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# **ULTRASTOR CORPORATION**

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## **ULTRA 12C**

### **CACHING ESDI CONTROLLER**

### **INSTALLATION MANUAL**

REVISION B

8.1.91

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# ULTRASTOR CORPORATION

## ULTRA 12C Caching ESDI CONTROLLER

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## 1.0 Introduction

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This manual explains how to install the ULTRA 12C Caching ESDI (Enhanced Small Device Interface) and floppy disk controller. While emphasis is placed on PC's running MS-DOS, the requirements for other operating systems are noted and references given to application notes (some of which are included in this document). Please read this document before you install the controller; you may find references

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to application notes which will facilitate or simplify your particular installation. In general, if you are installing in a standard AT class machine operating under MS-DOS with one ULTRA 12C controller that has two ESDI drives and up to three floppy drives, the information contained in this document will be sufficient for a successful installation.

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

The ULTRA 12C is the second member of this performance oriented, highly featured ULTRA family of caching disk controllers. It provides intelligent caching up to 16MBytes of cache memory to make the mechanical drive "invisible" when a cache hit is achieved, providing multiple increases in I/O performance. It is completely AT register and BIOS compatible. It supports two high transfer rate ESDI drives, both of which can have different transfer rates of up to 20Mbits per second and supports 1:1 interleaving on the fastest of AT buses available (16MHz). It supports the largest selection of hard drives in the market today. The ULTRA 12C also supports any mix (5.25" and 3.5") of up to three floppy disk drives or floppy-tapes. (See Appendix B, Installing the 3rd Floppy Drive.) In addition to the special support to break the 1024 cylinder and the 528MB partition limits of DOS and OS/2, the ULTRA family of caching controllers will also co-reside with any other controller under DOS as well as another ULTRA controller to support dual channels and/or duplexing/mirroring in popular network operating systems.

## **2.0 Features**

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### **Intelligent Caching for Optimum Performance**

- \* 1MB of intelligent caching
- \* Cache memory to 16MBytes onboard
- \* Provides parity bit for data security
- \* Accommodates standard SIMM memory modules of 256KBx9, 1MBx9 and 4MBx9 configurations

### **AT Register And BIOS Compatible**

### **ULTRA Performance Provided By:**

- \* 20Mbits per second ESDI support.
- \* Cache optimized to individual operating system
- \* User upgradable to 16MB cache

- 
- \* 1:1 interleave capability even with 20Mbits per second ESDI drive.
  - \* Automatic optimization head skew.
  - \* Screen Edit programmable interleave factor.
  - \* Automatic optimization cylinder skew.
  - \* 16MHz I/O bus speed support.
  - \* 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**

**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**

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

**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 20MHz ESDI Drive**

**Jumper Disabling of Onboard Floppy Controller**

**Automatic Drive Preparation for Ease of Installation**

**Supports Four ESDI Drives Under UNIX/Novell or OS/2 (With Two Controllers) for Dual Channel Operation**

**56 Bit ECC Ensures Data Integrity**

### **3.0 Hardware Installation**

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

**Floppy Disk Drives:** Up to 3 floppy 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 (34 wire, #10-#16 in twist) or a special cable for 3 floppies, (See Appendix B, Installing the 3rd Floppy Drive).

**Computer:** A PC with a 16-bit AT(ISA) or 32 bit EISA bus slot. The PC's power

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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 disk drive.

The controller exchanges information with the PC through a range of memory addresses and through some "input/output ports." If the ULTRA 12C is going to be the system's only disk controller, the default values for these numbers will probably work just fine. If you wish to install it in addition to another controller, you will have to know the memory and port addresses that other controller uses and perhaps those used by other options installed in your PC; please refer to Appendix C, Co-Residence Installation.

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 caching controllers support many different operating systems and networks. Installation instructions for several of them are included in this document; In addition, UltraStor has several additional application notes available upon request (See Appendix G).

There are three steps in the hardware installation prior to inserting the ULTRA 12C into a system I/O slot:

1. Verify the ESDI drive jumper configuration.
2. Verify the controller jumper configuration.
3. Connect all the necessary cables.

**CAUTION**

Please take proper electrostatic discharge precaution  
when handling the board. Handle the product by  
the ends of the board.

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### 3.1 ESDI Drive Configuration

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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.

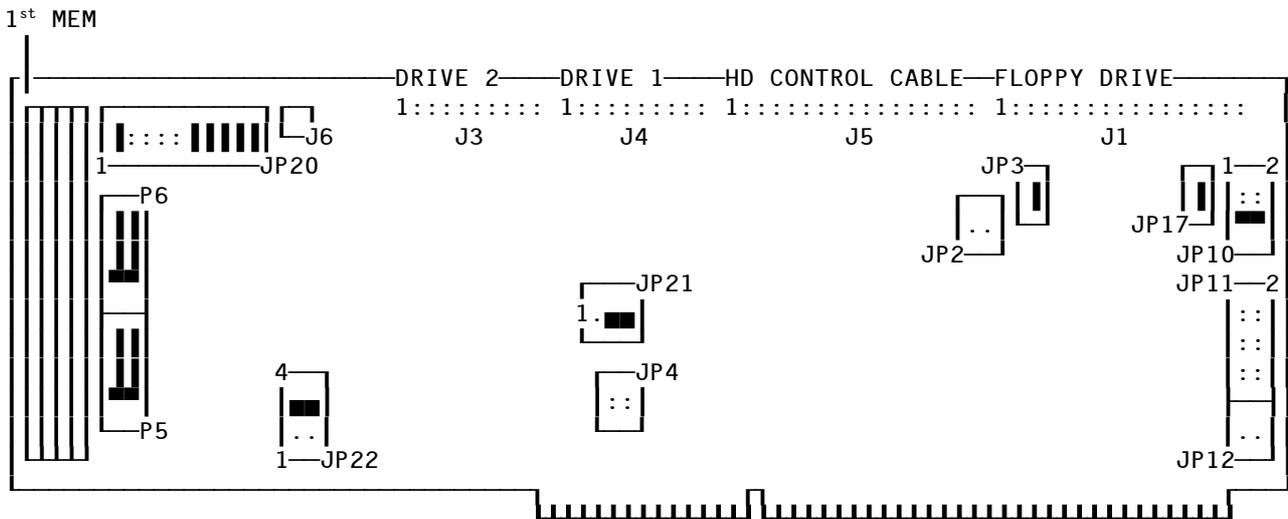
**Note:** A twisted 34 pin control cable is a 34 pin flat ribbon cable which has wires 25 through 29 twisted at one end of the cable.

