

# **FST-2**

**SunOS Driver**

**Software Reference**

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# Preface

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This manual contains information regarding installation and operation of the SunOS driver for the FST-2 Adapter. The technical contents have been written with the following assumptions in mind:

- You have a working knowledge of UNIX operating systems.
- You have access to full hardware and software documentation for your particular system.

The information in this manual is organized into the following chapters:

## **Chapter 1 - FST-2 Driver Installation**

This chapter explains how to install the SunOS driver onto your computer system .

## **Chapter 2 - Zformat Operation**

Chapter 2 explains the zformat utilities used to format, partition, and mirror disks.



# Table of Contents

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## Chapter 1 - FST-2 Driver Installation

1.0	Before You Begin . . . . .	1-3
	<i>Getting Started</i> . . . . .	1-3
1.1	Copying the Install Tape . . . . .	1-4
	<i>Copying the Tape Contents</i> . . . . .	1-4
1.2	Integrating FST-2 Drivers . . . . .	1-5
	<i>Add the FST-2 Driver Files</i> . . . . .	1-5
	<i>Modify Sun Driver Files</i> . . . . .	1-8
	<i>Modify the Kernel Configuration File</i> . . . . .	1-9
1.3	Building the Kernel . . . . .	1-13
	<i>Build a Sun Kernel</i> . . . . .	1-13

## Chapter 2 - Zformat Operation

2.0	Zformat Utilities . . . . .	2-3
	<i>What is Zformat?</i> . . . . .	2-3
	<i>Starting Zformat</i> . . . . .	2-3
2.1	The Zformat Main Menu . . . . .	2-5
	<i>Main Menu Options</i> . . . . .	2-5
2.2	The Format Utility . . . . .	2-6
	<i>Formatting</i> . . . . .	2-6

2.3	Mirroring . . . . .	2-7
	<i>The Mirroring Menu</i> . . . . .	2-7
2.4	The Partitioning Utility . . . . .	2-9
	<i>Write a Label</i> . . . . .	2-9
2.5	Other Menu Options . . . . .	2-11
	<i>Mirroring</i> . . . . .	2-11
	<i>Zformat Main Menu</i> . . . . .	2-11

# **Product Overview**

## **Introduction**

Zetaco's FST-2 Host Adapter is a high performance adapter designed for high-end disk and tape storage control for VMEbus systems.

The FST-2 SunOs Driver is the software required to operate the FST-2 under SunOs.





## **FST-2 Driver Installation**

### **Introduction**

This chapter explains how to install the FST-2 driver onto your computer system. The installation process requires you to copy the contents of the tape and to modify some of the SunOS configuration files.



## 1.0 Before You Begin

### Getting Started

These installation instructions assume that you have a working knowledge of the UNIX visual editor (*vi*), file hierarchies, and Sun file system preparation.

Before starting these installation procedures make sure you've created a partition on your system using the SUN Installation tape or the Sun *format* command. If you're not sure how to do this, consult your Sun documentation.

Installing FST-2 software includes the following steps:

- Copying the contents of the installation tape.
- Modifying some of the Sun kernel configuration files.
- Building a new kernel.

Before starting these procedures you may want to review the background information in your Sun Administrator's manual on rebuilding the kernel. Depending on your experience, this installation can take up to two hours to complete.

## 1.1 Copying the Install Tape

### Copying the Tape Contents

The first step in getting started is to insert the installation tape into the QIC drive and copy the contents into a directory called */usr/fst*. When you are finished there will be two directories contained in */usr/fst* - *drivers* and *bin*.

Type each command exactly as it appears in bold type. Press the Return key where the return symbol ( ↵ ) is indicated. Also, make sure you are logged on as root before starting these procedures.

1. Insert the tape into the 150M-byte tape drive.
2. Make a directory on your Sun workstation called */usr/fst*.  
**mkdir /usr/fst ↵**
3. Change to the directory you just made.  
**cd /usr/fst ↵**
4. Copy the contents of the installation tape to the */usr/fst* directory. (This assumes your tape drive is identified as *rst0*.)  
**tar xvf /dev/rst0 ↵**

## 1.2 Integrating FST-2 Drivers

### Add the FST-2 Driver Files

Copy the source files in the */usr/fst/drivers* directory to the */sundev* file directory, and edit the configuration file *conf.c*.

