

Green Cache DC-Series

IDE (Intelligent Drive Electronics) Caching + Mirroring Controller

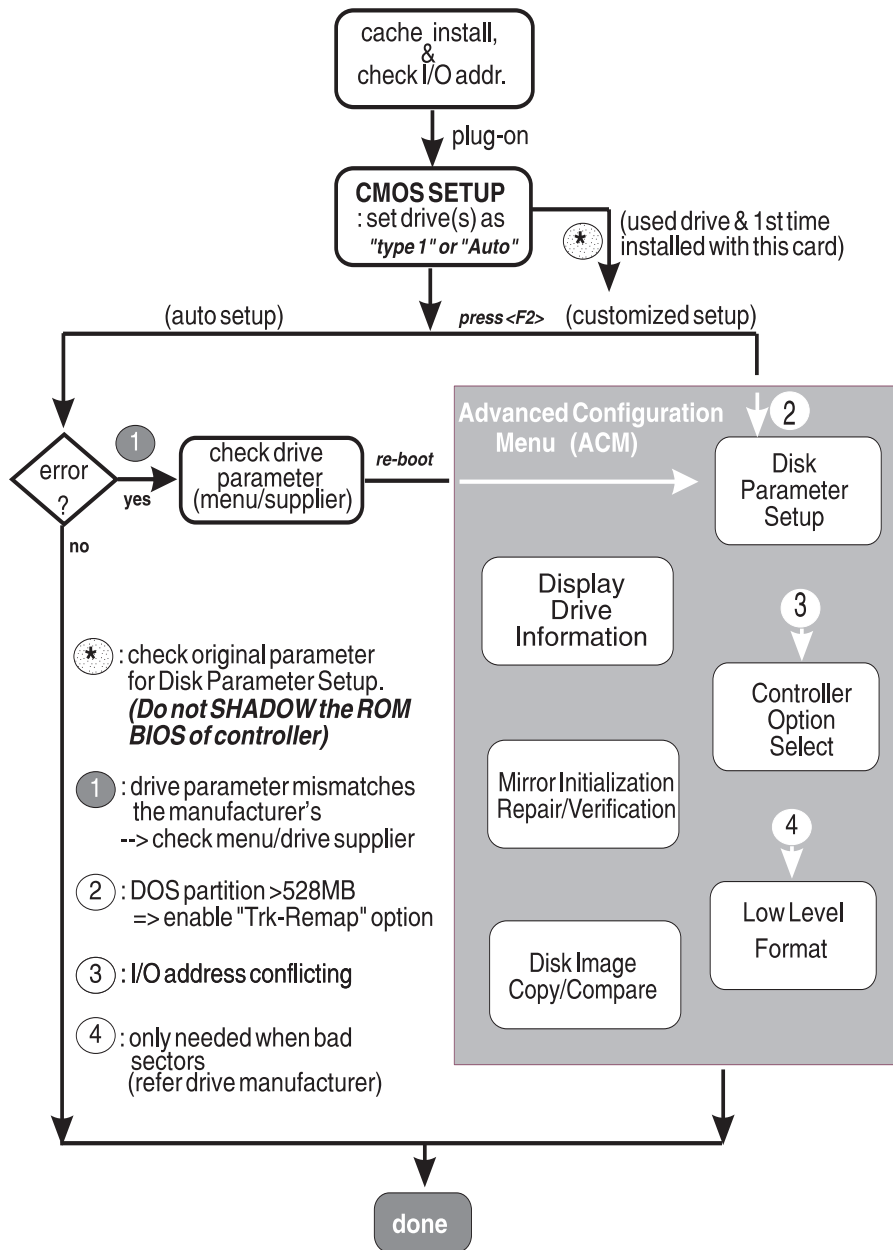
□ DC-600C/CF/CD	: ISA Bus
□ DC-620B	: EISA Bus
□ DC-680T/C/CD	: VL-Bus
□ DC-690C/CD	: PCI (Peripheral Component Interconnect) Bus

