ULTRASTOR CORPORATION

ULTRA 22CA

CACHING ESDI EISA CONTROLLER

REFERENCE MANUAL

REVISION A

11.1.91

RADIO FREQUENCY INTERFERENCE STATEMENT

CAUTION: Changes or modifications to this product not expressly approved by UltraStor Corporation could void the user's authority to operate this equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy, and, if not installed and used in accordance with the instruction, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult UltraStor Corporation or an experienced radio/TV technician for help.

ULTRASTOR CORPORATION

ULTRA 22CA Caching EISA ESDI CONTROLLER

REFERENCE MANUAL

1.0 Introduction

UltraStor's family of disk controllers are designed to break the present system bottleneck...its I/O throughput. The ULTRA family of disk controllers provides the ultimate in speed and features ideally suited to meet the needs of the high capacity,

high performance market. Its many advanced features are designed to support a broad range of applications, cost effectively and with ease of use.

The ULTRA 22CA is an EISA compatible Bus Master controller which controls up to two ESDI drives and up to three floppy drives. The transfer rate of the ESDI Interface can be a combination of 10, 15, 20, 22 or up to 24 MBits/sec with capacity range up to 2.1 GigaByte per drive. It provides intelligent caching up to 16MBytes of standard 80ns DRAM SIMM Modules to make the mechanical drive "invisible" when a cache hit is achieved, providing multiple increases in I/O performance.

The ULTRA 22CA utilizes the industry standard Intel BMIC chip to maintain compatibility while communicating with the motherboard and other expansion cards. It supports data transfers up to 33 MByte/sec on the EISA bus using the bus master mode/burst transfer method. The on-board BIOS allows OS drivers to interface efficiently to the controller and also provides users the ease of installing ESDI drives to the system.

In order to achieve the full advantage from the high speed EISA interface while maintaining downward compatibility with the current ISA disk BIOS, disk device driver, and application software, the ULTRA 22CA provides dual sets of interface protocol on the host side (ISA mode and EISA mode).

The ISA mode is the industry standard (WD1003 compatible) task file register interface, which provides compatibility with most currently available operating system disk device drivers. It uses the Task File Register command interface and 16 bit PIO data transfer. The industry standard task file registers (TFR) and full ISA disk command set are implemented for the current ISA protocol. Under the ISA compatible mode, the ULTRA 22CA provides backward compatibility with all PC operating systems and thousands of existing PC/AT hardware, software, and applications currently on the market.

The ISA mode can be disabled through the configuration utility.

On the EISA side, a multi-thread, Mail-Box type, 32 bit Bus Master protocol is implemented to reduce system CPU intervention and data command transaction overhead. Under the EISA mode operation, the controller will operate with a Bus Master/burst data transfer rate up to 33 MBytes per second and in excess of 20 MBytes per second sustained data transfer rate. Due to its efficient EISA command protocol, the system CPU is free most of the time to do other tasks while the controller's local CPU does all the command processing, ESDI drive accessing and data transfer operation. It interrupts the system CPU only when the command is completed or when an error has occurred. The benefit of the EISA mode operation can be summarized as follows:

    1.   Due to its high burst data transfer rate and sustained data transfer rates, the

ULTRA 22CA reduces the bandwidth utilization of the EISA Bus, freeing up the bus for other Bus Masters in the system including the main CPU. This means the system is able to maintain the same performance level even under heavy bus activity.

2. Since the system CPU's involvement in the ESDI drive operation is minimized to only sending command packets through a set of contiguous interface registers and waiting for command complete interrupt to check the resulting status, the CPU is free most of the time to execute other tasks. This increases the system's overall performance especially in a multi-tasking, multi-processing operating environment.

2.0   Features

Intelligent Caching for Optimum Performance

- **Cache Memory Up to 16MBytes On-board**

- **Intelligent Caching Optimized with Each O.S.**

- **Accommodates Standard 80ns DRAM SIMM Modules of 256KB, 1MB or 4MB Configurations**

- **Supports Mixing of SIMM Types On-board**

EISA Bus Master 33MB/Sec Burst Transfers

Full EISA (using Intel BMIC) Compatibility

Full ISA (Industry Standard AT Task File Register) Downward Compatibility

Unique Support of Duplexing and Mirroring Under Novell and OS/2 LAN Manager

Supports Slot Specific I/O Address

Virtual Memory Support

ULTRA ESDI Controller Performance Provided by:

- **10, 15, 20, 22 and Up to 24 MBits per second ESDI support**

- **Cache Optimized to Individual O.S.**

- **1:1 Interleave Capability Even with 24 MBits per second ESDI drive.**

- **Automatic Optimization Head Skew**

- **Automatic Optimization Cylinder Skew**

- **Screen Edit Programmable Interleave Factor**

·   **24MHz Internal Processor Speed to Minimize Firmware Overhead**

·   **Optional Spare Sectoring Allows Defect-Free Continuous Reading and Writing**

Supports > 1024 Cylinder Drives

Supports > 528MByte Drives as a Single Volume

Supports 2.1 GigaByte Drives

17, 32, and 63 Sector Mapping

Co-Resident with Another Controller in the System

Supports any Combination of Three Floppy Drives (3.5" or 5.25") or Two Floppy Drives Plus One Floppy Tape

Preserves Drive Manufacturer's Defect Lists

Screen Edit Menus for Easy Installation

DOS, XENIX, UNIX, Novell, OS/2 Compatible

Supports any Mix of 10, 15, or up to 20 MHz ESDI Drives

Automatic Drive Preparation to Ease Installation

Extensive Defect Management Functions

Supports Four ESDI Drives Under UNIX/Novell/OS2 (With Two Controllers) for Dual Channel Operation

56 Bit ECC Ensures Data Integrity

Highly Reliable Advanced Design

3.0   Software Installation Package

Included in the software package that comes with the ULTRA 22CA are:

1.   ULTRA 22 Family EISA ESDI Controller

Utilities & Device Drivers (DOS/OS2/NETWARE)

README	:	The readme file.
!USC0220.CFG	:	ULTRA 22C configuration file. To be used when ULTRA 22C is installed in an EISA system.
!USC0221.CFG	:	ULTRA 22CA configuration file. To be used when 22CA is

installed in an EISA system.

!USC0225.CFG	:	ULTRA 22F configuration file. To be used when 22F is installed in an EISA system.
\DOS\EXFDRV.SYS	:	Third floppy device driver. To be used when 22CA or 22F is installed in an EISA system.
\DOS\EXFDRV.HLP	:	Help file for the third floppy device driver. To be used when 22CA or 22F is installed in an EISA system.
\DOS\UVDS.SYS	:	DOS device driver with Virtual DMA Service support for ULTRA 22 family (22C, 22CA, 22F).
\DOS\UVDS.COM	:	TSR version of UVDS.SYS.
\OS2\DISK01.SYS	:	Device driver for OS/2 version 1.2 or later.
\NETWARE\U22_30.DSK	:	NOVELL NETWARE 386 version 3.0 device driver.
\NETWARE\U22_31X.DSK	:	NOVELL NETWARE 386 version 3.1x device driver.

2. ULTRA 22 Family EISA Disk Device Driver

    For SCO UNIX System V/386 Release 3.2

/hd	:	Device Driver and install script for primary controller.
/wd1	:	Device Driver and install script for secondary controller.

3. ULTRA 22 Family EISA Disk Device Driver
    For AT&T UNIX System V/386 Release 3.2
    For Primary Controller

    Device Driver and install script
    for primary controller.

4. ULTRA 22 Family EISA Disk Device Driver
    For Interactive UNIX OS Version 2.2

System V/386 Rel 3.2.

Device driver and install scripts for
primary and secondary controllers.

4.0   Hardware Installation

Hard Drives: 1 or 2 hard sector ESDI drives of any speed with the manufacturer's instructions for setting jumpers.

Floppy Disk Drives: Up to 3 floppy disk drives of any size with data rates from 125Kb/s to 500Kb/s with the manufacturer's instructions for setting jumpers.

Floppy Disk Cable: Standard twisted floppy control ribbon cable (34wire, #10-#16 in twist) or a special cable for 3 floppies. (See Appendix C, Installing the 3rd Floppy Drive.)

Computer: A PC with a 32 bit EISA bus slot. The PCs power supply must be able to deliver adequate power and, if it does not have enough drive power cables, you may need one or more Y-power cables.

Mechanical: You will need one or more screwdrivers or nut drivers to open the PC case and install the drives and controller board. A small pair of pliers or tweezers may be useful to change jumper settings.

Software: A bootable MS-DOS diskette that also contains the DEBUG, FDISK, and FORMAT external command files.

Before you begin the installation you will need to know how many heads, cylinders, and sectors per track of each hard disk drive. You need to know only the total formatted capacity for each floppy drive.

The controller exchanges information with the PC through a range of memory addresses and through some "input/output ports." If the ULTRA 22CA is going to be the system's only disk controller, the default values for these numbers will probably work fine. If you wish to install it in addition to another controller, you will have to know the memory, port address, and IRQ address that the other controller uses and perhaps those used by other options installed in your PC.

Finally, you will have to know which operating system your PC will be using (PC-DOS or MS-DOS, OS/2, UNIX, or Novell) and which version of that operating system.

The ULTRA family of EISA controllers support many different operating systems and networks. Installation instructions for several of them are included in this document.

There are three steps in the hardware installation prior to installing the operating

system:

1. Verify the ESDI drive jumper configuration.

2. Verify the Controller Setup Configuration.

3. Connect all the necessary cables.

```
                        CAUTION

      Please take proper electro-static discharge precaution
         when handling the board.  Handle the product by
                      the ends of the board.
```

4.1   ESDI Drive Configuration

The ESDI drive should be configured as follows:

a. Verify and set the drive select jumper on the drive as follows:

1. If a straight 34 pin control cable is used, jumper the first drive as drive select 1, and jumper the second drive as drive select 2.

2. If a twisted 34 pin control cable is used, jumper the first drive as drive select 2, and jumper the second drive also as drive select 2.

