GROUND</td>
<td>1</td>
<td>N/C</td>
<td>N/C</td>
</tr>
<tr>
<td>READ DATA</td>
<td>3 16</td>
<td>2 35</td>
<td>10 43</td>
</tr>
<tr>
<td>GROUND</td>
<td>15</td>
<td>18</td>
<td>27</td>
</tr>
<tr>
<td>READ CLOCK</td>
<td>5 17</td>
<td>3 19</td>
<td>11 28</td>
</tr>
<tr>
<td>GROUND</td>
<td>4</td>
<td>36</td>
<td>44</td>
</tr>
<tr>
<td>SEEK END</td>
<td>10 23</td>
<td>23 40</td>
<td>32 48</td>
</tr>
<tr>
<td>UNIT SELECTED</td>
<td>22 9</td>
<td>6 22</td>
<td>14 31</td>
</tr>
<tr>
<td>GROUND</td>
<td>21</td>
<td>39</td>
<td>47</td>
</tr>
<tr>
<td>INDEX ©</td>
<td>12 24</td>
<td>8 41</td>
<td>16 49</td>
</tr>
<tr>
<td>GROUND</td>
<td>11</td>
<td>7</td>
<td>33</td>
</tr>
<tr>
<td>SECTOR ©</td>
<td>13 26</td>
<td>9 25</td>
<td>17 50</td>
</tr>
<tr>
<td>GROUND</td>
<td>25</td>
<td>24</td>
<td>15</td>
</tr>
</tbody>
</table>

© “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

<table>
<thead>
<tr>
<th>Cable</th>
<th>Quantity</th>
<th>Description</th>
<th>Suggested Parts</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>As Required</td>
<td>34 Conductor Flat Ribbon Cable</td>
<td>3M 3431-5302</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>34 Pin Female Connector</td>
<td>3M 3414-6034</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>34 Pin Card Edge Connector</td>
<td>3M 3463-0001</td>
</tr>
<tr>
<td>B</td>
<td>As Required</td>
<td>20 Conductor Flat Ribbon Cable</td>
<td>3M 3365/20</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>20 Pin Socket Connector</td>
<td>3M 3421-6020</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>20 Pin Card Edge Connector</td>
<td>3M 3461-0001</td>
</tr>
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### Table E-6 Rimfire 3401 ESDI "A" (Control) Cable (P2 Connection)