- 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 rather than upon an ESDI spin-up command; generally the drive will come from the factory set to spin up upon power up.
- 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.

### 3.2 Controller Jumper Configuration

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Refer to Figure 1.0 for the board layout showing jumper locations on the board. Table 1.0 shows default factory jumper settings, and Table 2.0 shows controller jumper definitions.



**Figure 1.0 - ULTRA 12C BOARD LAYOUT**

**TABLE 1.0  
DEFAULT JUMPER SETTINGS**

JUMPER FUNCTION		ULTRA 12C
Factory Use	JP2	No Jumper
	JP3	Jumper
Reserved	JP4	No Jumper
	P5	See Figure 1.0 for jumper configuration
Battery Backup	P6	See Figure 1.0 for jumper configuration
	JP10	5-6
BIOS Address (C800:0)	JP11	No Jumper
Floppy Configuration	JP12	No Jumper
Hard Disk Primary Address	JP17	Jumper
Enable Floppy Controller	JP20	See Figure 1.0 for jumper configuration
Factory Use	JP21	2-3
IRQ14/15 Select	JP22	3-4
Cache Memory SIMM Configuration		

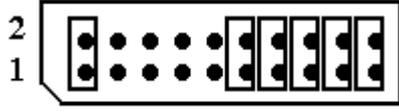
**TABLE 2.0**  
**JUMPER DEFINITION**

JUMPER NUMBER	DESCRIPTION																																								
JP2	OUT: Factory Use Only																																								
JP3	IN: Factory Use Only																																								
JP4	Reserved																																								
JP10	BIOS Address Setting:																																								
	<table border="0" style="width: 100%;"> <thead> <tr> <th style="text-align: center;">1-2</th> <th style="text-align: center;">3-4</th> <th style="text-align: center;">5-6</th> <th style="text-align: left;">BIOS Address</th> </tr> <tr> <th style="text-align: center;">----</th> <th style="text-align: center;">----</th> <th style="text-align: center;">----</th> <th style="text-align: left;">-----</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">OUT</td> <td style="text-align: center;">OUT</td> <td style="text-align: center;">OUT</td> <td>Disable BIOS</td> </tr> <tr> <td style="text-align: center;">OUT</td> <td style="text-align: center;">OUT</td> <td style="text-align: center;">IN</td> <td>C800:0</td> </tr> <tr> <td style="text-align: center;">OUT</td> <td style="text-align: center;">IN</td> <td style="text-align: center;">OUT</td> <td>CC00:0</td> </tr> <tr> <td style="text-align: center;">OUT</td> <td style="text-align: center;">IN</td> <td style="text-align: center;">IN</td> <td>D000:0</td> </tr> <tr> <td style="text-align: center;">IN</td> <td style="text-align: center;">OUT</td> <td style="text-align: center;">OUT</td> <td>D400:0</td> </tr> <tr> <td style="text-align: center;">IN</td> <td style="text-align: center;">OUT</td> <td style="text-align: center;">IN</td> <td>D800:0</td> </tr> <tr> <td style="text-align: center;">IN</td> <td style="text-align: center;">IN</td> <td style="text-align: center;">OUT</td> <td>DC00:0</td> </tr> <tr> <td style="text-align: center;">IN</td> <td style="text-align: center;">IN</td> <td style="text-align: center;">IN</td> <td>Disable BIOS</td> </tr> </tbody> </table>	1-2	3-4	5-6	BIOS Address	----	----	----	-----	OUT	OUT	OUT	Disable BIOS	OUT	OUT	IN	C800:0	OUT	IN	OUT	CC00:0	OUT	IN	IN	D000:0	IN	OUT	OUT	D400:0	IN	OUT	IN	D800:0	IN	IN	OUT	DC00:0	IN	IN	IN	Disable BIOS
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OUT	IN	OUT	CC00:0																																						
OUT	IN	IN	D000:0																																						
IN	OUT	OUT	D400:0																																						
IN	OUT	IN	D800:0																																						
IN	IN	OUT	DC00:0																																						
IN	IN	IN	Disable BIOS																																						

**NOTE:** Primary port address must use C800, D000, or D800. Secondary port address must use CC00, D400, or DC00. JP12 selects primary or secondary port.

JP11		Configure floppy controller
1-2	IN:	Support a third floppy drive with a single twisted cable. The drive should be jumpered as DS4.
	OUT:	Support a third floppy drive with a double twisted cable. The drive should be jumpered as DS2. (Assuming drive select begins with DS1 not DS0).
3-4	IN:	Drive 1 is configured for 3.5" PS/2 type or equivalent floppy drive. (PS/2 type has a different pin 2 polarity definition than the AT type floppy drive).
	OUT:	Drive 1 is configured for AT type floppy drive (Either 3.5" or 5.25").
5-6	IN:	Drive 0 is configured for 3.5" PS/2 type or equivalent floppy drive.
	OUT:	Drive 0 is configured for AT type floppy drive (Either 3.5" or 5.25").
7-8	IN:	Floppy secondary port address is 370-377.
	OUT:	Floppy primary port address is 3F0-3F7.
9-10	IN:	Dual speed floppy drive support.
	OUT:	Single speed floppy drive.