Note: A twisted 34 pin cable is a 34 pin flat ribbon cable which has wires 25 through 29 twisted at one end of the cable.

b. Install the drive termination resistors only on the drive that is at the end of the control cable.

c. Set the jumper to spin up the drive motor upon system power up (generally the drive will come from the factory set this way), rather than upon an ESDI spin-up command.

d. Set the drive jumper for hard sector mode. This is essential if the drive is to function properly with your high performance ULTRA controller.

e. Set the desired sectors per track jumper. For 10MHz ESDI drives it is normally 36 sectors or below, for 15 MHz ESDI drives, 54 sectors or below per track depending on the drive. Make sure you select an option which uses 512 byte sectors.

FIGURE 1.0

ULTRA 22CA BOARD LAYOUT

**FIRST MEMORY BANK
START FROM HERE
(BOTH SOCKETS SHOULD BE FILLED TO OPERATE)**

DRIVE 1

LED

DRIVE 0

HARD DISK

FLOPPY

J10

1 J11   1 J6   1 J5   1 P1

JP8
1   3   JP7

FIRMWARE

Ultra 22CA

BIOS HIGH

BIOS LOW

JP9
1   22

18
1
JP10

JP1
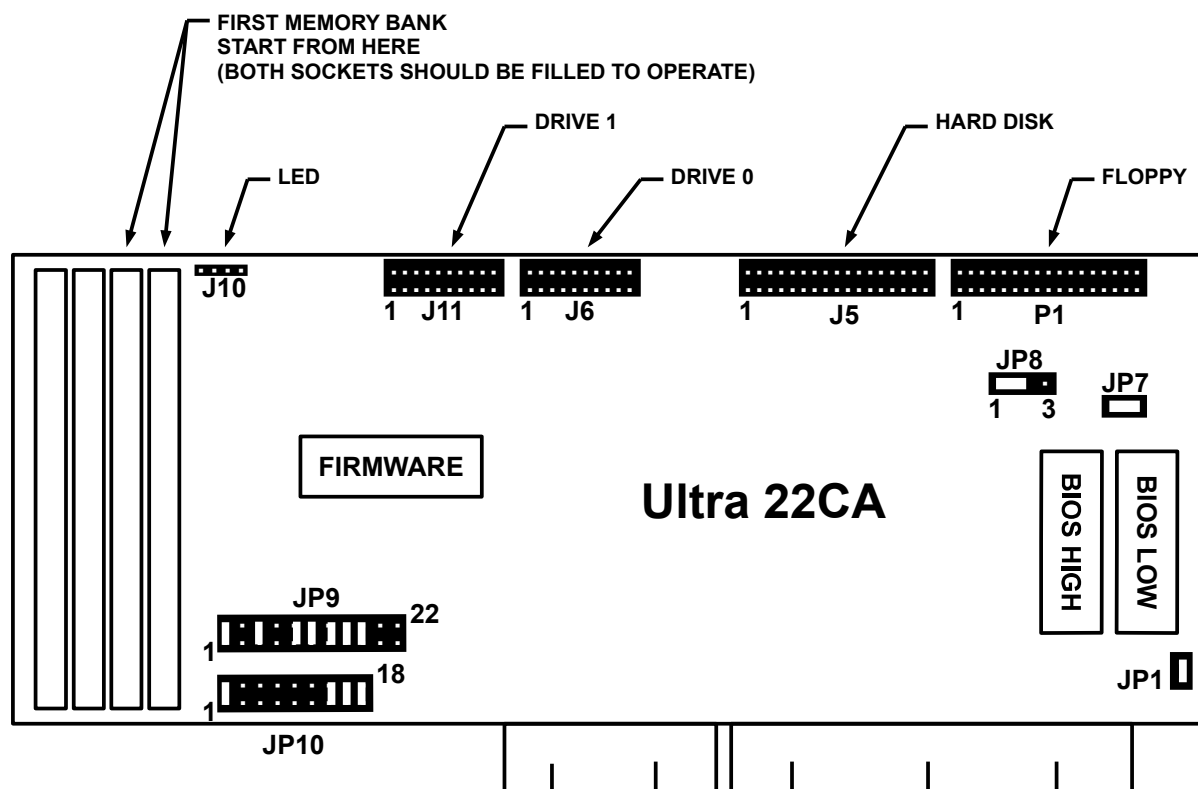
TABLE 1.0

DEFAULT JUMPER SETTINGS

Jumper Function	Name	Jumper Pin
Factory Use	JP1	Jumper
Enable Floppy Controller	JP7	Jumper
Third Floppy	JP8	1-2
Battery Backup	JP9	See Figure 1.0 for jumper configuration
	JP6	See Figure 1.0 for jumper configuration

TABLE 2.0
JUMPER DEFINITION

JUMPER	NUMBER		DESCRIPTION
JP1		OUT:	Factory Use
JP7		IN:	Enable Floppy Controller
		OUT:	Disable Floppy Controller
JP8	1-2	IN:	Supports a third floppy drive
		OUT:	Does not support a third floppy drive
	2-3	IN:	Supports a 1M Byte floppy drive
		OUT	Does not support a 1M Byte floppy drive
JP9	1-2	IN:	Factory Use
	3-4	OUT:	Factory Use
	5-6	IN:	Factory Use
	7-8	OUT:	Factory Use
	9-10	IN:	Factory Use
	11-12	IN:	Factory Use
	13-14	IN:	Factory Use
	15-16	IN:	Factory Use
	17-18	IN:	Factory Use
	19-20	OUT:	Factory Use
	21-22	OUT:	Factory Use
JP10	1-2	IN:	Factory Use
	3-4	OUT:	Factory Use
	5-6	OUT:	Factory Use
	7-8	OUT:	Factory Use
	9-10	OUT:	Factory Use
	11-12	OUT:	Factory Use
	13-14	IN:	Factory Use
	15-16	IN:	Factory Use
	17-18	IN:	Factory Use

<table>
<tr><td colspan="2" align="center">Table 3.0</td></tr>
<tr><td colspan="2" align="center">Connector Definition</td></tr>
<tr><td>J5</td><td>Drive Control Cable</td></tr>
<tr><td>J6</td><td>Data Cable for 1st Drive</td></tr>
<tr><td>J11</td><td>Data Cable for 2nd Drive</td></tr>
<tr><td>P1</td><td>Floppy Connector</td></tr>
<tr><td>J10</td><td>LED Connector</td></tr>
</table>

4.2   Controller Setup

Although the controller is designed to be configurable by the configuration utility, a floppy disable jumper must be provided to solve the I/O resource conflict if a floppy circuit is built onto the motherboard.

The floppy enable/disable jumper (JP7) is located at the upper right corner of the board:

Floppy Circuit Enable: JP7 in

Floppy Circuit Disable: JP7 out
(See FIGURE 1.0 and Table 1.0)

The controller configuration is done through the configuration file (!USC0221.CFG) diskette that comes with the ULTRA 22CA and the configuration utility that comes with the EISA system. The ULTRA 22CA does not need to be inserted into the system for the controller setup.

1. Copy the configuration file (!USC0221.CFG) to the configuration utility diskette that comes with the system.

2. Running the configuration utility may be different from vendor to vendor. Check the vendor manual for exact procedures. The following are examples of running the configuration utility from the configuration diskette:

A:>cf <CR>   (For Micro Computer Systems
                              configuration utility)

or

A:>ptlecu <CR>   (For Phoenix configuration utility)

3. Execute the "ADD" I/O board function and select !USC0221.CFG file. (If the ULTRA 22CA has already been inserted into the system, the configuration utility should automatically detect and add it to the installed list.)

4. The ULTRA 22CA configuration consists of the following options:

    ULTRA 22CA: Enable, Disable

    BIOS Address Selection: C8000, CC000, D0000, D4000, D8000, DC000, C4000, Disable

    IRQ Selection: 10, 11, 12, 15
                                (IRQ 14 is reserved for ISA mode operation.)

    ISA I/O Port Address: Primary, Secondary, Disable

    Floppy Port Address: Primary, Secondary, Disable

    Third Floppy Drive Cable: Single Twisted, Double Twisted
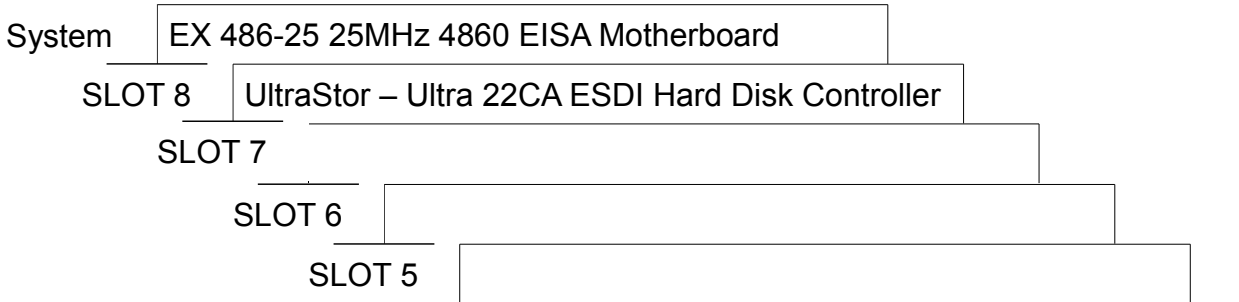

    ### CAUTION

    If you intend to install ULTRA 22CA SCO UNIX System V/386 device driver for the primary controller, select IRQs other than IRQ15, e.g. IRQ10, to avoid the conflict. IRQ15 is reserved by device driver WD1 for the secondary controller. IRQ11 may be used by some SCSI host adapters.

    NOTE: IRQ12 may be reserved by some EISA systems.