<table>
<thead>
<tr>
<th>Signal</th>
<th>P2 Connection</th>
<th>ESDI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground</td>
<td>C21</td>
<td>Pin 1</td>
</tr>
<tr>
<td>- Head Select 2(3)</td>
<td>A21</td>
<td>Pin 2</td>
</tr>
<tr>
<td>Unused Ground®</td>
<td>NC</td>
<td>Pin 3</td>
</tr>
<tr>
<td>- Head Select 2(2)</td>
<td>C22</td>
<td>Pin 4</td>
</tr>
<tr>
<td>Ground</td>
<td>A22</td>
<td>Pin 5</td>
</tr>
<tr>
<td>- Write Gate</td>
<td>C23</td>
<td>Pin 6</td>
</tr>
<tr>
<td>Unused Ground®</td>
<td>NC</td>
<td>Pin 7</td>
</tr>
<tr>
<td>- Configuration/Status Data</td>
<td>A23</td>
<td>Pin 8</td>
</tr>
<tr>
<td>Unused Ground®</td>
<td>NC</td>
<td>Pin 9</td>
</tr>
<tr>
<td>- Transfer Acknowledge</td>
<td>C24</td>
<td>Pin 10</td>
</tr>
<tr>
<td>Ground</td>
<td>A24</td>
<td>Pin 11</td>
</tr>
<tr>
<td>- Attention</td>
<td>C25</td>
<td>Pin 12</td>
</tr>
<tr>
<td>Unused Ground®</td>
<td>NC</td>
<td>Pin 13</td>
</tr>
<tr>
<td>- Head Select 2(0)</td>
<td>A25</td>
<td>Pin 14</td>
</tr>
<tr>
<td>Ground</td>
<td>C26</td>
<td>Pin 15</td>
</tr>
<tr>
<td>- Sector/Address Mark Found</td>
<td>A26</td>
<td>Pin 16</td>
</tr>
<tr>
<td>Unused Ground®</td>
<td>NC</td>
<td>Pin 17</td>
</tr>
<tr>
<td>- Head Select 2(1)</td>
<td>C27</td>
<td>Pin 18</td>
</tr>
<tr>
<td>Unused Ground®</td>
<td>NC</td>
<td>Pin 19</td>
</tr>
<tr>
<td>- Index</td>
<td>A27</td>
<td>Pin 20</td>
</tr>
<tr>
<td>Ground</td>
<td>C28</td>
<td>Pin 21</td>
</tr>
<tr>
<td>- Ready</td>
<td>A28</td>
<td>Pin 22</td>
</tr>
<tr>
<td>Unused Ground®</td>
<td>NC</td>
<td>Pin 23</td>
</tr>
<tr>
<td>- Transfer Request</td>
<td>C29</td>
<td>Pin 24</td>
</tr>
<tr>
<td>Ground</td>
<td>A29</td>
<td>Pin 25</td>
</tr>
<tr>
<td>- Drive Select 2(0)</td>
<td>C30</td>
<td>Pin 26</td>
</tr>
<tr>
<td>Unused Ground®</td>
<td>NC</td>
<td>Pin 27</td>
</tr>
<tr>
<td>- Drive Select 1(1)</td>
<td>A30</td>
<td>Pin 28</td>
</tr>
<tr>
<td>Unused Ground®</td>
<td>NC</td>
<td>Pin 29</td>
</tr>
<tr>
<td>- Drive Select 2(2)</td>
<td>C31</td>
<td>Pin 30</td>
</tr>
<tr>
<td>Ground</td>
<td>A31</td>
<td>Pin 31</td>
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<tr>
<td>- Read Gate</td>
<td>C32</td>
<td>Pin 32</td>
</tr>
<tr>
<td>Unused Ground®</td>
<td>NC</td>
<td>Pin 33</td>
</tr>
<tr>
<td>- Command Data</td>
<td>A32</td>
<td>Pin 34</td>
</tr>
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</table>

© 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)