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11-12	IN:	Precompensation is fixed at 125ns for all data rates.
	OUT:	Precompensation varies according to floppy data rates; 250, 300, and 500KHz data rates have 250ns, 208ns, and 125ns precompensation each.
JP12	IN:	Hard disk secondary I/O port address is 170-77
	OUT:	Hard disk primary I/O port address is 1F0-1F7
JP17	IN:	Enable floppy controller.
	OUT:	Disable floppy controller.
JP20		Factory Use
		
JP21	1-2	IRQ15 select
	2-3:	IRQ14 select
JP22	Cache Memory SIMM Module Configuration	
	1-2	3-4
	SIMM Configuration	
	IN	IN
	256KBx9	
	OUT	IN
	1MBx9	
	IN	OUT
	4MBx9	

### 3.3 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 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 connectors.
- c. Connect the 20 pin flat ribbon cable from the first drive to the J4 connector on the controller. Connect another 20 pin flat cable from the second drive to J3 connector on the cable.
- d. Connect the 34 pin daisy chained floppy flat cable to the J1 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 J6 connector on the controller board.
- f. Remove the bracket from an empty expansion slot and use the bracket

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screw in step g.

- g. Insert the controller card into any AT slot in the system and secure the board with a bracket screw.

## 4.0 Software Installation

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There are three steps for software installation:

1. Low Level format using the ULTRA 12C onboard BIOS utility.
2. Disk Partitioning using the FDISK command under DOS.
3. High Level format or surface scanning using the operating system's format command.

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 jumpered.

### **EXAMPLE:**

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

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

- d. The UltraStor "Utility Main Menu" will appear on the screen (See Figure 2.0). 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".

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## 4.1 Low Level Format Using ULTRA 12C Onboard Utility.

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### 4.1.1 UltraStor BIOS Setup Menu.

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Before the low level format is executed, set up the drive parameters. Select the "Drive Parameter Setup" option from the main menu (Figure 2.0); the onboard utility will go into "UltraStor BIOS Setup Menu", as shown in Figure 3.0.

The onboard 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 5.0 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 uses fixed 17 sectors per track. The track mapping option is used for drives greater than 528MBytes under DOS.

The onboard 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 readahead segment amount.

NOTE

Deferred Write feature must be turned "OFF" during installation of operating system and surface scanning under Novell. It may be turned "ON" once the installation and surface analysis has been completed.

To enhance the performance further, the ULTRA 12C 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.

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

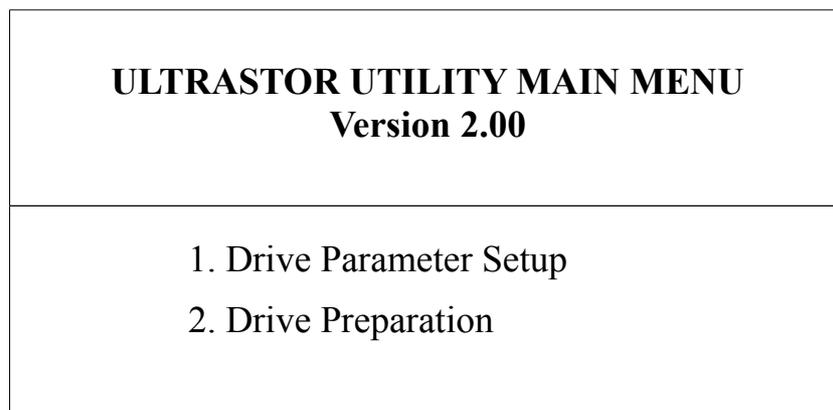
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combinations.

Please refer to Appendix A, 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 save the mapping option to the hard disk, then boot up again under DOS.

**FIGURE 2.0**



Use **Up/Down Arrow** keys to select, **Enter** key to execute, and **ESC** key to exit.

**FIGURE 3.0**

<b>UltraStor Bios Setup Menu (C) USC 1989</b>			
<b>Drive 0 Parameters</b>		<b>Drive 1 Parameters</b>	
Type	ESDI	Type	NONE
Cylinder	969	Cylinder	0
Head	9	Head	0
Sector	35	Sector	0
Precomp	65535	Precomp	0
Landing Zone	969	Landing Zone	0
One Spare Sector/Trk	NO	One Spare Sector/Trk	NO
Sector Mapping	NO	Sector Mapping	NO
Track Mapping	NO	Track Mapping	NO
1024 Cyl Truncation	NO	1024 Cyl Truncation	NO
<b>Caching Factors</b>		<b>Caching Buffer Size:</b>	<b>1024KB</b>
Operating System:	DOS	Deferred Write:	OFF
Segment Size:	32K	Maximum Dirty Threshold:	84%
Read Ahead Segments:	2		
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,

NOTE

Low level format is required if this option is changed.

---

creating a defect-free drive (for drive with only one defect per track).

### **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 any drive 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. UltraStor provides a device driver for OS/2 (See Appendix F).
- >1.2GB:** Track Mapping is performed to overcome the AT interface limitation under DOS of 528MB and 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, OS/2, or Unix/Xenix operating systems.

### **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

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capacity. UltraStor's OS/2 device driver (available through distributors) will be needed to achieve more than 528MB disk capacity.

## **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 are 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 read ahead 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:** To turn off the intelligent caching algorithm, a minimum of 256 KBytes of memory is still needed for data buffer.

**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 12C 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

NOTE

The Deferred write feature must be turned off during installation of operating system and surface scanning under Novell. It may be turned "ON" once the installation and surface analysis have been completed.

deferred write is done in the background.

**Maximum Dirty Threshold:**

Maximum percent of cache memory being allocated to cache the write data. When this maximum had 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%.

#### 4.1.2 Hard Disk Drive Preparation Menu

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Once the drive parameters have been set up according to the instructions in Section 4.1.1 above, the drive is ready to be low level formatted according to the following procedure:

- 
- a. 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

- b. 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 jumpered to C800:0) **OR**

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

- c. The UltraStor "Utility Main Menu" will appear on the screen (See Figure 2.0).
- d. Select the "Drive Preparation" option by using the up/down arrow keys and press "Enter".
- e. The "Hard Disk Drive Preparation Menu" will appear on the screen (as shown in Figure 4.0).
- f. Select the drive number to be low level formatted by using the arrow keys and the SPACE BAR. Users can also change the default value on interleave setup, head skew, and cylinder skew, before executing the low level format
- g. For most users, go to the AUTOFORMAT field to low level format the specified drive. Users can choose either the "Brief AutoFormat" or the "Extended Auto Format". The "Extended AutoFormat" will take longer to prepare the drive.
- h. For the advanced user or for certain applications, users can choose to bypass the AutoFormat and go to the disk controller commands for defect management and low level formatting (See Figure 4.0 for the option and command explanation).
- i. After the message "Format Complete", hit ESC key twice to get out of the low-level format utility.