5. Select the slot number that is intended for ULTRA 22CA. The slot must support EISA Bus Master Transfer.

6. Save the configuration and exit.

7. Power down the system, insert the ULTRA 22CA controller card into the selected slot.

FIGURE 2.0

ULTRA 22CA CONTROLLER DEFAULT CONFIGURATION

System   EX 486-25 25MHz 4860 EISA Motherboard

SLOT 8   UltraStor – Ultra 22CA ESDI Hard Disk Controller

SLOT 7

SLOT 6

SLOT 5

Press [F10] & select menu with arrow keys. Pull down selected menu with [Enter].

NOTE: This is only an illustration of a possible screen view of this utility. This is not to indicate that the slots indicated above are mandatory slot numbers for the referenced boards.

System Configuration Detailed View				F1 = Help
System	Edit	View	Settings	Help

EISA System Information

UltraStor - ULTRA 22CA ESDI Hard Disk Controller
Mass Storage Device

      UltraStor ULTRA 22CA Disk Controller
         UltraStor ULTRA 22CA................................Enable
         EISA Mode Configuration
            BIOS Address Selection........................C8000h
            Interrupt Selection................................IRQ 10 - Edge Trigger
         ISA Mode Selection......................................Primary
         Floppy Control Option
            Floppy Disk Controller.........................Disable
            Third Floppy Drive Cable Selection.....Single Twisted Cable

Press [F10] & select menu with arrow keys. Pull down selected menu with [Enter]

The highlighted options are default choices. In general, the default options should apply to most cases. Should conflict occur with other I/O cards in the

system, select another alternative (See FIGURE 2.0 for Default Configuration).

4.2.1 EISA Mode Configuration

· **Enable/Disable Disk Controller**

Enable ULTRA 22CA Disk Controller

Options : **Enable**/Disable

· **BIOS Address Selection:**

For on-board 16 bit BIOS location

Options :

C8000/CC000/D0000/D4000/D8000/DC000/C4000/Disable

· **IRQ Selection**

Interrupt vector selection.

Options:

IRQ10/IRQ11/IRQ12/IRQ15 (EISA Mode)

IRQ14 (ISA Mode)

· **ISA Mode Selection**

Configure ISA Mode to use Primary I/O port, Secondary I/O port, or Disable.

Options: **Primary**/Secondary/Disable

I/O port: Primary   (1FO - 1F7, 3F6 and 3F7)

Secondary   (170 - 177, 376 and 377)

4.2.2 Floppy Control Options

· **Floppy Disk Control**

Disable or select the floppy control circuit on the ULTRA 22CA. This option, as well as JP7 jumper on the board, controls the floppy circuit. Either one of them set to "Enable" will enable the floppy portion of ULTRA 22CA.

Options : **Disable**/Primary/Secondary

I/O port: Primary   (3F0 - 3F7)

Secondary   (370 - 377)

· **Third Floppy Drive Cable Selection:**

Options :

Single Twisted Cable   Third floppy jumpered to DS4

Double Twisted Cable   Third floppy jumpered to DS2

4.3   Cable Connection and System Integration

After the controller and the drives are properly configured, connect all the necessary cables according to the following steps with the system powered off:

a.   Connect the drive power to the system power supply.

b.   Connect the 34 pin daisy chained flat cable from the drive to the J5 connector on the controller. The twisted end of the cable is connected to the first drive. Make sure pin 1 of the cable is connected to pin 1 of the drive and controller connections.

c.   Connect the 20 pin flat ribbon cable from the first drive to the J6 connector on the controller. Connect another 20 pin flat cable from the second drive to the J11 connector on the controller.

d.   Connect the 34 pin daisy chained floppy flat cable to the P1 connector on the controller. Connect the floppy drive power cable to the system power supply.-

e.   Connect the drive activity LED cable from the system panel to the J10 connector on the controller board.

e.   Remove the bracket from an empty expansion slot and use the bracket screw in step g.

f.   Insert the controller card into the selected EISA slot in the system and secure the board with a bracket screw.

5.0   Software Installation

There are two steps to perform for software installation:

1.   Low Level format using the ULTRA 22CA on-board BIOS utility.

2.   Refer to the appropriate section for each operating system's installation instructions.

After following the hardware installation according to the above instructions, the

following steps need to be taken before the low level format:

a. Turn on the system power and boot up DOS on floppy drive "A" (Floppy drive "A" should contain DOS system diskette to boot.). SETUP programs and AT ADVANCED DIAGNOSTIC programs are not required to add the ESDI drive to the system CMOS RAM. However, in system setup, make sure that the hard drive is specified as "installed". (Type 1 can be used.)

b. Load DEBUG program (or SID for DR DOS) from floppy drive "A" by typing:

   DEBUG

   after the **DOS** prompt "A" sign.

c. Once in the DEBUG program, following the prompt "-" sign, type the appropriate BIOS address to which the board is configured.

   EXAMPLE:

   g=C800:5 (if the board is configured to C800:0) **OR**

   g=DC00:5 (if the board is configured to DC00:0)

d. The UltraStor "Utility Main Menu" will appear on the screen (See Figure 3.0). In order to do the low level format, the drive parameters need to be set up first. The main menu allows users to enter both the "Drive Parameter Set Up Menu" and the "Drive Preparation Menu".

5.1   Low Level Format Using ULTRA 22CA On-board Utility.

5.1.1 UltraStor BIOS Setup Menu.

Before the low level format is executed, set up the drive parameters. Select the "Drive Parameter Setup" option from the main menu (Figure 3.0); the on-board utility will go into "UltraStor BIOS Setup Menu", as shown in Figure 4.0.

The on-board utility will read the drive parameters from the attached ESDI drive(s) and put the values into the appropriate field on the screen. Thus, the user does not need to investigate and input these values manually. (Refer to Section 4.0 if drive parameter is incorrect).

Users can select from the "One Spare Sector/Track" option , the "Sector Mapping" option, or the "Track Mapping" option for each drive independently. "32 or 63" sector mapping is used for accessing drives that have more than 1024 cylinders. "17" sector mapping is used for running any software that requires 17 fixed sectors per track. The track mapping option is used for drives greater than 528MBytes under DOS or OS/2.

The on-board intelligent caching algorithm is optimized according to different operating systems used. When the user selects the desired operating system on the menu, all the caching factors and parameters are defaulted according to the operating system selected. However, the user also has the option to manually modify these caching parameters, e.g. specifying the caching segment size and read ahead segment amount.

To enhance the performance further, the ULTRA 22CA provides an option of the writeback caching. This option can be turned on or off from the menu and the maximum dirty threshold can also be set by the user.

```
+---------------------------------------------------+
|                      NOTE                         |
|                                                   |
| Deferred Write feature must be turned "OFF" during|
| installation of any operating system and surface  |
| scanning under Novell or any other operating      |
| system. It may be turned "ON" once the            |
| installation and surface analysis has been        |
| completed.                                         |
+---------------------------------------------------+
```

All the options are independent of each other, thus providing a maximum number of combinations.

Please refer to Appendix B, Mapping Options for Drives Under Various Operating Systems, to set up mapping options for various drives' geometry and capacity under different operating systems.

When all the appropriate options have been entered, press F10 to save then F5 to confirm execution. The utility will update the system CMOS RAM with the correct number of hard disk drives and then boot up again under DOS.

FIGURE 3.0

```
+---------------------------------------------------+
|           ULTRASTOR UTILITY MAIN MENU             |
|                  Version 2.00                     |
+---------------------------------------------------+
|           1.  Drive Parameter Setup               |
|           2.  Drive Preparation                   |
+---------------------------------------------------+
```

Use **Up/Down Arrow** keys to select, **Enter** key to execute,

and **ESC** key to exit.

FIGURE 4.0

ULTRASTOR BIOS SETUP MENU		(c) USC 1989

Drive 0 Parameters		Drive 1 Parameters	
Type	ESDI	Type	NONE
Cylinder	1747	Cylinder	0
Head	7	Head	0
Sector	54	Sector	0
Precomp	65565	Precomp	0
One Spare Sector/Trk	NO	One Spare Sector/Trk	NO
Sector Mapping	63	Sector Mapping	NO
Track Mapping	NO	Track Mapping	NO
1024 Cyl Truncation	NO	1024 Cyl Truncation	NO

More than 2 drives for DOS 5.0 or later		No	

Caching Factors		Cache Buffer Size:	8192 KB
Operating System	DOS		
Segment Size	32K	Deferred Write	OFF
Read Ahead Segments	2	Maximum Dirty Threshold	84%
Cache On/Off	On		

Use the **ARROW KEYS** to change fields, the **SPACE BAR**
to select options, the **ESC** key to exit and **F10** to save.

UltraStor BIOS Setup Menu

The drive parameters are obtained by inquiring the ESDI drive. Each drive can be configured to have a different Sector Mapping or Track Mapping than the other.

One Space Sector/Track:

NO: No spare sector per track is allocated. All sectors are used for data.

YES: Drive is formatted to have a spare sector per track. The controller will automatically relocate a bad sector on that track to a spare sector. Thus, creating a defect-free drive (for drive with only one defect per track).

NOTE: Low level format is required if this option is changed.

Sector Mapping:

NO: No Sector Mapping will be performed. The disk's physical parameters will be used.

17: 17 Sector Mapping will be performed. This is used to run any software which fixes the sectors per track to 17.

32: 32 Sector Mapping will be performed. This option is an alternative to the 63 Sectors Mapping in the event that the application software cannot function with a large sector per track number (e.g. PC-DOS version 3.2 with a drive having more than 1024 cylinders).

63: 63 Sector Mapping will be performed. This option is used when the drive has over 1024 cylinders and less than 528MB capacity. This option allows users to get around the 1024 cylinder AT system BIOS limitation and utilize the full capacity of the drive (up to 528 MBytes). This option must be turned on for drives with more than 63 sectors per track.

Track Mapping:

NO: No Track Mapping will be performed.

≤ 1.2GB: Track Mapping is performed to overcome the AT interface limitation under DOS of 528MB and the drive connected is above 528MB and under 1.2GB. With this option, the user will be able to use drives that are greater than 528MB without any third party software. This cannot be used under Novell, or Unix/Xenix operating systems. See the appropriate O.S. installation in this manual.