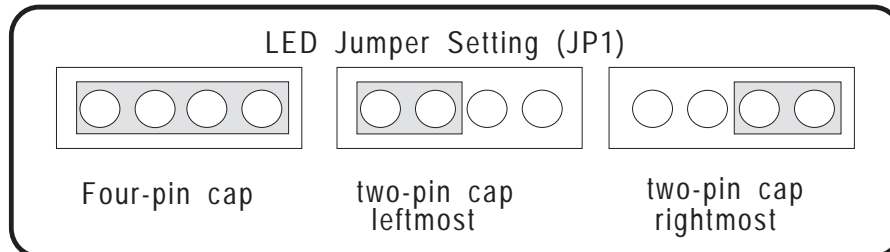
This manual is for DC-600C/CF/CD (ISA-Bus), DC-620B (EISA-Bus), DC-680T/C/CD (VL-Bus) and DC-690C/CD (PCI-Bus), and the DC-6X0 is short for these models.

VESA and VL-Bus are trademarks of the Video Electronics Standards Association
Novell and NetWare are trademarks of Novell, Inc.
MS-DOS and Windows are trademarks of the Microsoft Corporation.
SCO is a trademark of Santa Cruz Operation Inc.
ISC is a trademark of Interactive Systems Corporation.
UNIX is a trademark of AT&T Bell Lab.
OS/2 is a trademark of IBM.
Green-Cache is a trademark of TEKRAM Technology Co., Ltd.

(other trademarks shown are the property of their respective owners)

Quick Installation Reference:





How to do with CACHE:

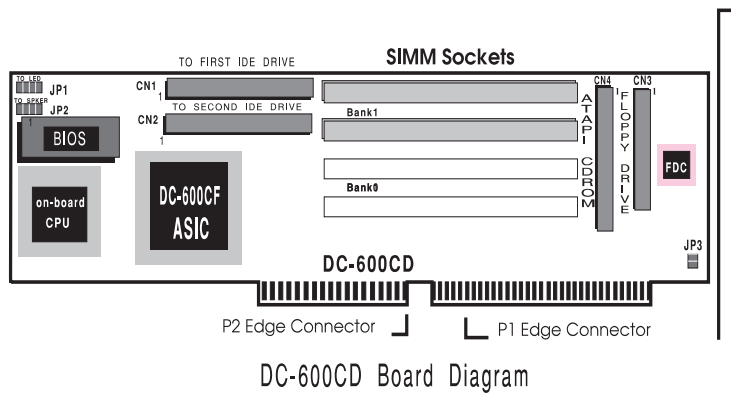
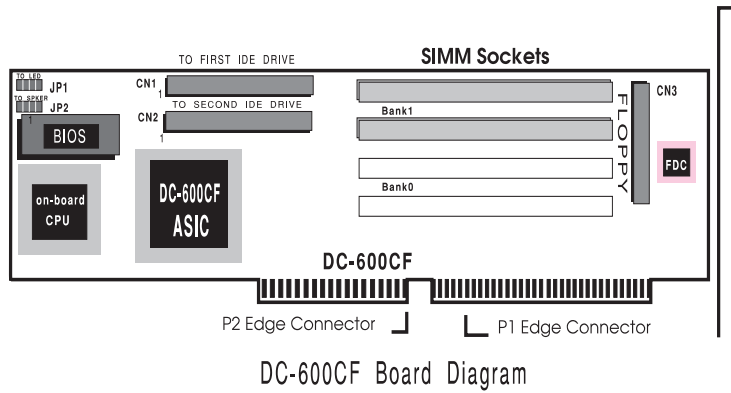
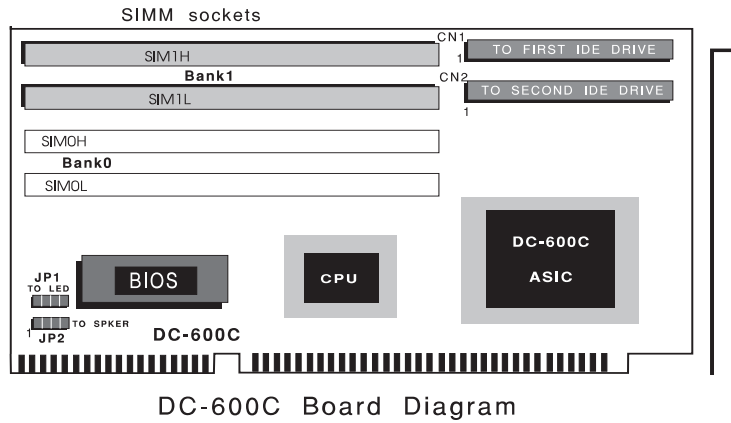
1. 256KB/1MB/4MB 80ns SIMM are required & can be mixed for different combinations.
2. two SIMMs as a bank, & must be with the same type.
3. Bank-0 must be installed with DRAM SIMMs, Bank-1 is O.K. to install or not.