1. Copy all the files in the */usr/fst/drivers* directory with the *.c* and *.h* extension to the directory named */usr/kvm/sys/sundev* .

```
cp /usr/fst/drivers/*.c /usr/kvm/sys/sundev ↵
cp /usr/fst/drivers/*.h /usr/kvm/sys/sundev ↵
```

2. Move to the directory */usr/kvm/sys/sun*

```
cd /usr/kvm/sys/sun ↵
```

3. Edit the configuration file called *conf.c*

```
vi conf.c ↵
```

4. Locate the line containing: **struct bdevsw** by typing: */struct bdevsw* . Create a new line just above the section beginning with *struct bdevsw* by typing an uppercase *O*. Press *<ESC>*. Verify your position in the file with Figure 1.0.

```
#endif

struct bdevsw bdevsw =
{
    {nodev,  nodev,  nodev,  nodev,  /*0*/
```

Figure 1.0: *conf.c* file

5. Read in the contents of */usr/fst/drivers/fst\_decl.txt* .

```
:r /usr/fst/drivers/fst_decl.txt ↵
```

Verify the first few lines with Figure 1.1

```
# include "zm.h"
# if NZM > 0
extern int zmopen(), zmclose(), zmstrategy(), zmread(), zmwrite();
extern int zmiocctl(), zmsize();
#else
#define zmopen nodev
#define zmclose nodev
#define zmstrategy nodev
#define zmread nodev
#define zmwrite nodev
```

Figure 1.1: *conf.c* file with text from *fst\_decl.txt*

6. Use the forward slash key to again find **struct bdevsw**. Move the cursor to the left brace ( { ) on the next line. Enter the % command to find the matching closing brace. (The brace is located on a line by itself followed by a semicolon (;). Open a line above the brace by typing an uppercase O. Press <ESC>.
7. Insert the contents of */usr/fst/drivers/fst\_bsw.txt*

```
:r /usr/fst/drivers/fst_bsw.txt ↵
```

The last few lines from the file *fst\_bsw.txt* are shown on the next page in Figure 1.2.

```
[idbopen, nuldev, idstrategy, iddump, /*49*/
idsize, 0),
{zmopen, zmclose, zmstrategy, nodev, /*50*/
zmsize, 0),
};
```

Figure 1.2: *conf.c* file with text from *fst\_bsw.txt*

8. Replace the **xxx** at the line starting with `{zmopen,` with the next logical number in the sequence started by the other devices listed in the file. The **xxx** refers to the block device major number. Write this number down, as it will be used later on for creating the block device nodes.

In the example shown in Figure 1.2 the value for the block device major number **xxx** is 50. The value you enter may be different depending on how your system was set up.

9. Press `<ESC>`, then locate the line containing `cdevsw` in the file by entering `/cdevsw` to go to the character device section.
10. Press `j` to move down to the next line in the file and place the cursor on the left brace (`{`). Enter the `%` sign to find the matching closing brace and open a line above it by typing an uppercase `O`. Press `<ESC>`.
11. Copy in the contents of `/usr/fst/drivers/fst_csw.txt`.

```
:r /usr/fst/drivers/fst_csw.txt ↵
```

Verify your location in the file by looking at the last few lines of the file *fst\_csw.txt*, as shown in Figure 1.3

```
{
  zmopen,  zmclose,  zmread,  zmwrite,  /*104*/
  zmioctl, nuldev,  selftrue  0,
  0,      0,
},
};
```

Figure 1.3: *conf.c* file with text from *fst\_csw.txt*

12. Replace the **xxx** at the end of the text you just inserted with the next logical number in the sequence started by the other devices previously listed in the file. The **xxx** refers to the character device major number. Write it down, as it will be used to create the character device (dev) nodes.

In the example shown in Figure 1.3 the value for the character device major number **xxx** is 104. The value you enter may be different depending on how your system was set up.

13. Press **<ESC>** and save the file using **:wq!** ↵

## Modify Sun Driver Files

Modify the file called *files* in the */usr/kvm/machine/conf* directory.