>1.2GB: Track Mapping is performed to overcome the AT interface limitation under DOS of 528MB when the connected drive is over 1.2GB. With this option, the user will be able to use drives that are greater than 528MB without any third party software. This cannot be used under Novell, or Unix/Xenix operating systems. See the appropriate O.S. installation in this manual.

1024 Cyl Truncation:

NO: 1024 Cylinder Truncation will not be performed.

YES: Cylinder number will be truncated to 1024 to allow operating systems that cannot use Track Mapping to overcome the 1024 cylinder limitation. This is used in OS/2 applications to achieve a maximum of 528MB drive capacity. UltraStor's OS/2 device driver will be needed to achieve more than 528MB disk capacity.

More than 2 Drives For DOS 5.0 or later:

NO: DOS 5.0 or later is not used. The maximum number of drives supported in a system with DOS versions below 5.0 is 2 (even with 2 controllers).

YES: DOS 5.0 or later is used. The maximum number of drives supported in a system with DOS version 5.0 or later is 4 (with 2 controllers).

NOTE: The "More than 2 Drives for DOS 5.0 or Later" option will only

appear if the ULTRA 22CA is configured as the secondary controller.

Caching Factors

Operating Systems:

Different operating systems have their own distinct characteristics. The caching parameters are adjusted according to the operating system used. Options of DOS, Xenix, Unix, OS/2, Novell and others are provided for user selection.

Segment Size:

A Segment is a caching unit which consists of a cluster of sectors. This caching segment is used to maintain UltraStor's caching data structure. Depending on the user application and file structure of a program, the size of the segment can be specified by users as: 1K, 2K, 4K, 8K, 16K, or 32KBytes. A default value will be used for a specified operating system selected.

In general, choosing a smaller segment will increase the efficiency of memory usage and a larger one will decrease it, but it depends on how fragmented the data is on the disk. If the disk files are fragmented and/or are small, then a segment size to match the operating systems cluster size is desirable. If the disk files are large and/or contiguous physically on the disk, then a larger segment size is recommended for better performance.

Readahead Segments:

The number of segments to be read ahead can be selected as 0, 1, or 2 segments. A default value will be selected as part of UltraStor's caching parameters to maximize the I/O performance.

When readahead is enabled and Cache ON/OFF is set to ON, the controller will read in additional sectors that follow the next requested sectors. This is done in anticipation that the next requested sectors may be the sectors following the current request. Many application programs retrieve data from files by issuing 1 sector read command. Read ahead will benefit this greatly, especially if the file is physically contiguous on the disk.

Read ahead may be terminated before it is completed, if the next request is not partly or wholly in the read ahead range. Under this condition, we would rather terminate it and service the new request.

Cache On/Off:

ON: The intelligent caching algorithm is turned on to provide a maximum cache hit to increase I/O performance.

OFF: Turning off the intelligent caching algorithm.

Cache Buffer Size:

The size of the cache buffer installed on the ULTRA 22C will be displayed. This parameter is automatically detected from the controller.

Deferred Write:

OFF: Turn off deferred write. If "OFF", all writes are written directly to the disk.

ON: Write back caching is activated. All write files will be cached and files will be written to the disk whenever the ULTRA 22CA is in idle mode or the maximum dirty threshold has been reached. The processing of the deferred write does not interfere with the host's new command because the deferred write is done in the background.

```
+----------------------------------------------------------+
|                          NOTE                            |
|                                                          |
|  The  Deferred  write  feature  must  be  turned off during |
|  installation  of  any  operating  system  and surface scanning |
|  under  Novell  or  other  operating  system. It may be turned |
|  "ON"  once  the  installation  and  surface analysis have been |
|  completed.                                              |
+----------------------------------------------------------+
```

Maximum Dirty Threshold:

Maximum percent of cache memory being allocated to cache the write data. When this maximum has been reached, the data will all be written to the disk. However, the write data will automatically be written to the disk whenever the system is in idle mode, regardless of the dirty threshold limit. The percentage of maximum dirty threshold to be selected is 12%, 24%, 36%, 48%, 60%. 72%, or 84%.

5.1.2 Hard Disk Drive Preparation Menu

Once the drive parameters have been set up according to the instructions in Section 5.1.1 above, the drive is ready to be low level formatted according to the following procedure:

a.   Hit "F10" key to save the drive parameters set earlier in the BIOS Setup Menu.

b.   Hit "F5" key to confirm. This will record the drive setup information into

the disk and the system will go through a re-boot process.

c.   After system bootup is complete from drive "A" (DOS System disk is in drive A), load **DEBUG** program (or SID for DR DOS) from floppy drive "A" by typing:

>   **DEBUG** after the **DOS** prompt "A" sign

d.   Once in the **DEBUG** program, following the prompt "-" sign, type the appropriate BIOS address to which the board is jumpered.

EXAMPLE

g=C800:5 (if the board is configured to C800:0) **OR**

g=CC00:5 (if the board is configured to CC00:0)

e.   The UltraStor "Utility Main Menu" will appear on the screen (See Figure 3.0).

f.   Select the "Drive Preparation" option by using the up/down arrow keys and press "Enter".

g.   The "Hard Disk Drive Preparation Menu" will appear on the screen (as shown in Figure 5.0).

FIGURE 5.0

<table>
<tr><td colspan="7" align="center">**HARD DISK DRIVE PREPARATION MENU**</td></tr>
<tr>
<td>**Drive**
0</td>
<td>**Interleave**
1</td>
<td>**HdSkew**
2</td>
<td>**CylSkew**
16</td>
<td>**AutoFormat**
Brief</td>
<td>**DefectList**
Retrieve</td>
<td>**Primitives**
Verify</td>
</tr>
<tr>
<td>**Drive**
0</td>
<td>**Cylinder**
1457</td>
<td>**Head**
16</td>
<td>**Sector**
57</td>
<td>**Precomp**
NONE</td>
<td>**Landing Zone**
1457</td>
<td>**Capacity(MB)**
679,4</td>
</tr>
<tr>
<td colspan="7" align="center">**DEFECT LIST**
HD/CYL/SC/BFI/LEN   **HD/CYL/SC/BFI/LEN**   **HD/CYL/SC/BFI/LEN**</td>
</tr>
</table>

Use **ARROW KEYS** to change fields, **SPACE BAR** to select options, **ESC** key to exit, **RETURN** key to execute, and **F1** to pause or continue.

Hard Disk Drive Preparation Menu

Drive: Choose Drive 0 or Drive 1 to be prepared.

Interleave: Interleave can be programmed from 0 to 9.
> *NOTE:* Interleave 0 and 1 both provide 1:1 interleaving.

HdSkew: Head skew can be programmed from 0 to 25. Head skew 0 means no head skew will be performed. The default value shown is calculated and maximized according to the ESDI drive connected.

CylSkew: Cylinder skew can be programmed from 0 to 25. Cylinder skew 0 means no cylinder skew will be performed. The default value shown is calculated and maximized according to the ESDI drives connected.

AutoFormat: This option will perform automatic format procedure on the drive. Four options are provided: "Brief", "Extended", "Brief-N", and "Extended-N" formatting.

> **Brief:** Selecting the Brief AutoFormat will instruct the controller to do the following steps automatically:
>
> *   Retrieve the drive defect list from the ESDI drive.
>
> *   Low Level format the entire drive.
>
> *   Format the factory defects as bad sectors.
>
> *   Verify the entire drive and record any additional grown bad spots.
>
> *   Store the grown defect list discovered during drive verification.
>
> *   Format the grown defects as bad sectors.
>
> **Extended:** The Extended version of AutoFormat will use the write and verify command instead of the verify command, as in the Brief AutoFormat. The rest of the sequence and the commands are the same as in the Brief AutoFormat. Because the controller will write a few different patterns to the drive and verify each pattern, the Extended AutoFormat will take much longer to prepare the drive.
>
> **Brief-N:** This option will perform all the steps as in "Brief" but will also perform the following:
>
> *   Scan the entire disk and create the defect list structure compatible with Novell.
>
> **Extended-N:** This option will perform all the steps as in "Extended" but will also perform the following:

* Scan the entire disk and create the defect list structure compatible with Novell

---

A feature to speed up and ease Novell 286 COMPSURF installation is provided. This UltraStor feature enables the user to perform Novell COMPSURF in minutes rather than hours. After the disk has been prepared using the "-N" options (in the AutoFormat or Primitive field), run COMPSURF and answer the questions as described below:

Format the Disk	No
Maintain the Current Media Defect List	Yes
Number of Sequential Passes	1
Number of I/O Random Test	"Enter" To Use Default
Are the Parameters Correct	Yes

After COMPSURF has initialized track 0, the user may press Alt +F10 to terminate the lengthy scanning process. Continue by executing Netgen to install Novell

---

Defect List: The user can manipulate the defect list manually, if so desired. The defect list field allows the user to retrieve the defect list from the ESDI drive, add a defect entry, delete a grown defect entry, store the manually entered grown defect list to the drive, and clear the screen.

> **Note:** *If a defect location +/- 15 bits around it falls between 2 sectors, BOTH sectors will be marked as bad. Thus, it is possible for the controller to report more defect sectors than the number of defects shown on the drive, even with no grown defects found. This extra precaution is designed to provide a more reliable defect free drive.*

Retrieve: Retrieve the factory defect list and the grown defect list (if any) from the drive.

Add Entry: Add more defects to the original list.

Del Entry: Delete a grown defect list entry. Users cannot delete the original factory defect list. Only the grown defect list can be deleted.

Store: Store the defect list shown on the screen to the drive.

ClrEntries: Clear defect entries on the screen.

Primitives: This option allows the user to get into the low level disk functions.

Format: Low level format of the entire disk.

Wrt & Vrfy: Write and verify command. Controller will write a few data patterns to the drive and verify each pattern.

Verify: The controller will verify the data integrity of the drive.

LockDefect: Lock defect command will take the defect list information on the screen and map out those defects from the drive. They are formatted as bad sectors.

Scan-N: This option will scan the entire disk and create the defect list structure compatible with Novell.