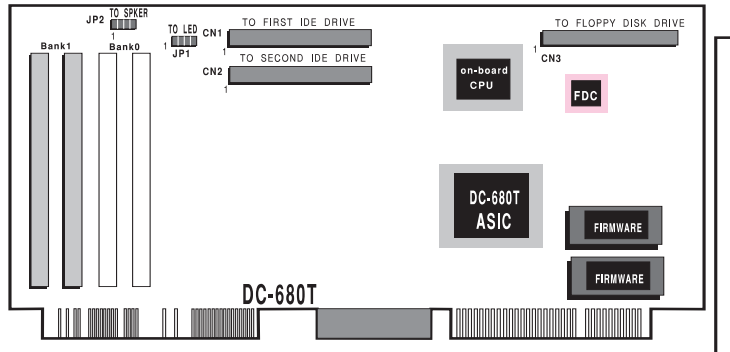
Warning

It is especially important with a caching controller that you do not power-off the system while the hard drive activity LED is still active.

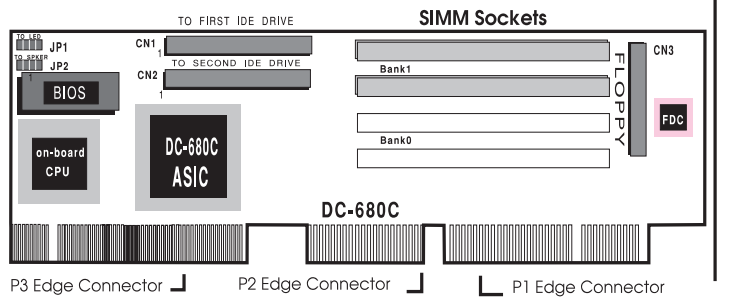
Doing so will result in loss of data!