**FIGURE 4.0**

<b>HARD DISK DRIVE PREPARATION MENU</b>						
<b>Drive</b>	<b>Interleave</b>	<b>HdSkew</b>	<b>CylSkew</b>	<b>AutoFormat</b>	<b>Defect List</b>	<b>Primitives</b>
<b>0</b>	<b>1</b>	<b>2</b>	<b>16</b>	<b>Brief</b>	<b>Retrieve</b>	<b>Verify</b>
<b>Drive</b>	<b>Cylinder</b>	<b>Head</b>	<b>Sector</b>	<b>Precomp</b>	<b>Landing Zone</b>	<b>Capacity(MB)</b>
<b>0</b>	<b>1457</b>	<b>16</b>	<b>57</b>	<b>NONE</b>	<b>1457</b>	<b>679.4</b>
<b>DEFECT LIST</b>						
<b>HD/CYL/SC/BFI/LEN</b>		<b>HD/CYL/SC/BFI/LEN</b>		<b>HD/CYL/SC/BFI/LEN</b>		

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.

<p style="text-align: center;">NOTE</p> <p style="text-align: center;">Interleave 0 and 1 both provide 1:1 interleaving.</p>
--

**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.

**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 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.

## 4.2 Disk Partitioning and High Level Format

---

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 3.3 and below have a partitioning limit of 32MBytes per drive partition. Using third party disk partitioning software will overcome this limitation. Consult your DOS manual for installing the operating system.

## 4.3 Novell and COMPSURF

---

A feature to speed up and ease Novell 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.

For additional details on Novell Installation, please refer to the Appendix Section of this installation guide.

#### **4.4 Cache RAM Upgrade**

---

The minimum cache RAM configuration for the ULTRA 12C is 256KBytes. However, it is user upgradable to a maximum of 16MBytes cache RAM onboard. The SIMM module memory type cannot be mixed on the board, therefore with the 4 available SIMM sockets on the ULTRA 12C, it is upgradable according to the following configuration:

- \* With 256KB x 9 SIMM module, it is upgradable to 1MByte
- \* With 1MB x 9 SIMM module, it is upgradable to 4MBytes
- \* With 4MB x 9 SIMM module, it is upgradable to 16MBytes

All the SIMM modules are standard off the shelf with 100ns speed. JP22 is the jumper to configure the SIMM module type used (please refer to Table 2.0 for jumper configuration). The memory module should be inserted from the left most slot first (the farthest slot away from the bracket) with the memory chip on the left hand side. (Please refer to Figure 1.0.)

#### **5.0 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 attaches drive(s) in Drive Parameter Setup Menu are shown as "None 0 0 0 0" upon entering the menu:

1. Check cable connections (refer to Section 3.3)
2. Check drive select jumper on the hard drive (refer to Section 3.1.a)
3. Check to see if the hard drive is set for "motor spin" at power up (Section 3.1.c).
4. If the above settings are correct, replace cables with a new set of cables, (both the 34 pin and the 20 pin cable).

##### **3rd Floppy Drive Installation (For DOS Only)**

---

Contact your vendor for the UltraStor 3rd floppy device driver "EXFDRV.SYS" and see Appendix B, Installing the 3rd Floppy Drive.

### **Tape Backup Unit Installation**

Please see Appendix B, Installing the 3rd Floppy Drive.

### **Add-On Card Conflict with ULTRA 12C**

If a conflict exists with other add-on cards (video cards, network cards, or another hard disk controller) and the ULTRA 12C, the symptoms are:

1. System "hangs" upon power up, or;
2. Debug cannot access ULTRA 12C 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 sections "Debug Hangs" and "Video Conflict" for solutions.

### **Debug Hangs**

- Try to get a different controller BIOS address. On jumper JP10, choose any of C800, D000, D800 for primary controller, any of CC00, D400, DC00 for the secondary controller.
- Also see "Add-on Card Conflict" and "Video Conflict".

### **Video Card Conflict**

- If using a different BIOS address (see Debug Hangs) does not solve the problem, try turning the VGA memory access to 8 bit mode.
- Contact your vendor for technical assistance.

### **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 3.1.e).

### **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.

---

## **Don't Achieve Full Capacity Under OS/2 1.1, 1.2 for Drives Greater than 528MB**

To obtain the maximum drive capacity (528MB) that OS/2 1.1, 1.2 can support, select 63 sector mapping and 1024 Truncation mapping options for a drive that is greater than 528MB. (See Appendix A, Mapping Options for Drives Under Various Operating Systems, for other drive sizes.)

To achieve drive capacity above 528MB, please refer to Appendix F.