5.2   DOS Installation

There are 2 EPROMs on the ULTRA 22CA for the 16 bit BIOS code. The on-board BIOS will hook the system disk I/O service routine (INT 13) to the ULTRA 22CA EISA disk I/O service routine after system power on and before booting the operating system. After boot up, the controller is operated under EISA bus master mode.

After the drive has been successfully low level formatted, the operating system needs to be installed. For most users, run the FDISK program first, then run the FORMAT program under DOS. DOS 3.2 and below have a partition limit of 32 MBytes per drive, but DOS 4.01 and above do not have this limitation. Using third party disk partition software will overcome this limitation. Consult your DOS manual for installing the operating system.

The BIOS supports up to 2 hard disks under DOS 4.01 or prior versions, and up to 4 hard disks under DOS 5.0 and above.

5.2.1 Virtual DMA Service Support

There are two files in the ULTRA 22 Family "Utilities & Device Driver For DOS/OS2/ NetWare" diskette for support of virtual DMA service.

UVDS.SYS: used as a device driver in the CONFIG.SYS

UVDS.COM   used as a TSR program in DOS command line

The selection of which program to use is up to the user's preference and is application specific.

The purpose of UVDS programs are:

1.   Replace the on-board BIOS to speed up the disk I/O service routine.

2. Provide the Virtual DMA Service for applications that use the 386/486 virtual mode operation.

3. Provide double buffering for applications that use the 386/486 virtual mode operation but do not support "Virtual DMA Service".

Since the on-board BIOS services the system hard disk activity, the performance of the disk controller may depend on the speed of the BIOS execution. Some of the EISA systems don't cache the add-on card BIOS memory, which not only slows down the execution of the command transaction but also introduces more overhead to the bus master data transfer over the EISA bus, since both BIOS instruction fetch and controller data transfer have to arbitrate for the same EISA bus. One alternate solution is to use the UltraStor DOS device driver UVDS program, which will replace the BIOS disk service routine and is resident in the system memory.

In addition, the UVDS also provides the function of virtual to physical address translation if the system is running in the virtual mode of 386/486.

If you are running applications such as MS Windows 286, MS Windows, or QEMM386 or 386MAX that use the virtual mode of the 386, the UVDS device driver will be needed. For MS Windows applications: if SMARTDRV.SYS is used, UVDS is not necessary, as SMARTDRV.SYS already handles double buffering. The UVDS supports the industry standard "Virtual DMA Service". If the application supports the virtual DMA service, such as QEMM386 version 5.0 and 386MAX version 4.08 or later, include this line in the CONFIG.SYS:

    device=UVDS.SYS

    OR, if the TSR version of UVDS is preferred, then include

    uvds   on the DOS command line

The UVDS.SYS and UVDS.COM are in the DOS directory in the diskette labeled "Ultra 22 Family EISA ESDI Disk Controller Utilities & Device Drivers (DOS/OS2/NetWare)".

Copy this file to the hard disk root directory or any other directory. If the UVDS.SYS is not in the root directory, a path must be specified in front of UVDS.SYS.

Please check the vendor of the application program to see if the "Virtual DMA Service" is supported.

If the application doesn't support the Virtual DMA Service, a virtual buffer should be allocated to overcome the virtual address problem with a controller using Bus Mastering data transfers. Include the following line in the CONFIG.SYS:

    device=UVDS.SYS/b

    OR, type the following if TSR version is preferred:

UVDS/b   in the DOS command line

to enable double buffering for the UVDS.

5.3   SCO UNIX System V/386 Release 3.2 Installation

Since the controller supports the ISA (task file registers) compatible mode, the installation of the UNIX operating system is the same as the installation using a regular ISA disk controller (Such as ULTRA 12F). Proceed with the operating system installation until the Basic Utilities and Extended Utilities have been installed.

> NOTE
>
> During the installation, the "Deferred Write" option needs to be turned off. After installation, the "Deferred Write" can be turned back on. Turning "Deferred Write" on and off can be done by running the UltraStor on-board BIOS setup utility by DOS debug.com. User should have a provision to guard against a sudden power loss when the "Deferred Write" feature is turned "ON". (i.e. UPS or battery backup.)

Skip the installation if you had UNIX installed using ULTRA 12F controller before. Reboot the system from UNIX. At this time the UNIX disk device driver still operated in the ISA mode. This can be verified by the device I/O location.

Device	Address	Vector
% disk	0x1F7 - 0x1F7	16

The following is the procedure to change the disk device driver to UltraStor's EISA disk device driver which allows running the controller in the EISA bus master mode.

1. Login as a superuser (root).

2. Change to tmp directory

   # cd/tmp

3. Insert the diskette labeled "ULTRA 22 Family EISA Disk Device Driver for SCO UNIX system V/386 Release 3.2", in drive A: and execute:

   # tar xvf/dev/fd048ds9   (for 360K diskette)

   # tar xvf/dev/fd0135ds9   (for 720K diskette)

   Files "Install", "Driver.0", "System", "Remove", and "Name", will be copied to the /tmp/hd directory.

4. Install and rebuild the UNIX kernel.

   a. For primary controller:

      # cd hd

      # ./Install

   b. For secondary controller:

      # cd wd1

      # ./Install

5. During installation, when asked for the interrupt number, type in the same IRQ number that was selected by the EISA configuration utility when configuring the ULTRA 22CA controller in the system. Selecting an incorrect IRQ number will cause unexpected installation failures.

6. You must relink your kernel to be able to use device "hd" (or "wd1"). Answer "Y" to rebuild the kernel now, and "Y" to boot the kernel by default, and "N" to rebuild the kernel environment.

7. After rebuilding the kernel, shut down the system:

   # shutdown

8. Reboot the system. The system will be running under EISA mode.

Device	Address	Vector
% disk	0xC80 - 0xCA0	17 (or 12, 13, 14)

If a second drive needs to be added to the UNIX system, proceed with the following steps:

1. Use the mkdev script file to create, partition and add file system for the second drive.

2. Run sysadmsh-> system -> hardware->hard disk to execute mkdev hd.

   · Select "1.ST506" (standard disk support) for the controller type.

   · Select "(2) Second" drive on this controller.

   · Select "(1) First" for ST506 primary controller.

3. The procedures for creating UNIX partitions, scanning the disk ,and creating file system can be found in detail in the "UNIX System Administration Manual".

```
┌─────────────────────────────────────────────────────────┐
│                          NOTE                           │
│                                                         │
│   Before making the file system, scanning the entire    │
│   UNIX partition is required for the kernel to record   │
│   all the defects (which were marked as bad sectors     │
│   by the controller low level format utility) in the    │
│   drive.                                                │
└─────────────────────────────────────────────────────────┘
```

4. Add the file system to the kernel

    Run sysadmsh -> filesystem -> add

5. Refer to "UNIX System Administration Manual" for detailed procedures.

5.4   AT&T UNIX System V/386 Release 3.2 Installation

This installation procedure for AT&T UNIX System V/386 Release 3.2 can be applied to other UNIX Operating Systems which are based on the AT&T version, such as INTEL UNIX and Everex ESIX version 5.3.2.

Since the controller supports the ISA (task file registers) compatible mode, the installation of the UNIX operating system is the same as the installation using a regular ISA disk controller (such as the ULTRA 12F). Install the operating system until the entire Base system foundation set has been installed.

```
┌─────────────────────────────────────────────────────────┐
│                          NOTE                           │
│                                                         │
│   During the installation, the "Deferred Write" option  │
│   needs to be turned off. After installation, the       │
│   "Deferred Write" can be turned back on. Turning       │
│   "Deferred Write" on and off can be done by running    │
│   the UltraStor on-board BIOS setup utility by DOS      │
│   debug.com. User should have a provision to guard      │
│   against a sudden power loss when the "Deferred        │
│   Write" feature is turned "ON". (i.e. UPS or battery   │
│   backup.)                                              │
└─────────────────────────────────────────────────────────┘
```

Skip the installation if you had UNIX installed using the ULTRA 12F controller. Reboot the system from the UNIX operating system. At this time, the UNIX disk device driver still operates in the ISA mode.

The following is the procedure to change the disk device driver to UltraStor's EISA disk device driver which allows running the controller in the EISA bus master mode as a primary controller:

1. Login as a superuser (root).

2. Run Installpkg utility

   # Installpkg

   Insert the "ULTRA 22 Family Disk Device Driver for AT&T UNIX System V/386 Ref 3.2 for the Primary Controller" diskette in the appropriate floppy drive as instructed by the Installpkg script.

3. The Installpkg will copy the ULTRA 22CA device driver to the hard disk and rebuild the UNIX kernel.

4. If the ULTRA 22C Disk Device Driver was installed previously, it needs to be removed by using Removepkg utility. Hit "ESC" to exit Installpkg and run Removepkg to remove the device driver.

   # Removepkg

   Rerun the Installpkg.

5. During installation, when asked for the Interrupt number, type in the IRQ number that was selected by the EISA configuration utility when configuring the ULTRA 22CA controller in the system. Selecting an incorrect IRQ number will cause unexpected installation failures.

6. Once the IRQ number has been selected, the system will rebuild the kernel. When it is completed, a shutdown will be initiated automatically.

7. Reboot the system. The system will now be running under the EISA mode.

5.5 Interactive UNIX Operating System Version 2.2 UNIX V/386 Release 3.2 Installation

Since the controller supports the ISA (task file registers) compatible mode, the installation of the ISC UNIX operating system is the same as the installation using regular ISA disk controller (such as ULTRA 12F). Install the operating system until at least the "core", and "Kernel Configuration" diskettes are installed.

NOTE

During the installation, the "Deferred Write" option needs to be turned off. After installation, the "Deferred Write" can be turned back on. Turning "Deferred Write" on and off can be done by running the UltraStor on-board BIOS setup utility by DOS

> debug.com. User should have a provision to guard against a sudden power loss when the "Deferred Write" feature is turned "ON". (i.e. UPS or battery backup.)