<table>
<thead>
<tr>
<th>Drive</th>
<th>Signal</th>
<th>P2 Connection</th>
<th>ESDI</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Drive Selected</td>
<td>C1</td>
<td>Pin 1</td>
</tr>
<tr>
<td></td>
<td>Sector/Address Mark Found</td>
<td>A1</td>
<td>Pin 2</td>
</tr>
<tr>
<td></td>
<td>Command Complete</td>
<td>C2</td>
<td>Pin 3</td>
</tr>
<tr>
<td></td>
<td>Address Mark Enable</td>
<td>A2</td>
<td>Pin 4</td>
</tr>
<tr>
<td></td>
<td>Ground</td>
<td>C3</td>
<td>Pin 5</td>
</tr>
<tr>
<td></td>
<td>Ground</td>
<td>A3</td>
<td>Pin 6</td>
</tr>
<tr>
<td></td>
<td>+ Write Clock</td>
<td>C4</td>
<td>Pin 7</td>
</tr>
<tr>
<td></td>
<td>Write Clock</td>
<td>A4</td>
<td>Pin 8</td>
</tr>
<tr>
<td></td>
<td>Ground</td>
<td>C5</td>
<td>Pin 9</td>
</tr>
<tr>
<td></td>
<td>+ Read Reference Clock</td>
<td>A5</td>
<td>Pin 10</td>
</tr>
<tr>
<td></td>
<td>Read Reference Clock</td>
<td>C6</td>
<td>Pin 11</td>
</tr>
<tr>
<td></td>
<td>Ground</td>
<td>A6</td>
<td>Pin 12</td>
</tr>
<tr>
<td></td>
<td>+ NRZ Write Data</td>
<td>C7</td>
<td>Pin 13</td>
</tr>
<tr>
<td></td>
<td>– NRZ Write Data</td>
<td>A7</td>
<td>Pin 14</td>
</tr>
<tr>
<td></td>
<td>Ground</td>
<td>C8</td>
<td>Pin 15</td>
</tr>
<tr>
<td></td>
<td>Ground</td>
<td>A8</td>
<td>Pin 16</td>
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<td></td>
<td>+ NRZ Read Data</td>
<td>C9</td>
<td>Pin 17</td>
</tr>
<tr>
<td></td>
<td>– NRZ Read Data</td>
<td>A9</td>
<td>Pin 18</td>
</tr>
<tr>
<td></td>
<td>Ground</td>
<td>C10</td>
<td>Pin 19</td>
</tr>
<tr>
<td></td>
<td>– Index</td>
<td>A10</td>
<td>Pin 20</td>
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<table>
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<th>Signal</th>
<th>P2 Connection</th>
<th>ESDI</th>
</tr>
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<tr>
<td>2</td>
<td>– Drive Selected</td>
<td>C11</td>
<td>Pin 1</td>
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<td></td>
<td>Sector/Address Mark Found</td>
<td>A11</td>
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<td></td>
<td>Command Complete</td>
<td>C12</td>
<td>Pin 3</td>
</tr>
<tr>
<td></td>
<td>Address Mark Enable</td>
<td>A12</td>
<td>Pin 4</td>
</tr>
<tr>
<td></td>
<td>Ground</td>
<td>C13</td>
<td>Pin 5</td>
</tr>
<tr>
<td></td>
<td>Ground</td>
<td>A13</td>
<td>Pin 6</td>
</tr>
<tr>
<td></td>
<td>+ Write Clock</td>
<td>C14</td>
<td>Pin 7</td>
</tr>
<tr>
<td></td>
<td>Write Clock</td>
<td>A14</td>
<td>Pin 8</td>
</tr>
<tr>
<td></td>
<td>Ground</td>
<td>C15</td>
<td>Pin 9</td>
</tr>
<tr>
<td></td>
<td>+ Read Reference Clock</td>
<td>A15</td>
<td>Pin 10</td>
</tr>
<tr>
<td></td>
<td>Read Reference Clock</td>
<td>C16</td>
<td>Pin 11</td>
</tr>
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<td></td>
<td>Ground</td>
<td>A16</td>
<td>Pin 12</td>
</tr>
<tr>
<td></td>
<td>+ NRZ Write Data</td>
<td>C17</td>
<td>Pin 13</td>
</tr>
<tr>
<td></td>
<td>– NRZ Write Data</td>
<td>A17</td>
<td>Pin 14</td>
</tr>
<tr>
<td></td>
<td>Ground</td>
<td>C18</td>
<td>Pin 15</td>
</tr>
<tr>
<td></td>
<td>Ground</td>
<td>A18</td>
<td>Pin 16</td>
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<td></td>
<td>+ NRZ Read Data</td>
<td>C19</td>
<td>Pin 17</td>
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<td></td>
<td>– NRZ Read Data</td>
<td>A19</td>
<td>Pin 18</td>
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<td>Ground</td>
<td>C20</td>
<td>Pin 19</td>
</tr>
<tr>
<td></td>
<td>– Index</td>
<td>A20</td>
<td>Pin 20</td>
</tr>
</tbody>
</table>

© 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.
Appendix F - Jumper Settings

- **J20**: Clock
- **J10**: Oscillator
- **J21**: Processing Speed (factory set)
- **J14**: Exact Burst
- **J22**: Processing Speed (factory set)
- **J23**: Processing Speed (factory set)
- **J24**: Processing Speed (factory set)
- **JSUN**: Sun Emulation Setting
- **J13**: RF3223 Address = 0x2000

**Bus Request/Grant Jumpers (0-3)**

- **A7**
- **A6**
- **A5**
- **A4**
- **A3**
- **AM2**
- **AM1**
- **AM0**

- **A3**: Out = 8
- **In** = (default) = 0

**JX1**: Emulation Address

**JX2**: Emulation Address

**AM2**: In = 29

- (non-privileged access)
- Out = (default) = 2D

**Figure F-1 Rimfire 3223/3224 Jumpers**

F-2 Rimfire 3200/3400 Installation Guide
Figure F-2 Rimfire 3202 Jumpers
Figure F-3  Rimfire 3231 Jumpers
Appendix F - Jumper Settings