### **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 NOT 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

### 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 must be performed.

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

	<b><u>DOS 3.3 or Above</u></b>				
	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>1 spare/trk</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No</b>
<b>sect map</b>	<b>No</b>	<b>63</b>	<b>No</b>	<b>63</b>	<b>63</b>
<b>track map</b>	<b>No</b>	<b>No</b>	<b>≤1.2GB</b>	<b>≤1.2GB</b>	<b>&gt;1.2GB</b>
<b>1024 map</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No</b>

	<b><u>OS/2 1.1, 1.2, 1.3:</u></b>				
	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>1 spare/trk</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No</b>
<b>sect map</b>	<b>No</b>	<b>63</b>	<b>63</b>	<b>63</b>	<b>63</b>
<b>track map</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No</b>
<b>1024 trunc</b>	<b>No</b>	<b>No</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>

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

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

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

**UNIX Group (1)**

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

**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)**

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

**Interactive UNIX 2.02**

**NOVELL 286 Group**

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

**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**

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

**NetWare 386 3.0, 3.1, 3.11**

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## APPENDIX B

### 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**

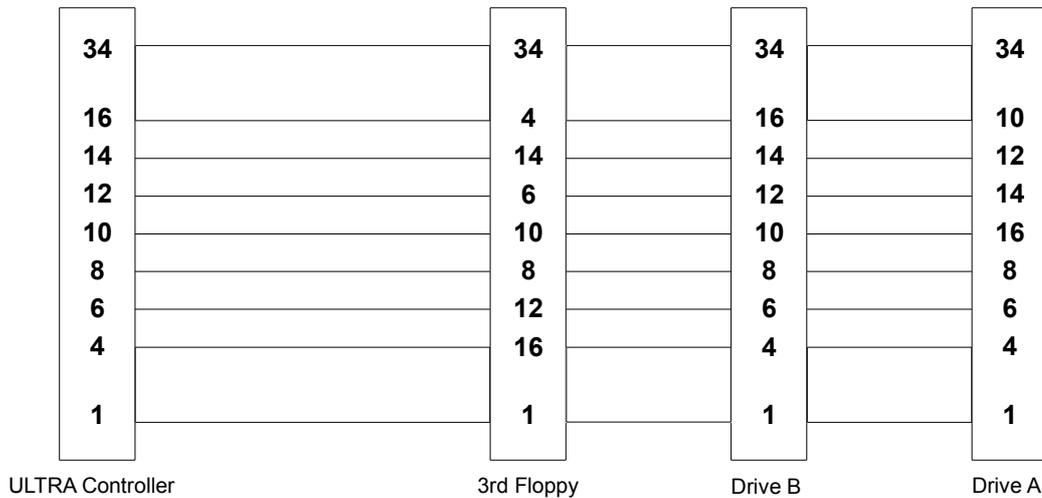
This method can be used only if the drive to be installed as the 3rd drive has drive select jumpers DS1, DS2, DS3, DS4(or DS0, DS1, DS2, DS3). The 3rd drive should be jumpered as DS4 (or DS3 if counting from DS0). Drive A & B should be jumpered as DS2 (or DS1 if counting from DS0). Drives that are jumpered 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.



**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.

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## APPENDIX C

### Co-residence Installation

Co-residence is one of the unique features provided by UltraStor's ULTRA 12F and 12C ESDI controllers. The term "Co-residence" means the controller can co-reside and operate with an existing hard disk controller in the same system. The installation of the secondary controller leaves the primary controller, drive and its data intact. The ISA (AT) bus can support up to 2 drives under MS-DOS.

This application note describes the co-residence of two controllers controlling up to 2 hard disk drives combined.

The UltraStor controller will be used as secondary controller. The primary controller can be a built-in controller (such as PS/2 Model 30-286), or IDE type interface (such as COMPAQ DeskPro 386/20e), or a regular AT MFM, RLL, ESDI or SCSI type of controller. The primary controller may or may not be connected to one drive. If the primary controller doesn't control a drive, such as the PS/2 Model 30-286 floppy only configuration, then the 12F or 12C can connect up to 2 ESDI drives.

Operating systems that do not bypass the system BIOS INT13 call for disk operation, such as DOS, Concurrent DOS or PC MOS-386, will work flawlessly with the Co-resident type of setup without any device driver or software. Operating systems that bypass BIOS INT13 call, such as NetWare, OS/2, XENIX or UNIX will need a device driver to interface with the secondary controller.

#### **Controller Preparation**

Set the secondary (UltraStor) controller jumpers according to Appendix Reference II.

#### **Drive Preparation.**

The system CMOS drive type should be set up for the primary controller configuration, i.e. if the primary controller controls one drive, the CMOS should be set up as one drive only. The secondary controller setup doesn't affect the system CMOS setup procedure.

The ESDI drives to be connected to the secondary controller should be jumpered as Drive Select 2 (Same as for the regular primary controller drive setup). The first drive at the twisted cable end, the second drive in the non-twisted connector.

- o Refer to Sections 3.1. and 3.3 to set up and connect ESDI drives.

## **APPENDIX C**

---

- o Refer to Section 4.1, Low Level Format Utility in the ULTRA Installation Guide.

After the low level drive preparation is done, the drive(s) is ready for OS partitioning and formatting, such as FDISK and FORMAT command in the DOS operating system.

---

## APPENDIX D

### Novell NetWare 386 Disk Duplexing

Duplexing is a feature supported by Novell NetWare 386 to protect data against the failure of a hard disk or a hard disk controller by allowing two controllers to be installed in the system. NetWare 386 provides the capability to duplicate disks on one controller with disks on another controller. Currently, Novell claims that COMPAQ is the only known vendor that supports a secondary controller and drive(s). UltraStor allows any IBM compatible computer to support disk subsystem duplexing under Novell. The ULTRA family of ESDI controllers has been tested and approved by Novell for disk duplexing; please refer to Novell IMSP Level 1 Disk Driver Bulletin #D-97, available upon request.

UltraStor's ULTRA 12F and 12C ESDI disk controllers are currently the only controllers in the market that support NetWare 386 disk duplexing in any 386 AT compatible system. With two ULTRA controllers co-residing in the same system, one in the primary port, the other in the secondary port, the system can support up to 4 ESDI drives operating under NetWare 386. Any pair of disk drives can be selected as a mirroring or duplexing pair as long as the drive pair capacity is close or similar (as recommended by Novell documentation).

This application note describes the setup procedure for running the Novell NetWare 386 disk duplexing feature using two UltraStor ULTRA ESDI disk controllers with Firmware revision 28001-007 and BIOS revision 38001-007 or higher. If you are installing NetWare 386 Version 3.1, please modify the ISADISK.DSK file as detailed at the end of this appendix before you start the installation.