Green Cache

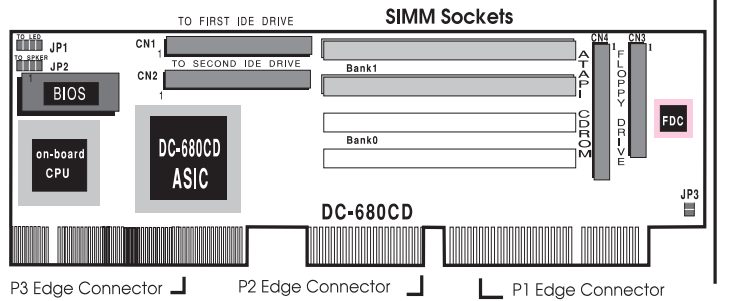




DC-680T Board Diagram

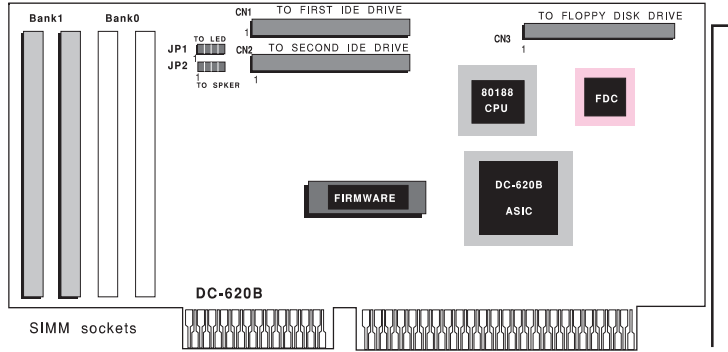


DC-680C Board Diagram

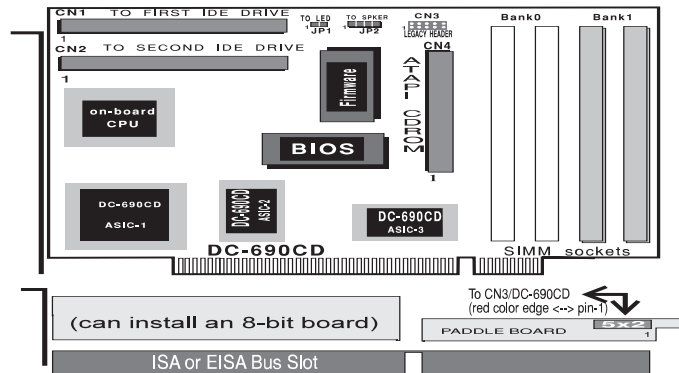
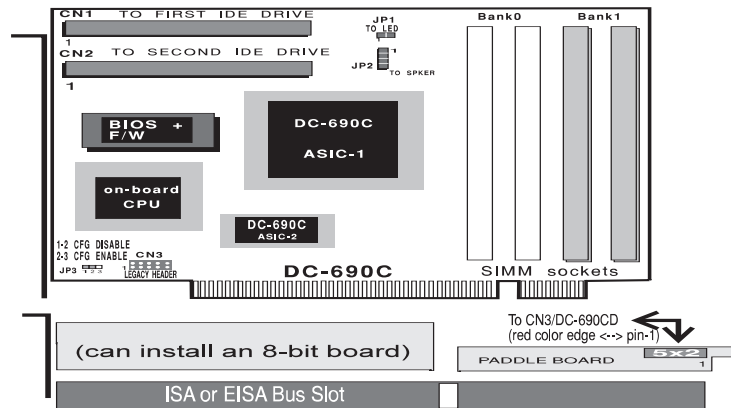


DC-680CD Board Diagram

Green Cache



DC-620B Board Diagram



For DC-690C(D) with A Paddle Board

That the DC-690C(D) equips with a paddle board is to resolve the IRQ14/15 problem, which is mainly caused by specification inconsistency between Standard IDE and PCI Interrupt Protocol. This Paddle Board can be inserted onto an ISA or EISA bus slot and re-routes IRQ14/15 signals directly from ISA/EISA bus on the mainboard to DC-690C(D), and thus resolves the possible compatibility problem caused by some of the mainboards.

To add the Paddle Board or not is up to you, if your system already can work without it. *If you have compatibility problem as explained in the above, to install the paddleboard would be necessary:*

- CN3:** Legacy Header (5x2) -> connect to paddleboard
- JP3:** PCI Configuration Space (PnP support). Pin1-2: disable & Pin2-3: enable. (for DC-690C only)

* Keep mainboard's setting for INTA-D# as its default value, i.e., don't have to change anything.

The Paddle Board provides one **5x2** connector for connecting to **CN3** of the DC-690C(D).

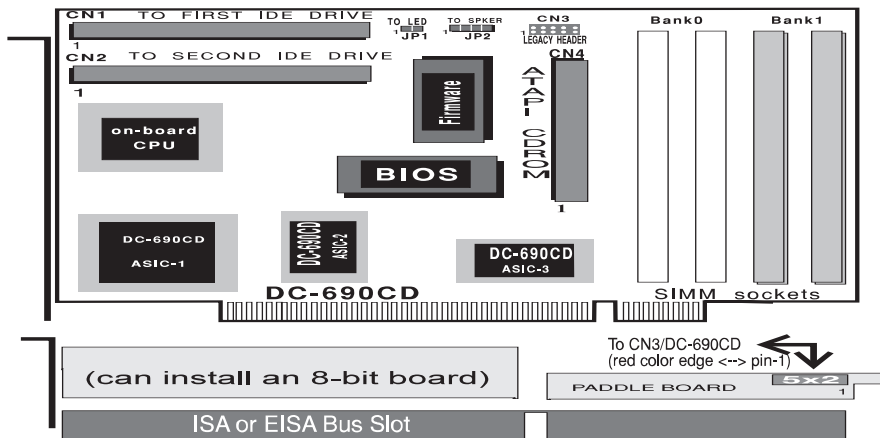


Table of contents

0. Introduction	10
1. Preparation	14
1.1 JP1 - Hard Drive LED Indicator	14
1.2 JP2 - Mirroring Beeper	15
1.3 JP3 - ATAPI CD-ROM Jumper (DC-600CD/680CD)	15
1.4 Cable Connection (CN1, CN2, CN3, CN4)	15
1.5 Cache DRAM Installation	16
1.6 If I/O Card ROM Address Conflicts	16
1.7 Running the ECU (for DC-620B only)	16
2. Quick Setup	18
2.1 CMOS Configuration	18
2.2 Auto Setup	19
2.3 Drive Parameters	20
3. Advanced Configuration Menu (ACM)	22
3.1 Disk Parameter Setup	23
3.2 Controller Option Select	27
3.3 Display Drive Information	32
3.4 Low Level Format	33
3.5 Mirror Initialization or Repair	34
3.6 Mirror Drive Verification	35
3.7 Disk Image Copy	36
3.8 Disk Image Compare	36
4. Driver Installation	38