Skip the installation if you had UNIX installed using the ULTRA 12F controller. Reboot the system from UNIX. At this time, the UNIX disk device driver still operates in the ISA mode.

1. Login as a superuser (root).

2. Change to tmp directory

   # cd /tmp

3. Insert the "ULTRA 22 Family EISA Disk Device Driver for Interactive UNIX Operating System Version 2.2" diskette in drive A: and execute

   # tar xvf /dev/dsk/fod9dt   (for 360 diskette)

   Files "Master", "dconfig", "usc.h", "Install", "Files", "Size", "Driver.0", "System", "Remove", "space.dsk usc", and "Name" will be copied to the /tmp/hd directory.

4. Install and rebuild the UNIX kernel

   # cd usc

   # ./Install

5. "dconfig" provides two options:

   a. 1- Display High Performance Disk Driver Configuration

   b. 2- Configure High Performance Disk Driver

   Enter choice [1-2, q]

   Select option 2 to configure the ULTRA 22CA driver.

6. Answer "Y" when asked, "Is there a primary ULTRA 22CA controller?" (If the ULTRA 22CA is used as the primary port); and answer "Y" when asked, "Do you have a secondary ULTRA 22CA controller?" (If the ULTRA 22CA is used as the secondary port.)

7. During installation, when asked for the interrupt number, type in the IRQ number that was selected by the EISA configuration utility when configuring the ULTRA 22CA controller in the system. Selecting an incorrect IRQ number will cause unexpected installation failures.

8. Answer "Y" when asked, "IS THIS THE DESIRED CONFIGURATION?" Enter "q" to quit the DCONFIG main menu, and "Y" to save the modified system files in /etc/conf.

9. The system will rebuild the kernel using the newly configured device drivers and make the UNIX.1 (or UNIX.2 ...).

10. After the kernel has been rebuilt, answer "Y" to install the new kernel to the system; enter the number of seconds for shutdown user warning; answer "Y" to shutdown and reboot with the new kernel; and answer "Y" to "Do you want to continue?"

11. Reboot the system. The system will now be running under EISA mode.

5.6   NOVELL NetWare 386 Version 3.0 And 3.1x Installation.

Installation of the NetWare 386 for ULTRA 22CA is similar to the installation for an ISA disk controller. Instead of loading Isadisk.dsk for the ISA controller, load the U22_30.DSK (for version 3.0) or U22_31x.DSK (for version 3.1) driver during the NetWare Installation.

> ### NOTE
>
> During the installation, the "Deferred Write" option needs to be turned off. After installation, the "Deferred Write" can be turned back on. Turning "Deferred Write" on and off can be done by running the UltraStor on-board BIOS setup utility by DOS debug.com. User should have a provision to guard against a sudden power loss when the "Deferred Write" feature is turned "ON". (i.e. UPS or battery backup.)

1. Copy U22_30.DSK (or U22_31x.DSK) from "ULTRA 22 Family Utilities & Device Drivers for DOS/OS2/NetWare" in the NetWare directory to the NW386 "system" diskette(s) or the DOS partition in the hard disk that has the NW386 system files.

2. Type "server" to invoke NetWare Installation.

3. Enter the server name and the internal network number in the NOVELL SERVER program. Following the prompt ":", enter the following command to load the hard disk device driver for the primary controller.

   :load U22_30   (or U22_31x for version 3.1x)

Loading module U22_30.DSK

ULTRA 22CA as primary port in slot N1 has been loaded.

4. Reload the U22CA loadable device module for secondary (if applicable)

    :load U22_30   (or U22_31x for version 3.1x)

    Loading module U22_30DSK

    ULTRA 22CA as secondary port in slot N2 has been loaded.

5. Load NetWare 386 "INSTALL" module

    :LOAD INSTALL

    This invokes the system installation options. The drives that are attached to the ULTRA 22CA controllers will be shown under the drive options.

    Proceed with the NetWare 386 installation procedures to do the partitioning, mirroring, mounting, volume creation, and surface testing of the hard disk drives.

    NOTE: Please refer to the NOVELL NetWare 386 installation guide.

5.7   OS/2 Version 1.2 or Later Installation.

The device driver supports the IBM OS/2 1.2 or later and standard OEM edition of MS OS/2 1.21 or later. Some OEMs may modify their version of OS/2 and make the procedures listed below incompatible. If unforeseen problems occur, contact the OEM supplying OS/2.

The device driver for OS/2 version 1.2 supports two controllers with up to 4 ESDI drives. One controller should be setup as the primary port and the other as the secondary port.

Support for LAN MANAGER 2.0 is available only with OS/2 version 1.21 or later.

The replacement procedure for the OS/2 device driver works with IBM OS/2 1.2 or later and the standard OEM MS OS/2 version 1.21 or later.

If the OS/2 operating system has been installed using the ISA controller, the only step needed is to copy the disk01.sys from the directory of "OS2" in the diskette labeled "ULTRA 22 Family Utilities & Device Drivers for DOS/OS2/NetWare" to the C: drive root directory. When the system is rebooted, the OS/2 will use the ULTRA 22 disk01.sys for disk service which will be running the controller in the 32 bit bus master mode.

```
                        NOTE

During the installation, the "Deferred Write" option needs to be
turned off. After installation, the "Deferred Write" can be turned
back on. Turning "Deferred Write" on and off can be done by
running the UltraStor on-board BIOS setup utility by DOS
debug.com. User should have a provision to guard against a
sudden power loss when the "Deferred Write" feature is turned
"ON". (i.e. UPS or battery backup.)
```

1. Procedures for OS/2 Version 1.2 or later with 3-1/2" diskette are:

    a. **"IMPORTANT!!!"** Back up the original OS/2 "Installation" diskette
        and use the backup copy of the diskette to do the following.

    b. Replace the OS/2 ISA disk device driver with UltraStor's device driver
        by copying OS2\disk01.sys from "Ultra 22 Family Utilities & Device
        Drivers for DOS/OS2/NetWare" diskette to the OS/2 "Installation"
        diskette.

        EXAMPLE:

        A>copy a:OS2\disk01.sys b:

    c. Boot the system with the modified "Installation" diskette in drive A:.

    d. Proceed with the normal OS/2 installation.

        NOTE: Please refer to the OS/2 Installation Guide.

2. Procedures for OS/2 Version 1.2 or later with 5-1/4" diskette.

    NOTE: If the original OS/2 "Installation" diskette contains the file
    "Disk01.sys" (such as IBM OS/2 v1.3), follow the procedures for 3-1/2"
    diskettes, or proceed with the following.

    a. **"IMPORTANT!!!"** Back up the original OS/2 "Installation" diskette
        and use the backup copy of the diskette to do the following.

    b. Because the "Installation" diskette does not have enough space to
        accommodate the UltraStor device driver, performance of the following
        steps will offer ease of installation.

    c. Copy all *.RC@ files and FDISK.COM to a temporary diskette.

    d. Delete all *.RC@ files from the "Installation" diskette to make room
        for UltraStor's device driver "disk01.sys".

e. Copy OS2\disk01.sys from UltraStor's "ULTRA 22 Family Utilities & Device Drivers for DOS/OS2/NetWare" diskette to the OS/2 "Installation" diskette.

Example:

A>copy a:OS2\disk01.sys b:

f. Boot the system with the modified "Installation" diskette in drive A:.

g. Proceed with the normal OS/2 Installation by inserting operating diskettes 1, 2, 3, 4, and 5, until asked to insert the "Installation" diskette.

h. Before inserting the "Installation" diskette,

   1) Delete FDISK.COM from the "Installation" diskette.

   2) Restore all the *.RC@ files from the temporary diskette to the "Installation" diskette.

   3) Insert the "Installation" diskette to complete the installation.

i. After completion of the OS/2 Installation, you may want to restore the "Installation" diskette by:

   1) Deleting UltraStor's disk01.sys.

       AND

   2) Restoring files *.RC@ and FDISK.COM from the temporary diskette.

3. Procedures for LAN MANAGER Version 2.0 (with 3-1/2" diskette).

   There are two steps for installing the LAN MANAGER file server.

a. OS/2 installation: (LAN MANAGER works only with OS/2 V1.21 or later).

   1) **"IMPORTANT!!!"** Back up the original OS/2 "Installation" diskette and use the backup copy of the diskette to do the following.

   2) Replace the OS/2 ISA disk device driver with UltraStor's device driver by copying OS2\disk01.sys from UltraStor's "ULTRA 22 Family Utilities & Device Drivers for DOS/OS2/NetWare" diskette to the OS/2 "Installation" diskette.

   Example:

   A>copy a:OS2\disk01.sys b:

3) Boot the system with the modified "Installation" diskette in drive A:. Proceed with normal OS/2 installation.

4) In "Preparing the Fixed Disk" menu, select "Specify your own partition", if you intend to use the disk duplexing function. If there are only two hard disks in the system, either "Accept predefined partition" or choose the maximum size for the primary partition which will prevent disk mirroring setup. The "Accept predefined partition" option will create a single boot partition on the entire drive 0 and the boot partition <u>cannot</u> be mirrored under LAN MANAGER Version 2.0.

5) In the "Select the File System" menu, select "High Performance File System". <u>Only</u> the "High Performance File System" allows the disk duplexing function. Proceed to complete the OS/2 installation.

b. LAN MANAGER Installation.

1) After the OS/2 system is installed successfully, reboot the system.

2) Insert Disk 1 LAN MANAGER "OS2-SETUP" diskette in drive A:. Go to OS/2 Full Screen and type

   A:SETUP

   Hit "Enter" and follow LAN MANAGER installation.

3) In the "Install LAN MANAGER" menu, select "Server" option and follow the installation instructions.

4) Please refer to LAN MANAGER documentation for the detailed LAN MANAGER installation description.

c. Fault Tolerance Setup.

1) After LAN MANAGER is installed successfully, go to the OS/2 window. Run "FDISKPM" for partition creation and run "FTSETUP" for Fault-Tolerance System Setup.

   Please refer to LAN MANAGER documentation for the detailed descriptions.