#### **Controller and Drive Preparation**

1. Follow Controller Jumper Setting and Drive Preparation as outlined in Appendix Reference I.
2. Create a small bootable DOS partition of approximately 2MBytes in the first drive of the primary controller (by using FDISK and FORMAT command in the DOS.)
3. The system is ready for installing Novell.

#### **Novell NetWare 386 Installation:**

1. Copy all the files in the Novell NetWare 386 "SYSTEM" diskette onto drive C. (Some of the files may not be needed for installation, refer to Novell NetWare 386 installation guide)

## **APPENDIX D**

---

2. Type "server" to invoke NetWare installation
3. Enter server name and internal network number in the Novell Server program, following the prompt ":", enter the following commands to load the hard disk device driver for primary controller.

```
:LOAD ISADISK ( for the primary controller )      I/O port : 1F0  
Interrupt number : E
```

Reload the device driver again for the secondary controller.

```
:LOAD ISADISK ( for the secondary controller )    I/O port : 170  
Interrupt number : F
```

4. Load NetWare 386 INSTALL module

```
:LOAD INSTALL
```

This invokes the system installation options. The drives that are attached to the ULTRA 12F or 12C controller will be shown under the drive options.

Proceed with Novell installation procedures to do the partitioning, mirroring, mounting, volume creation, and surface testing of the hard disk drives. Note: Please refer to Novell NetWare 386 installation guide.

### **Installing Under NetWare 386 Version 3.1**

Novell released NetWare 386 Version 3.1 on June 29, 1990. Unlike the previous version 3.0, the new ISADISK.DSK program changes the way drive parameters are derived for the secondary controller. The secondary controller is no longer accessible if the primary controller has an onboard BIOS which redirects the drive parameters to a memory location other than the F000 segment.

Unlike other controllers in the market, the ULTRA family of ESDI controllers provides the drive parameter reference with a method that allows the NetWare ISA disk driver to retrieve the correct parameters for both the primary and secondary controllers. With this method, a straight forward solution for ESDI drive duplexing is provided without the need for another DCB/SCSI controller/drive set and additional device drivers. The UltraStor solution to duplexing has been tested and approved, as previously stated earlier in this document.

There are two methods available to effect disk duplexing with the ULTRA family of controllers under NetWare 386 version 3.1.

#### **Method 1.**

When installing NetWare 386 version 3.1, replace the ISADISK.DSK (located on the System disk) with the old ISADISK.DSK file which is

---

supplied with version 3.0. This driver will run without problems; however, it does not support the "read after write verify" capability which is available in version 3.1.

### **Method 2.**

Patch the new ISADISK.DSK so that driver does not check the F000 segment for drive parameter table location. This is accomplished using the standard DOS debug program.

- a. Make a backup copy of the original "SYSTEM" diskette. Work from the backup copy.
- b. Load the ISADISK.DSK file with the DOS Debug program by typing:

```
debug ISADISK.DSK <>:f>
```

- c. Once the debug program's prompt sign "-" appears, search for the hexadecimal data '3D 00 F0' by typing:

```
s 0 L1000 3D 00 F0 <>
```

The debug program should find the data stream and show the address as:

```
ssss:xxxx
```

Where ssss is the segment address and xxxx is the offset.

- d. Replace the data stream '3D 00 F0' with '3D 00 C8' by typing the following:

```
e ssss:xxxx <CR>
```

```
ssss:xxxx 3D.3D 00.00 F0..C8 <CR>
```

- e. Save the patched file by:

```
w <CR>
```
- f. The ISADISK.DSK has been patched.
- g. Proceed with the NetWare installation.

### Installing Under NetWare 386 Version 3.11.

Like NetWare 386 Version 3.1, a patch is still required for dual channel operations. Fortunately, that patch has already been implemented by Novell so that there is no need to do the patch manually. Following are the steps needed to setup for dual channel operations.

1. Copy all the files in the Novell NetWare 386 "SYSTEM" diskettes (total of three diskettes) onto drive C.
2. Go to C drive and type "**SERVER**" to invoke NetWare installation.
3. Enter server name and internal network number in the **Novell Server** program. Following the prompt ":" enter the following commands to load the hard disk device driver for primary and secondary controller card.

**:LOAD ISADISK /I I/O port: 1F0 Interrupt number: E**

**:LOAD ISADISK /I I/O port: 170 Interrupt number: F**

**(NOTE: The entry following "/" is a lower case "L")**

4. Load NetWare 386 **INSTALL** module by typing in **LOAD INSTALL** following the ":" prompt.
5. **NOTE:** Be sure that the **STARTUP.NCF** file contains the following two lines with the option "**I**" switch.

load **ISADISK** port=1F0 int=E /I

load **ISADISK** port=170 int=F /I

**(NOTE: The entry following "/" is a lower case "L")**

6. Proceed with normal NetWare 386 installation.

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## APPENDIX E

### SCO UNIX Installation Guide for Two Controllers

This application note describes the setup procedure for adding up to two ESDI drives with a secondary UltraStor controller card.

The primary card in the system can be an MFM, RLL or ESDI controller. The ULTRA 12F or 12C co-resides with these controllers without any conflicts and without requiring reinstallation of the operating system. Using any combination of both ULTRA 12F or 12C as primary and secondary controllers, up to four ESDI drives can be used in the operating system, e.g. with four 650 Mbyte (formatted) ESDI drives, a total of 2.6Gbyte storage capacity is available for the system.

This application note only describes the setup procedure for second disk controller. It assumes that the operating system was installed for the primary controller and two drives were connected to the primary controller. There should be 0s0 and 1s0 "devices" existing in the /dev/rdisk directory. The mkdev that will be used to create "device" will create 2s0 and 3s0 for first and second drive in the secondary controller respectively.

Please refer to SCO documentation for detailed procedures on "making device", creating and adding filesystems to the kernel, such as UNIX Installation Guide, System Administration Manual, etc.

After following the controller jumper setting and drive preparation as outlined in Appendix Reference I, following this section, the drive(s) is ready to be added to the UNIX operating system.

Please note the cylinder, head and sector numbers and mapping mode selected as they will be used during mkdev process.