1. Move to the */usr/kvm/machine/conf* directory

```
cd /usr/kvm/machine/conf ↵
```

2. Edit the file called *files* .

```
vi files ↵
```



3. Go to the end of the file by typing **<SHIFT> g** and then open a line below by typing a lowercase **o**.
4. Read in the contents of `/usr/fst/drivers/driver_files.txt`. Verify the changes with Figure 1.4

```
:r /usr/fst/drivers/fst_files.txt ↵
```

sunwindowdev/ws.c	optional dtop device-driver
sunwindodev/ws_dispense.c	optional win device-driver
sunwindowdev/ws_interrupt.c	optional win device-driver
sun/stubs.c	standard
sundev/zm.c	optional zm device-driver

Figure 1.4: files with text from `driver_files.txt`

5. Press **<ESC>** and write the file using **:wq!** ↵

## Modify the Kernel Configuration File

Next, create a kernel configuration file. You can use the file called `GENERIC` and copy it to a different file name or a file you may have previously modified with a different name, when you originally set up your Sun system. (The kernel configuration file is displayed in the message line when you first log on to your system.) The `GENERIC` configuration file describes a generic Sun-4 kernel, including all possible standard devices and software options. It includes support for all Sun-4 CPU types.

Another way to determine the name of the configuraton file to use is by entering:

```
dmesg | head -10 ↵
```

(This command displays several lines including one that identifies the kernel configuration file, depending on how much activity has occurred since the last time the system was booted.) It should display a line that looks something like this:

## SunOS Release 4.1 (GENERIC)

1. Move to the directory called `/usr/kvm/machine/conf`

```
cd /usr/kvm/machine/conf ↵
```

2. In this next step make a copy of the configuration file `GENERIC` or the file you previously modified when you originally set up your system. In this example we will copy the file `GENERIC` to a file called `SAMPLECFG`, and then edit `SAMPLECFG`.

```
cp GENERIC SAMPLECFG ↵
```

3. Edit the configuration file called `SAMPLECFG`.

```
vi SAMPLECFG ↵
```

4. Go to the very end of the file by pressing `<SHIFT> g`. Insert an open line by typing a lowercase `o`.
5. Enter new text as shown in Figure 1.5. Figure 1.5 is an example of the entries included in the kernel configuration file for four devices found on two FST-2 Adapters.

```
# Support for Zetaco FST-2 Adapter
```

```
controller zmc0 at vme16d32? csr 0x7000 priority2 vector zmintr 0xC8  
controller zmc1 at vme16d32? csr 0xF000 priority2 vector zmintr 0xc9
```

```
disk          zm0 at zmc0 drive 0000 flags 0x21  
tape          zm1 at zmc0 drive 0010 flags 0x22  
disk          zm2 at zmc1 drive 0000 flags 0x21  
disk          zm3 at zmc1 drive 0030 flags 0x21
```

Figure 1.5: example configuration file entries

Each field breaks down as follows:

**For the line beginning with "controller":**

The line beginning with "controller" is required and describes the adapter. There are three variable fields on this line. The first field following "controller" is the controller name. It must be of the form "zmcX", where X is the controller index. The index must start at 0 and increment by one for each additional FST-2 adapter installed. The field that follows "csr" is the adapter's VME bus address. Enter the address that the adapter is set to. The third variable field in this file is located after the word "zmintr". The value used for zmintr selects the VME bus interrupt vector. These fields should have unique values. If necessary, consult your Sun documentation for assistance in choosing the appropriate values for these fields.

**For the lines beginning with "disk", "tape", or "device":**

The lines beginning with "disk", "tape", or "device" describe the devices attached to the FST-2 Adapters.