Appendix A: Technical Specifications 42
Appendix B: Product Support Form 44
Appendix C: Error Messages and General Troubleshooting
Tips 46

Chapter 0: Introduction

The *Green Cache* controller is designed to meet the environmental protection requirements by switching storage system into sleeping mode in order to reduce the power consumption. This controller offers **RAID-1** (Redundant Array of Inexpensive Disks, Level 1) hardware-based **disk mirroring** with *Jumper-Less* installation utility under all operating systems to safeguard your valuable data. Its **caching** capability is to relieve the bottleneck between slow I/O bus interface and IDE disk subsystems. Microprocessor-controlled Caching Algorithms are employed to easily handle heavy bus loading. It also provides the most flexible means of installing and upgrading the IDE drive, and is compatible with all major operating systems.

Its on-screen Advanced Configuration Menu, or ACM, provides assorted utilities:

- **Disk Parameter Setup:** Allows you to mirror/link two drives into one logical drive and enable the *Track-Remapping* function for >528MB drive under DOS environment.
- **Controller Option Select:** *Green Cache* (power saving), *max 4 drives support*, cache line size, and other settings for controller.
- **Display Drive Information:** Displays all the drive information, such as Drive model/Firmware version/Serial#/Cylinder/Head/sector.
- **Low Level Format**
- **Mirror Initialization/Repair:** Ease your initialization/repair preparation for mirroring pair drives.
- **Mirror Drive Verification:** Check if the mirroring pair have identical data.
- **Disk Image Copy/Compare:** Copy/Compare the whole disk data from SOURCE disk to TARGET disk.

Green Cache (Power Saving)

The Green Cache controller not only saves power for IDE drive(s) but also the board itself:

- **Board:** During its IDLE state, i.e., no access activity to the storage subsystem, the clock signal generated by on-board processor would be turned off automatically, and thus force the rest power-consuming components into the SLEEPING states. The Power saving during this GREEN period is tremendous:

<u>Main Component</u>	<u>Active</u>	<u>GREEN (sleeping)</u>	<u>Power Saved</u>
80C286	1.4W	0.025W	98.21%
E ² ROM	15mW	0.25mW	98.33%

- **IDE Drive:** Those drives featured with the "MOTOR OFF" command would enjoy even more power saving from the GREEN CACHE. This is because the controller would turn off the drive's motor after a specific period of IDLE time by using this optional command. The following is an example based upon an ALPS 312C drive:

<u>State</u>	<u>Power Consumption</u>
Idle	2.5W
GREEN (Standby)	0.6W
=====	
Power Saved	76%

Refer to Green Cache Mode of **Controller Option Select** module in the ACM (Chapter 3) for details.

Disk Mirroring (RAID-1)

This disk fault tolerance feature is available for all operating systems without sacrificing the performance. It's transparent to both the user and operating system. With this feature enabled, the controller would write to two hard disks at the same time and keeps your system running, even when one of the drives is crashed. Refer to Attribute of **Disk Parameter Setup** module in the ACM (Chapter 3) for details.

4 Drives Support

The Green Cache controller provides you three options to optimize the storage subsystem and supports up to four drives. These three options can be mixed

within the same system and thus give you great flexibility on the disk sub-system.

- **4 Individual Drives:** It allows you to work with up to four independent drives, i.e., physical drives C:, D:, E: & F:, and *change the booting drive to any one of them* at your own will. This not only overcomes the only_two_drives limitation under DOS, but also provides you the flexibility to handle different kinds of operating systems within one machine, which may require to boot from another O.S. from time to time. If two of them are installed, one as primary & the other one as secondary, you can even control up to eight individual drives.
- **Mirroring:** Two mirrored drives would function as one logical drive with fault tolerance capability. This advanced option allows you to maintain data security for disk sub-system. With the ACM, you are free to re-configure your drives into mirroring or just individual ones without opening the cabinet, and eventually costs you nothing to have this RAID-1 feature. Maximum 2 pairs for each controller.
- **Linking:** Two linked drives would be seen as one logical drive with capacities summed together. It provides you an alternative to expand the desired drive capacity from your current used drives without purchasing another new drive of larger capacity. Maximum two pairs for each controller.