#### **Adding Devices to the Operating System**

1. Modify Kernel Parameter NDISK, a constant which is used to determine how much space in the kernel is allocated for hard disk drives. It is set at 2 for the AT primary controller, which controls up to two drive(s). For adding drives on the secondary controller, the NDISK parameter needs to be

changed to 4. Change to directory `/etc/conf/cf.d` and Run

**configure -y NDISK** to see the current setting of the NDISK

**if it is 2, change it to 4 by running**

**configure NDISK=4**

**Rerun -y option to verify the changes**

2. Rebuild a New Kernel. After the changes, the kernel needs to be rebuilt by running:

**`/etc/conf/cf.d/link_unix`**

Answer 'Y' to boot the kernel by default, and 'Y' to rebuild the kernel environment. The system should reboot with the new kernel.

3. Make Device. Use the `mkdev` script file to create, partition and add file system to the device.

Here we assume that `0s0` and `1s0` devices exist in the `/dev/rdisk` directory. There should be no `2s0` and `3s0` in that directory. The `mkdev` will create the `?s0` with `?` being the next available device number, although `dkinit` only refers to `2s0` as the first drive in the secondary controller and `3s0` as the secondary drive in the secondary controller. If the device created is not `2s0` or `3s0`, a problem will occur during `mkdev` procedures when `dkinit` needs to change the drive parameters. A more detailed procedure is needed to handle such situation and is beyond the scope of this application note.

Run `sysadmsh` → system → hardware → hard disk to execute `mkdev hd`.

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

Select either "(1)First" or "(2)Second" drive on this controller.

Select "(2)Second" for ST506 secondary controller.

Since the drive(s) connected to the secondary controller didn't get defined in the CMOS setup, the `dkinit` shows invalid drive parameters. Select the "Modify Current Drive Parameters" to change to the correct drive parameters. Retrieve the numbers shown on the drive parameter setup screen during drive media preparation step 4.

Assume X is the number of cylinders for the drive, Y is the number of heads, Z is the number of sectors per track. Enter the following number accordingly.

<b>Disk Parameters</b>	<b>If no sector mapping</b>	<b>If 63 sector mapping</b>
<b>1. Cylinders</b>	<b>X-2</b>	<b><math>((X-2)*Y*Z) / (63*16)</math></b>
<b>2. Heads</b>	<b>Y</b>	<b>16</b>
<b>3. Write reduce</b>	<b>0</b>	<b>0</b>
<b>4. Write Precomp</b>	<b>65535</b>	<b>65535</b>
<b>5. ECC</b>	<b>7</b>	<b>7</b>
<b>6. Control</b>	<b>0 if Y =&lt;8</b>	<b>1 if Y &gt;8</b>
<b>7. Landing Zone</b>	<b>X-2</b>	<b><math>((X-2)*Y*Z) / (63*16)</math></b>
<b>8. Sectors/Track</b>	<b>Z</b>	<b>63</b>

Note, the minus 2 for the cylinder number is for the two reserved cylinders that is used by the ESDI drive to store manufacturing defect map.

The following procedures for creating UNIX partition, scanning disk, creating filesystem are the same as the regular procedures for adding the 2nd drive in the primary controller. Please refer to "UNIX system administration manual" for detailed procedures.

**NOTE**

Before making filesystem, 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 filesystem to the kernel

**Run sysadmsh —> filesystem —> add**

This is the same procedure as adding filesystem for the 2nd drive in the primary controller. Refer to "UNIX system administration manual" for detailed procedures

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## APPENDIX F

### Breaking the 528MB OS/2 Limitation and Duplexing Under OS/2 Lan Manager

This application note describes the procedure for installing the ULTRA 12F & 12C ESDI disk controllers and device driver under OS/2 to eliminate the 528 Mbyte hard disk partition limitation and to provide disk mirroring under LAN Manager release 2.0. Note that if you intend to utilize disk mirroring under LAN Manager release 2.0, please read the section titled "Configuring LAN Manager" towards the end of this note before you install OS/2. In addition, UltraStor has tested only LAN Manager 2.0 and if another version or release is required, please contact UltraStor. The device driver supports the standard OEM edition of OS/2 Version 1.1 and 1.2 along with their unmodified ISA disk device driver. Some OEMs may modify this driver and make the procedure listed below incompatible. If unforeseen problems occur, contact the OEM supplying OS/2.

While the UltraStor's OS/2 device driver supports the ULTRA BIOS track mapping mode for large drives, this feature will not be supported under OS/2 release 1.1. The driver does support two controllers with up to 4 ESDI drives under OS/2 release 1.2; one controller should be set up as the primary and the other as the secondary controller. This device driver will support LAN Manager 2.0 when used with OS/2 release 1.2 or higher. Under this environment (OS/2 1.2 plus LAN Mgr 2.0), the driver will support fault tolerance (disk duplexing/mirroring) with one or two UltraStor controllers.

#### **Controller and Drive Preparation**

Follow the controller jumper setting and drive preparation as outlined in Appendix Reference I.

#### **NOTE**

Provided the UltraStor OS/2 device driver is used, the track mapping mode should be set to **<=1.2GB** if the drive has more than 1024 cylinders with capacity more than 512MB but less than 1.2GB, **OR** set to **>1.2GB** if the drive has more than 1024 cylinders with capacity greater than 1.2GB.

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### **OS/2 Installation**

The replacement procedure for the OS/2 device driver works with IBM OS/2 1.1, IBM OS/2 1.2 or the standard OEM MS OS/2 version 1.1 & 1.2 with unmodified ISA disk device drivers. Other versions have not been tested.

#### **Procedures for OS/2 Release 1.1**

1. **"IMPORTANT !!!"**. Back up the original OS/2 "Install" diskette and use the backup copy of the "Install" diskette for the following steps.
2. Copy OS2\_1.1\DISK01.sys from UltraStor's OS/2 ISA disk device driver diskette to the OS/2 "install" diskette.
3. Boot up the system with the modified "Installation" diskette in drive A.
4. Proceed with the normal OS/2 installation.