The first field is the device type. Enter "disk" for disk drive, "tape" for tape device, and "device" for anything else.

```
disk    zm0 at zmc0 drive 0000 flags 0x21
```

The second field is the device index. The number following "zm" (i.e. zm2) must start at 0 and be incremented for each device description line that is entered.

```
disk    zm2 at zmc1 drive 0020 flags 0x21
```

The third field indicates to which FST-2 Adapter the device is attached. This field must correspond to a "controller" description line, as specified above.

```
disk    zm0 at zmc0 drive 0000 flags 0x21
```

The fourth field is located after the keyword "drive". This value is an octal number which breaks down as follows:

drive w x y z

where      w = 0 (signifies octal)  
            x = the SCSI bus # on FST-2 (0 or 1)  
            y = the SCSI ID of device (0-6)  
            z = logical unit (usually 0)

disk           zm0 at zmc0 **drive 0000** flags 0x21

This describes SCSI ID 0 on SCSI bus 0.

disk           zm1 at zmc0 **drive 0100** flags 0x21

This describes SCSI ID 0 on SCSI bus 1.

The flags field is derived by "OR"ing together the appropriate bit flags, as defined below. For example a synchronous disk would have a flags value of 0x21.

DISKTYPE	0x0001	- for disk
TAPETYPE	0x0002	- for tape
NO_MODEGEOM	0x0004	- if unit doesn't support mode sense geometry pages
RMV_MED	0x0008	- if unit has removeable media
NO_MDSLCT	0x0010	- if unit should not be mode selected during system boot or open
SYNCH	0x0020	- if unit supports synchronous data transfer

6. Press <ESC> and write the file by typing :wq!

## 1.3 Building the Kernel

### Build a Sun Kernel

In this section you will build a new Sun kernel containing the FST drivers. Carefully follow the steps listed below.

1. Move to the `/usr/kvm/machine/conf` directory.

```
cd /usr/kvm/machine/conf ↵
```

2. Enter the command: `/etc/config <KERNEL NAME>`. Substitute `<KERNEL NAME>` with the kernel configuration file you created in step 3, page 12.

3. Move to the directory containing the `KERNEL NAME`. In this example we will use `SAMPLECFG`.

```
cd /usr/kvm/machine/conf ↵
```

4. Enter the `make` command:

```
make ↵
```

5. Make a copy of the original kernel:

```
cp /vmunix /vmunix.org
```

6. Move the new kernel `vmunix` to the root directory.

```
mv vmunix /vmunix ↵
```

7. Change to the `/dev` directory.

```
cd /dev ↵
```

8. Copy the `zmknod` utility into the `/dev` directory and create the required device nodes.

```
cp /usr/fst/bin/zmknod /dev ↵
```

9. Run the *zmknod* script for each configured device using the following format:

```
zmknod <name> <block major#> <character major#>
```

For example, to create all of the nodes for a disk named *zmd0* enter the following command:

```
zmknod zmd0 50 104 ↵
```

The above command makes block devices *zmd0a* - *zmd0h* and character devices *rzmd0a* - *rzmd0h*.

Create the device nodes for a tape device named *zmt3* using the following format:

```
zmknod zmt3 50 104 ↵
```

This will create two character device nodes, *rzmt3* and *nrzmt3*. The device node *nrzmt3* is a no rewind device.

Note: The *zmknod* utility only accepts disk names of *zmdx*, and tape names of *zmtx*. "X" is the unit number corresponding to the device index in the kernel configuration file.

**NOTE:** All devices attached to FST-2 adapters consume eight minor numbers (the last field in the *mknod* command is a minor number), regardless of whether the device uses them for partitions or not. For this reason the minor number field increments by eight for each device.

This completes installation of the SunOS driver for the FST-2 Adapter. Before making use of your system you must run the *zformat* utility to format and partition disks and to set up mirroring. **DO NOT USE THE SUNOS FORMAT UTILITY.** For more information on *zformat* and other utilities for the FST-2 adapter refer to Chapter 2.





---

## Zformat Operation



## 2.0 Zformat Utilities

### What is Zformat?

The FST-2 SunOS driver comes with a formatting utility called `zformat` that allows you to format, analyze, and partition disks. In addition, `zformat` provides the capability to set up mirroring and the synchronization of two disks.

The `zformat` utility was copied to your system when you first installed the contents of the FST-2 driver tape. It is located in the `/usr/fst/bin` directory. Add the `/usr/fst/bin` directory to your environment path if you want to be able to execute `zformat` from any directory.