**In** = Board Self-Test
**Out** = Normal Operation
    = (default)

Oscillator

**Default Setting**

Oscillator

**Req.**

**Grant**

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
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<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Bus Request/Grant Jumpers (0-3)

**Normal Operation**
    = (default)

**Exact Burst Only**

**Exact Burst Jumper**

**AM2 - In = 29**

**Out = 2D**
    = (default)

Board Address = 0x2000

*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.

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Appendix G - Disk Drive Parameters

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):

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<thead>
<tr>
<th>Switch</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<tbody>
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<td>A213</td>
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<td>1</td>
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<td>A224</td>
<td>X</td>
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<td>Logical Address</td>
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<td>B/C</td>
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Jumper Settings:

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<th>SWP1</th>
<th>SWPD</th>
<th>IDX</th>
<th>S</th>
<th>RUNT</th>
<th>FF</th>
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<tbody>
<tr>
<td>Out</td>
<td>In</td>
<td>Out</td>
<td>Out</td>
<td>Out</td>
<td>N/A</td>
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</tr>
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**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.
Appendix G - Disk Drive Parameters

CDC-9773

RF3200 on Sun with RFUTIL

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):

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</table>
Appendix G - Disk Drive Parameters

Century Data C2800

RF3200 on Sun with RFUTIL

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):

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**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.).
Appendix G - Disk Drive Parameters

Fujitsu 2333

RF3200 on Sun with RFUTIL

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):

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</table>
Appendix G - Disk Drive Parameters

Fujitsu 2344

RF3200 on Sun with RFUTIL

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):

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</table>
Appendix G - Disk Drive Parameters

Fujitsu 2372

RF3200 on Sun with RFUTIL

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):

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</table>
Appendix G - Disk Drive Parameters

Fujitsu 2382

RF3200 on Sun with RFUTIL

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):

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Fujitsu M2249E

RF3400 on Sun with RFUTIL

Label: Fujitsu M2249E cyl 1238 alt 5 hd 15 sec 34 apc 15
Sectors/cylinder: 510
Bytes/cylinder: 266120
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:

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<th>5-6</th>
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<th>11-12</th>
<th>13-14</th>
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</table>

(Unit 1)
Appendix G - Disk Drive Parameters

Fujitsu M2322 Swallow

RF3200 on Sun with RFUTIL

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):

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</table>

G-10

Rimfire 3200/3400 Installation Guide
Fujitsu-M2351 Eagle

RF3200 on Sun with RFUTIL

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:

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<td>BE7</td>
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</tr>
<tr>
<td>BF7</td>
<td>3-4 6-7 10-11 13-14</td>
</tr>
</tbody>
</table>
Appendix G - Disk Drive Parameters

Fujitsu-M2361A

RF3200 on Sun with RFUTIL

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):

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</table>

Latest Update: 1/19/89
Appendix G - Disk Drive Parameters

Hitachi DK815-10

RF3200 on Sun with RFUTIL

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:
  #all/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):

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</table>
Appendix G - Disk Drive Parameters

Maxtor XT-8760E

RF3400 on Sun with RFUTIL

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:

<table>
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<th>Setting</th>
<th>Jumper</th>
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<td>JP39</td>
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</tbody>
</table>
RF3200 on Sun with RFUTIL

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):

<table>
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<tr>
<th>Switch</th>
<th>1</th>
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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
Appendix G - Disk Drive Parameters

Toshiba MK-288FC

Latest Update: 9/23/88

RF3200 on Sun with RFUTIL

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):

<table>
<thead>
<tr>
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</tr>
</tbody>
</table>
Toshiba MK-388FA

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:
   # of cylinders 1160
   # of heads 15
   # of sectors/track 68
   label location 0
   physical partition # 0
   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):

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</table>
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