6.0 Cache RAM Upgrade

The ULTRA 22CA uses a standard off the shelf DRAM SIMM module for the cache memory. Any 256KB, 1MB or 4MB SIMM module configuration with <u>80ns speed</u> can be used to upgrade or install on the board.

The SIMM memory module should be installed in pairs starting from slot 1 and 2 (at location U88 and U89) for the board to operate. Slot 1 at location U88, is the slot closest to the EISA bus edge connector (See FIGURE 1.0).

Different SIMM module types can be mixed as long as the SIMM type on Slots 3 and 4 have a higher memory configuration than the ones installed in Slots 1 and 2. The ULTRA 22CA supports up to 16MBytes of cache memory on the board.

Below is the acceptable cache memory configuration:

256KB <u>SIMM pair to start in Slots 1 and 2:</u>

Slot 4 (U91)	Slot 3 (U90)	Slot 2 (U89)	Slot 1 (U88)	Cache Memory Size
		256KB	256KB	512KB
256KB	256KB	256KB	256KB	1MB
1MB	1MB	256KB	256KB	2.5MB
4MB	4MB	256KB	256KB	8.5MB

1MB <u>SIMM pair to start in Slots 1 and 2:</u>

Slot 4 (U91)	Slot 3 (U90)	Slot 2 (U89)	Slot 1 (U88)	Cache Memory Size
		1MB	1MB	2MB
1MB	1MB	1MB	1MB	4MB
4MB	4MB	1MB	1MB	10MB

4MB <u>SIMM pair to start in Slots 1 and 2:</u>

Slot 4 (U91)	Slot 3 (U90)	Slot 2 (U89)	Slot 1 (U88)	Cache Memory Size
		4MB	4MB	8MB
4MB	4MB	4MB	4MB	16MB

7.0   Trouble Shooting Guide

The following are the most often encountered problems and solutions that may be helpful in solving your problems. Please check them before calling your vendor for technical assistance.

Wrong Drive Parameters

If parameters for the attached drive(s) in Drive Parameter Setup Menu are shown as "None 0 0 0 0 0" upon entering the menu:

1. Check cable connections (refer to Section 4.3).

2. Check drive select jumper on the hard drive (refer to Section 4.1).

3. Check to see if the hard drive is set for "motor spin" at power up (Section 4.1).

4. If the above settings are correct, replace cables with a new set of cables, (both the 34 pin and the 20 pin cable).

Add-On Card Conflict with ULTRA 22CA

If a conflict exists with other add-on cards (video cards, network cards, or another hard disk controller) and the ULTRA 22CA, the symptoms are:

1. System "hangs" upon power up, or;

2. Debug cannot access ULTRA 22CA BIOS utility:

   - Try to determine which cards have the conflict by the process of elimination. Leave the cards that have the conflict and the video card in the system only.

   - Then see section "Debug Hangs" for solutions.

Debug Hangs

   - Try to get a different controller BIOS address. Choose any of C800, D000, D800, CC00, D400, DC00 or C400. The second controller should have a higher BIOS address than the BIOS address chosen for the first controller.

   - Also see "Add-on Card Conflict".

Slow in Formatting OR Every Sector is Reported as Bad During Verify

   - Check to see that drive is set to hard sector mode.

   - Check to see that the drive's "sector per track" is set properly (Section 4.1).

Don't Achieve Capacity Under DOS

Check to see if the correct mapping option is selected according to the drive geometry and size. (See Appendix A, "Mapping Options for Drives Under Various Operating Systems".) If incorrect mapping options are chosen (backup data from hard disk, if necessary), delete all partitions that are already defined, then select and save the correct mapping options in the Parameter Setup Menu. Using FDISK, redo the drive partition and high level format.

Hints Regarding DiskManager and SpeedStor

* Running SpeedStor - use default parameter, reported from System INT 13 "Read Drive Parameter" by running SSTOR/NOTYPE. Install SpeedStor Device Driver by running ADDEVICE/NOTYPE.

* Running DiskManager - use Manual Mode by DM/M.

* Do <u>NOT</u> perform low level format for either DiskManager or SpeedStor.

Operating System or System BIOS Error Messages

* "Hard Disk Failure" - this message is displayed if the drive is unformatted.

* "Shadow RAM error at 3E00" - try different BIOS address at D000, D800, (See Debug Hangs).

* "Error accessing Hard Disk Controller" during NOVELL or UNIX installation; make sure Track Mapping is disabled in UltraStor Drive Parameter Setup Menu.

* "Invalid Hard Disk Controller Failure"- Check jumper settings on the controller.

APPENDIX A

Changing from ULTRA 22C to ULTRA 22CA

If you have a system with ULTRA 22C already installed and you want to change it to ULTRA 22CA, please perform the following.

NOTE: Before changing the controller card, the device driver used by the operation system must be upgraded. Refer to the upgrade procedure below for the particular operating system you have installed.

DOS

1. Boot the system using the ULTRA 22C controller card.
2. Replace the old UVDS.SYS or UVDS.COM by copying UVDS.SYS or UVDS.COM from the \DOS directory in the diskette labeled "Ultra 22 Family EISA ESDI Disk Controller Utilities & Device Drivers (DOS\OS2\NETWARE) Version 1.01" to your hard disk.
3. Run system configuration and add the appropriate controller to your system. (See System Configuration below.)
4. Reboot the system using the new controller card.

OS/2

1. Boot to OS/2 using the ULTRA 22C controller card.
2. Replace the existing DISK01.SYS with the new one by copying the file from the \OS2 directory in the diskette labeled "Ultra 22 Family EISA ESDI Disk Controller Utilities & Device Drivers (DOS\OS2\NETWARE) Version 1.01" to your root directory.
3. Reboot to DOS and run system configuration to add the appropriate controller to your system. (See System Configuration below.)
4. Reboot the system using the new controller card.

NETWARE386

1. Boot up using ULTRA 22C to DOS.
2. Change the file U22C_30.DSK (or U22C_31.DSK for version 3.1x) by copying the file U22C_30.DSK (or U22C_31.DSK for version 3.1x) from the \NETWARE directory in the diskette labeled "Ultra 22 Family EISA ESDI Disk Controller Utilities & Device Drivers (DOS\OS2\NETWARE) Version 1.01" to the hard disk.
3. Change the STARTUP.NCF file to contain the appropriate file to start up the server, i.e. U22_30 for version 3.0 or U22_31x for version 3.1x.
4. Run system configuration to add the desired card to the system. (See System Configuration below.)

5. Reboot using the new controller card.

SCO UNIX

1. You must reinstall the EISA device driver and reconfigure the kernel.
2. Boot to UNIX using the ULTRA 22C
3. Login as a superuser (root).
4. Change to tmp directory

   # cd /tmp

5. Reload the EISA device driver by inserting the diskette labeled "Ultra 22 Family EISA Disk Device Driver For SCO UNIX SYSTEM V/386 Release 3.2 Version 1.01" in drive A: and execute

   # tar xvf /dev/fd048ds9(for 360K diskette)

   OR

   # tar xvf /dev/fd0135ds9   (for 720K diskette)

6. See section 5.3, SCO UNIX System V/386 Release 3.2 Installation in this manual for details on EISA device driver installation.
7. After the new driver has been installed, be sure that you relink the kernel so that the new device "hd" (or "wd1") will be used.
8. Shutdown the system and reboot to DOS.
9. Run system configuration to add the desired card to the system. (See System Configuration below.)
10. Reboot using the new controller card.

AT&T UNIX

1. Boot to UNIX using ULTRA 22C.
2. Login as a superuser (root).
3. You must remove the existing EISA device driver before you can reinstall the new EISA device driver. Type

   # removepkg

4. Rerun the installpkg utility to install the new driver

   # installpkg

   Install, the diskette labeled "Ultra 22 Family EISA Disk Device Driver For AT&T UNIX SYSTEM V/386 Release 3.2 for the Primary Controller Version 1.01" into the appropriate floppy drive.

5. See section 5.4, AT&T UNIX System V/386 Release 3.2 Installation in this manual for more details.
6. After the installation is completed, reboot the system to DOS.

7. Run system configuration to add the desired card to the system. (See System Configuration below.)
8. Reboot using the new controller card.

Interactive UNIX

1. You must reinstall the EISA device driver and reconfigure the kernel.
2. Boot to UNIX using the ULTRA 22C
3. Login as a superuser (root).
4. Change to tmp directory

   # cd /tmp

5. Insert the diskette labeled "Ultra 22 Family EISA Disk Device Driver For Interactive UNIX OS Version 2.2 System V/386 Rel 3.2 Version 1.01" in drive A: and execute

   # tar xvf /dev/dsk/f0d9dt   (for 360K diskette)

6. See section 5.5, Interactive UNIX Operating System Version 2.2 UNIX V/386 Release 3.2 Installation in this manual for details on EISA device driver installation.
7. After the new driver has been installed, be sure that you relink the kernel.
8. Shutdown the system and reboot to DOS.
9. Run system configuration to add the desired card to the system. (See System Configuration below.)
10. Reboot using the new controller card.

System Configuration

1. Copy the appropriate configuration file(s) to the systemconfiguration utility diskette.
2. Configure the controller to the system by running:

   A:\>cf   <CR>(For MCS configuration utility)

   OR

   A:\>ptlecu   <CR>(For Phoenix configuration utility)

3. Shutdown the system and insert the selected card.

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APPENDIX B

Mapping Options for Drives Under Various Operating Systems

1) Select the corresponding drive choice (A, B, C, D, E) based on:

CYL=No. of cylinder SECT = No. of sector CAP =capacity of the hard disk

> **A = CYL<1024, SECT<63, CAP<528MB**
>
> **B = CYL>1024, SECT<63, CAP<528MB**
>
> **C = CYL>1024, SECT<63, CAP>528MB (≤1.2GB)**
>
> **D = CYL>1024, SECT>63, CAP>528MB (≤1.2GB)**
>
> **E = CYL>1024, SECT>63, CAP>1.2GB**

NOTE: It is not necessary to do low level formatting when the mapping option is changed; however, the FDISK and high level FORMAT are required. If the 1 spare/trk option is changed, low level format <u>must</u> be performed.