### Starting Zformat

The `zformat` utility uses a menu driven interface. To start `zformat` following these steps:

1. Make sure you are signed on as superuser.
2. Change to the `/usr/fst/bin` directory, or make sure it is set up in your environment path.
3. Enter the command `zformat`.

After you enter `zformat` your screen displays the following:

```
Looking for valid disks

Disks Found:
    zmd0
    zmd1
    zmd2
    zmd3
    zmd4

Select a device:
```

Figure 2.0: Starting `zformat`

The `zformat` command identifies all the drives located on your system. Enter the appropriate drive name after the line that reads `Select a device`. For example, if you want to format, analyze, partition, or set-up mirroring on drive `zmd0`, then enter `zmd0`.

## 2.1 The Zformat Main Menu

### Main Menu Options

After entering the appropriate drive name, the zformat main menu is displayed.

```
zformat commands:
[F]ormat      Format a disk
[A]nalyze    Surface analysis of a disk
[P]artition  Partition and label a disk
[M]irroring  Disk mirroring commands
[S]elect     Select a device
[Q]uit

Enter your choice:
```

Figure 2.1: zformat Main Menu

The zformat main menu allows you to format, analyze, partition, or set up mirroring. In addition, you can execute each of these commands on a different disk by choosing the [S]elect option. Each command is executed by entering the first letter of the command as it appears on the menu.

If you are setting up your system for the first time perform the following steps in this order:

1. Format a disk
2. Set-up mirroring
3. Define a partition
4. Write a label

Note: You can ignore step two if you are not going to set up mirroring.

## 2.2 The Format Utility

### Formatting

The format command formats the selected disk and takes approximately one-half hour to format a 600MB disk. If you are going to set up mirroring you will need to format two disks.

Enter F after the line that reads `Enter your choice` from the main menu. The following message is displayed:

```
All data will be lost.  
Are you sure you want to format zmd0?
```

Enter Y if you want to continue or N if you want to cancel the process. You can also enter Ctrl+C at any time if you want to abort the formatting procedure. After entering Y the following message is displayed:

```
Retain current defect list?[yes]
```

All SCSI disks keep a list of bad blocks or sectors. If you answer No to the above question formatting will erase any record of bad blocks, except for the manufacturer's primary defect list. The format utility will not delete the manufacturer's primary defect list. Press <ENTER> if you want to accept the default yes and begin to format a disk. Repeat the same steps if you want to format another disk.

## 2.3 Mirroring

### The Mirroring Menu

Mirroring is a feature in which the FST-2 duplicates data on two disks. The PRIMARY disk is the main disk in a mirrored pair. The SECONDARY disk contains a "mirror image" of the data on the PRIMARY disk.

After a pair of disks is mirrored with zformat, the PRIMARY device is mounted and all I/O should be directed to that device. Attempts to write to the SECONDARY device are not allowed while the mirrored pair is synchronized and will fail.

In the event of a hard failure, the FST-2 breaks the mirror and continues operation of the functional disk. The hard failure may be addressed and corrected when the system becomes available. Once the failure has been corrected, the FST-2 can resynchronize the PRIMARY and SECONDARY devices in a matter of minutes instead of the hours it may take to rebuild a normal disk from a tape backup.

Enter M from the main menu to display the mirroring menu:

```
Mirroring Menu
[M]ake a mirror
[B]reak a mirror
[S]ync a mirror
[G]et unit status
[Q]uit

Enter your choice:
```

Figure 2.3: Mirroring Main Menu

From the mirroring menu you can execute commands to make, to break a mirror, to sync a mirror, or to display the current mirror status of a single disk.

Select option M to begin the process of mirroring. After entering M the following message is displayed:

```
Enter the primary unit [zmd0]:
```

Enter the disk that is to serve as the primary unit. The default is the currently selected unit. After you enter the primary unit a second message is displayed:

Enter the secondary unit:

Enter the disk that you want to use as the secondary unit. After entering the secondary unit value, a message is displayed confirming your choices and asking if you want to continue.

```
Primary device: zmd0 (target: 0 lun:0)
Secondary device: zmdl (tartet: 1 lun:0)
```

```
Send this command?
```

```
Enter Y to continue.
```

When mirroring is complete you will then be asked to write a label and partition map to the primary unit. Labeling and partitioning is done through use of the partition command which is selected from the main menu.