**Note:** Please refer to the OS/2 installation guide.

#### **Procedures for OS/2 Release 1.2 with 3.5" diskette**

1. **"IMPORTANT !!!"**. Back up the original OS/2 "Install" diskette and use the backup copy of the "Install" diskette for the following steps.
2. Copy OS2\_1.2\DISK01.sys from UltraStor's OS/2 ISA disk device driver diskette to the OS/2 "install" diskette.
3. Boot up the system with the modified "Installation" diskette in drive A.
4. Proceed with the normal OS/2 installation.

**Note:** Please refer to the OS/2 installation guide.

#### **Procedures for OS/2 Release 1.2 with 5.25" diskette**

1. **"IMPORTANT !!!"**. Back up the original OS/2 "Install" diskette and use the backup copy of the "Install" diskette for the following steps. Since the **"Installation"** diskette does not contain enough space to accommodate the UltraStor device driver, several extra steps are required.
2. Copy all \*.RC@ and FDISK.COM to a temporary diskette.

3. Delete all \*.RC@ and FDISK.COM from the "Installation" diskette to make space for the UltraStor device driver DISK01.SYS.
4. Copy OS2\_1.2\DISK01.sys from UltraStor's OS/2 ISA disk device driver diskette to the OS/2 "inst all" diskette.
5. Boot up the system with the modified "Installation" diskette in drive A.
6. Proceed with the normal OS/2 installation by inserting operating system diskettes 1, 2, 3, 4, and 5, and stop when asked to insert the "Installation" diskette.
7. Prior to inserting the "Installation" diskette, delete FDISK.COM from the installation diskette, restore all the \*.RC@ from the temporary diskette to the installation diskette, and insert the "Installation" diskette to complete the installation.
8. After completing the OS/2 installation, you may want to restore the "Installation" diskette by deleting disk01.sys and restoring all the \*.RC@ and FDISK.COM from the temporary diskette. (Please refer to OS/2 installation guide.)

### **Configuring LAN Manager 2.0 with Disk Mirroring/Duplexing**

**NOTE**

LAN Manager only works with OS/2 version 1.21 or later.

### **OS/2 Installation**

Follow the previously described steps to install OS/2 **except**:

1. In "Preparing the Fixed Disk" menu, select "Specify your own partition", if you plan to use the disk duplexing function, and enter the desired primary partition size. If there are only two hard disk drives in the system, if you choose "Accept predefined partition" or choose the maximum size for the primary partition, the disk mirroring setup will not be successful since a single boot partition will be created and boot partition cannot be mirrored under LAN Manager 2.0.

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2. In "Select the File System" menu, choose the "High Performance File System" option (follow disk duplexing function) and proceed with the OS/2 Installation.

### **LAN Manager Installation**

1. After the OS/2 system is installed successfully, reboot the system.
2. Insert Disk 1, LAN Manager "OS/2 - SETUP" diskette, into drive A.
3. Go to the OS/2 Full Screen and type "A :SETUP" and press the return key.
4. Proceed with the installation until the "Install LAN Manager" menu appears and then select the "Server" option.

Refer to the LAN Manager documentation for a detailed description on installation.

### **Fault Tolerance Setup**

1. After the LAN Manager is successfully installed, go to the OS/2 window.
2. Run "FDISKPM" program to create a partition.
3. Run "FTSETUP" program to setup the fault tolerant parameters.

Refer to the OS/2 documentation for a detailed description on all of the above.

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## APPENDIX G

### Other Application Notes Available from Ultrastor

Installation Procedure for Novell NetWare 286	(AN001)
Head and Cylinder Skew Calculation	(AN004)
Automatic Drive Preparation Utility – UFORMAT Command	(AN006)
ESDI Drives for Use with UltraStor Controllers	(AN012)
Dual Channels Under Interactive UNIX	(AN015)

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## APPENDIX REFERENCE I

Below are the steps to perform to prepare the drive(s) for Novell, UNIX, or OS/2 installation:

1. Set both primary and secondary controllers according to Appendix Reference II.
2. Follow Sections 3.1 and 3.3, Pages 5-8, to set up and connect ESDI drives to both primary and secondary controllers.
3. Follow Section 4.1.1, Page 10, for BIOS setup to both controllers and set the mapping mode for all the drives as below:

The Mapping Mode for all drives is as follows:

One Spare Sector/Trk	NO
Sector Mapping	NO *
Track Mapping	NO
1024 Cyl Truncation	NO

\* Select 63 Sector Mapping mode if the drive sector per track number is more than 63, as with most 20 MHz ESDI drives, otherwise select no mapping for sector and track options.

### NOTE

The Deferred Write feature must be turned "OFF" during installation of operating system and surface scanning. It may be turned "ON" once the installation and surface analysis have been completed.

4. Follow Section 4.1.2, for both primary and secondary controllers.

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## APPENDIX REFERENCE II

On the primary controller card, the following jumpers should be set as below:

JP10 - 1-2 OUT BIOS address at C800:0\*

3-4 OUT

5-6 IN

JP12 - OUT Hard disk primary I/O port address (1F0-1F7, 3F6-3F7)

JP17 - IN Enable floppy controller (If system board doesn't support floppy circuit)

OUT If system motherboard support floppy

\*\*JP20 - 1-2 OUT

2-3 IN IRQ14 select

On the secondary controller card, the following jumpers should be set as below:

JP10 - 1-2 OUT BIOS address at CC00:0\*

3-4 IN

5-6 OUT

JP12 - IN Hard disk secondary I/O port address (170-177, 376-377)

JP17 - OUT Disable floppy controller

\*\*JP20 - 1-2 IN IRQ15 select

2-3 OUT

\* Note: The primary card BIOS address can be at D000:0 or D800:0. The secondary card BIOS address can be at D400:0 or DC00:0. Make sure that the primary card BIOS address is lower than the secondary card BIOS address.

Please refer to UltraStor ULTRA 12F or 12C Installation Guide for additional BIOS addresses.

\*\* Note: JP20 for 12F, JP21 for 12C.

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