2) Select the operating system and choose the mapping options in the same column under drive choice.

DOS 3.3 or Above

	A	B	C	D	E
1 spare/trk	No	No	No	No	No
sect map	No	63	No	63	63
track map	No	No	≤1.2GB	≤1.2GB	>1.2GB
1024 trunc	No	No	No	No	No

OS/2 1.1, 1.2, 1.3:

	A	B	C	D	E
1 spare/trk	No	No	No	No	No
sect map	No	63	63	63	63
track map	No	No	No	No	No
1024 trunc	No	No	Yes	Yes	Yes

Without UltraStor OS/2 Device Driver
(Max capacity 528MB)

	A	B	C	D	E
1 spare/trk	No	No	No	No	No
sect map	No	63	No	63	63
track map	No	No	≤1.2GB	≤1.2GB	>1.2GB
1024 trunc	No	No	No	No	No

With UltraStor OS/2 Device Driver
(To break 528MB Limitation)

UNIX Group (1)

	A	B	C	D	E
1 spare/trk	No	No	No	No	No
sect map	No	No	No	63	63
track map	No	No	No	No	No
1024 trunc	No	No	No	No	No

AT&T UNIX 3.2.2, SCO UNIX 3.2, 3.2.2
SCO XENIX 2.3.2, Intel UNIX 3.2
and ESIX 3.2 Interactive UNIX 2.2

UNIX Group (2)

	A	B	C	D	E
1 spare/trk	Yes	Yes	Yes	Yes	Yes
sect map	No	63	63	63	63
track map	No	No	No	No	No
1024 trunc	No	No	Yes	Yes	Yes

Interactive UNIX 2.02

NOVELL 286 Group

	A	B	C	D	E
1 spare/trk	No	No	No	No	No
sect map	No	63	No	63	63
track map	No	No	No	No	No
1024 trunc	No	No	No	No	No

ELS Level I 2.12, ELS Level II 2.12, 2.15
Advanced NetWare 286 2.12, 2.15a
SFT NetWare 286 2.12, 2.15a, 2.15c, 2.2

NOVELL 386 Group

	A	B	C	D	E
1 spare/trk	No	No	No	No	No
sect map	No	No	No	63	63
track map	No	No	No	No	No
1024 trunc	No	No	No	No	No

NetWare 386 3.0, 3.1, 3.11

APPENDIX C

Installing the 3rd Floppy Drive

This document describes how to install the 3rd Floppy Drive on an UltraStor disk controller. Please note that UltraStor provides software to run the 3rd floppy under DOS only..

Part 1: Cable Requirement

Option 1: Single twisted cable

This method can be used only if the drive to be installed as the 3rd drive has drive select jumpers DS1, DS2, DS3, DS4(or DS0, DS1, DS2, DS3). The 3rd drive should be jumpered as DS4 (or DS3 if counting from DS0). Drive A & B should be jumpered as DS2 (or DS1 if counting from DS0). Drives that are jumpered permanently to DS2 (or DS1 for number counting from DS0) by the manufacturer cannot be installed using this method. The cable needed for this installation is shown in FIGURE 1 below. Users can take the standard twisted floppy cable and clamp an additional 34 pin header in between drive B and controller connection header.
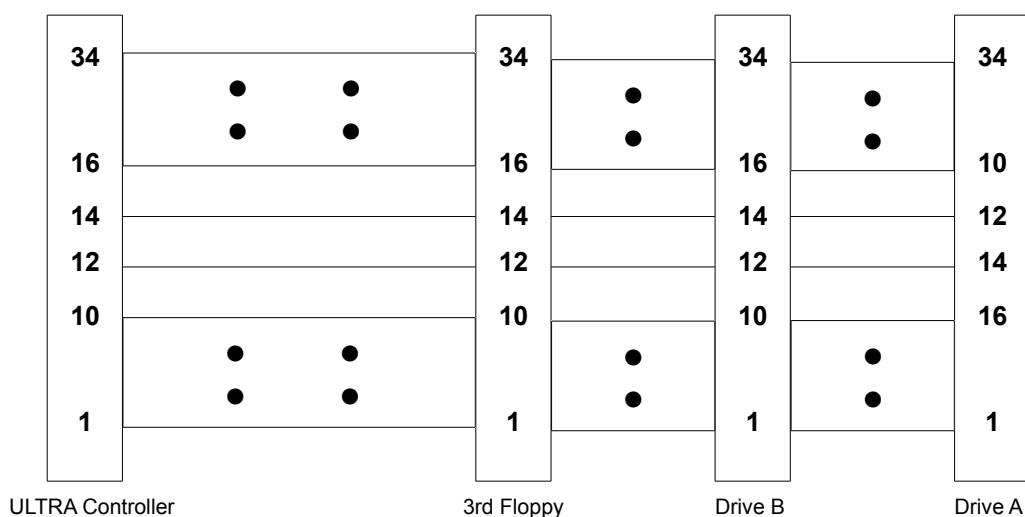

FIGURE 1

Option 2: Double twisted cable

This method, as shown in FIGURE 2, is for the drive that is to be used as the 3rd drive and is jumpered permanently to DS2 (or DS1 for number counting from DS0) by the manufacturer. All 3 drives have to be jumpered as DS2.
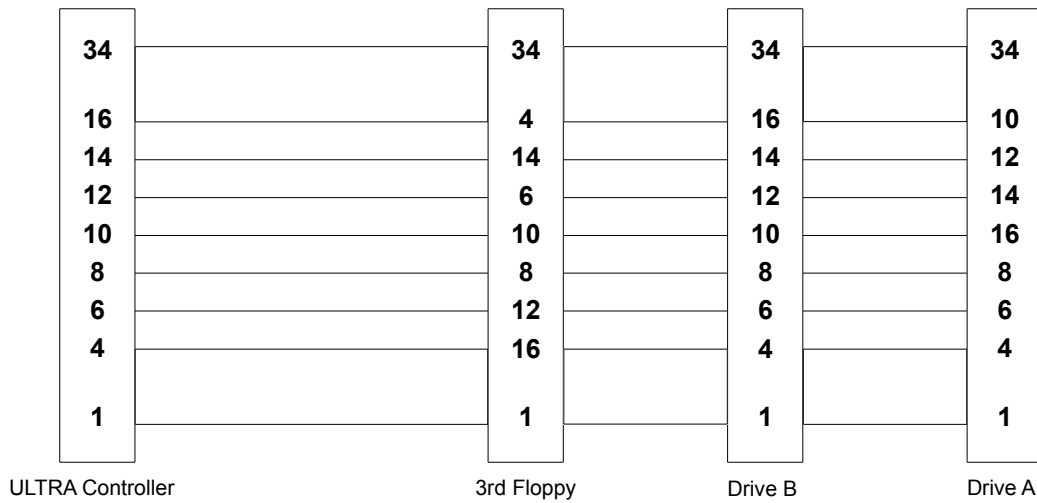
ULTRA Controller	3rd Floppy	Drive B	Drive A
34	34	34	34
16	4	16	10
14	14	14	12
12	6	12	14
10	10	10	16
8	8	8	8
6	12	6	6
4	16	4	4
1	1	1	1

FIGURE 2

Part 2: Hardware Setup

1. Select either option 1 or option 2 above and jumper the drive according to the option selected.

2. Take out the terminators in both the 3rd floppy drive and drive B. Leave the terminator in drive A only.

3. Jumper JP11 Pin 1-2 on the ULTRA controller if using single twisted cable. Remove JP11 Pin 1-2 if using double twisted cable.

4. Mount the drives in the computer according to the manufacturer's instructions.

5. Make sure that the power supply in your computer has enough power to support the 3rd floppy drive and connect the power cable to the 3rd drive. You may need a Y power cable if you have more than 4 drives (hard disk and floppy combined) in your system since most power supplies come with only 4 drive power cables.

6. Connect the 34-conductor ribbon cable to the 3rd floppy making sure that pin 1 of the cable is aligned with pin 1 of the connector on the drive.

7. Power up the computer and boot up the operating system.

Part 3: Software Setup

1. If the 3rd floppy drive is a floppytape type of drive and already has the tape backup/retrieve utility that is provided with the drive, no software setup is

necessary. The tape utility program will directly address the controller 3rd floppy hardware.

2. If the 3rd floppy drive is intended to be used in the DOS operating system as a logical block device, the following procedure is used to install the 3rd floppy device drive.

3. Copy DRIVER.SYS provided with DOS 3.2 and above, and the UltraStor 3rd floppy device driver file (EXFDRV.SYS) onto your usual boot drive.

4. Modify or create CONFIG.SYS by adding 2 lines shown below.

    DEVICE=EXFDRV.SYS /1:xx

    where xx =   1 for 360KB drive
                  2 for 1.2MB drive
                  3 for 720KB drive
                  4 for 1.44MB drive

    DEVICE=DRIVER.SYS /D:2/T:aa/S:bb/H:2/F:cc

    where aa =   40 for 360KB   bb = 9 for 360KB and 720KB
                  80 for all others   15 for 1.2M
                                           18 for 1.44MB

    And where

          cc =   0 for 360KB
                  1 for 1.2MB
                  2 for 720KB
                  7 for 1.44MB

    Refer to the DOS manual for detailed explanation on the usage of DRIVER.SYS.

5. Reboot the computer again. The computer will go through the normal boot procedure with 3 additional sign-on messages of the 3rd floppy BIOS and DRIVER.SYS as follows:

          EXFDRV V1.xx   (C) Copyright 1990

 UltraStor Corp.   Registered Number xxxxxx   Loaded External Disk Driver for Drive "?"

 (where "?" is the next available drive letter assigned by DOS). The 3rd floppy is now ready to be used.

NOTES

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TLA 98388-00A
FW28130-001
BIOS 38100-003 – LOW   BIOS 38101-003 – HIGH

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