**Please Note:** When mirroring two disks the secondary disk must be greater or equal in size to the primary disk. You cannot designate a secondary disk that is smaller than the primary disk. If the secondary unit is not equal to or greater than the size of the primary unit an error message will be displayed.

```
The secondary unit is smaller.
Not sending command!
Please choose a secondary drive
greater or equal in size to the primary.
```



## 2.4 The Partitioning Utility

### Define a Partition Map and Write a Label

Even though you may have formatted an disk you will still have to label the disk even if you accept the default partition. After two disks are successfully mirrored you will need to write a label to disk. This is done through the partition command from the main menu. The label contains information about the disk, as well as a partition map.

Enter P from the main menu to display the partition menu:

```
PARTITION MENU:
  [C]urrent partition map display
  [D]efault partition map display
  [E]dit a partition map
  [W]rite a label and partition map
        to disk
  [Q]uit this menu
```

Figure 2.4: The Partition Menu

When the partition menu is displayed you can either show the current (if the disk is labeled), or default partition map, define a partition, or write a label to the selected disk. If you just completed mirroring then select option 3 to define a partition map.

If you want to view the current or default partition you can enter "C" or "D". The default partition sets up two partitions, A and C, over the entire disk. Under the SunOS operating system, partition C has to be the entire disk.

The default partition map looks like this:

Default partition map for zmd0:

```
Partition a: Starting Cyl:0 blocks: 2676225 [2099-0-0]
Partition b: Starting Cyl:0 blocks: 0 [0-0-0]
Partition c: Starting Cyl:0 blocks: 2676225 [2099-0-0]
Partition d: Starting Cyl:0 blocks: 0 [0-0-0]
Partition e: Starting Cyl:0 blocks: 0 [0-0-0]
Partition f: Starting Cyl:0 blocks: 0 [0-0-0]
Partition g: Starting Cyl:0 blocks: 0 [0-0-0]
Partition h: Starting Cyl:0 blocks: 0 [0-0-0]
```

If you need to define a new partition map select menu option 3 by entering an "E". You can partition a disk into eight logical pieces. When you define a partition map, you can edit the current (if it is already labeled), or the default partition.

Edit [C]urrent partition map or [D]efault?

Next, zformat asks:

Select a free hog partition? [n]

If you answer "Yes" zformat asks:

Which partition? [g]

This selects a "free hog partition". This partition will automatically adjust to define the remaining unassigned cylinders of the disk while editing the partition map.

Next, select a partition to edit.

Select a partition [a-h] to edit or [Q]:

When you edit a partition, zformat asks for the starting cylinder and number of cylinders you would like to set up.

```
Starting cylinder?  
Number of cylinders?
```

When designating the starting cylinder and number of cylinders, make sure none of the cylinders overlap. Start the next cylinder where the previous one left off.

When you have edited the partition map the way you want it, select menu option 4 [w] to write the label to disk.

## 2.5 Other Menu Options

### Mirroring

#### **Break a mirror**

The break a mirror option does the opposite of making a mirror. This command option unmirrors the primary and secondary drives. Both the primary and secondary disk names are needed to perform this operation.

#### **Sync a mirror**

This option remakes a mirrored pair of the selected disks, and synchronizes them by copying the data from the primary unit to the secondary unit. Use this option when a mirrored pair is broken, either manually with the "Break a mirror" option or because of a disk failure. Enter both the primary and secondary disk names when using the sync command.

#### **Get unit status**

This option reports the current mirroring status of the selected unit.

### Zformat Main Menu

#### **Analyze**

The analyze option is accessed from the zformat main menu. With the analyze command option you can identify bad blocks or errors located on the selected disk.

**Please Note:** This operation writes data to the entire disk! Only use this command option after using the formatting command. Also, the analyze command takes a considerable amount of time to complete.

#### **Select**

The Select a device option is accessed from the zformat main menu. Select this option to designate a different disk for formatting, partitioning, etc.