Refer to More Than 2 Drives of **Controller Option Select** module in the ACM (Chapter 3) for details.

Driver Support

32-bit drivers are supported for DOS, Windows, OS/2, NetWare, AT&T UNIX, SCO UNIX and ISC UNIX. These drivers also support you to install two DC-6X0 controllers and work with maximum eight individual drives. Newly updated drivers will be put in the driver diskettes without notice in the manual. Please check the **README** in the Novell driver diskette for further details.

Chapter 1: Preparation

With ACM menu and jumper-less design, the DC-6X0 is extremely easy to configure and install. Normally, the DC-6X0 has four SIMM sockets, yet some of the models may have two 512KB DRAM chips mounted to replace the two SIMM sockets on Bank-0. JP3 and JP4 on the DC-680T are for manufacturing purpose.

1.1 JP1 - Hard Drive LED Indicator

JP1 is used to indicate hard disk activity and connected to the hard disk activity LED in the front panel of your system. This LED also flashes some diagnostics codes right after power-up.

The following shows the flash frequency of each fatal error condition:

- One short flash : No Cache DRAM installed
- Two short flashes : CPU error
- Three short flashes : SRAM error
- Four short flashes : Timer error

The DC-6X0 supports *write back* mode to achieve the best performance for a caching controller. It would write modified cache data back to disk when the system is idle, or when a cache read request misses and it becomes necessary to flush the modified cache line buffers to make room for new data. If the system is busy, DC-6X0 would ensure the modified data to be written back to disk after 0.5 second from the update command was issued to further prevent potential data corruption by accidental wrong doing or system malfunctioning. Write back mode results in superior cache performance because it permits the cache controller to combine and sort write operations prior to updating the disk, and because the updating is done in the background when the system is idle or the write time threshold is reached.

Due to the nature of Write Back, you must be cautious when turning the power down: **Do not Power-down the system while this LED is still active. Doing so may result in loss of data as the contents of the cache buffer have not been completely written to the disk.**

1.2 JP2 - Mirroring Beeper

JP2 is used to issue the warning beep through a speaker when an error occurs during the process of disk mirroring. It can be connected to the **SPEAKER** in the front panel of your system or to another speaker complying with the same specification of the system's **SPEAKER**.

1.3 JP3 - ATAPI CD-ROM Jumper (for DC-600CD/680CD only)

When JP3 is installed, the DC-600CD/680CD would allow you to install up to four hard drives (on the Primary port) and two ATAPI CD-ROM drives (on the Secondary port: 170H).

If you install two DC-6x0 in a single system, then you cannot use the ATAPI interface on either board. This is due to the fact that each board requires a primary or secondary port address. Once the secondary port address 170H is used for the ATAPI connector, there will be no additional port address for one of the boards. So you must disable this option to install two DC-6x0 in a single system.

For the DC-690CD, please refer to Sec.3.2 for how to enable/disable ATAPI CD-ROM installation.

1.4 Cable Connection (CN1, CN2, CN3, CN4)

CN1 and CN2 are for hard drive connection. If you are attaching a **single** new or used IDE drive to the DC-6X0, connect the drive to the IDE BUS1 connector, **CN1**, on the DC-6X0 using either an existing or the supplied 40 pin data/control cable.

If you are attaching "two or more" IDE drives to the DC-6X0, refer to the advanced installation instructions in Chapter 3 before continuing.

CN3 is for floppy cabling. The 34-pin flat cable should be connected to CN3 with its colored edge, normally **red**, aligning with Pin 1 of CN3.

Note: CN3 on the **DC-690C/CD** is a 5x2 header, which is for Legacy Header and not the floppy drive.

CN4 is for ATAPI CD-ROM cabling and available for DC-6x0CD only. The standard 40-pin AT flat cable should be connected to CN4 with its colored edge, normally **red**, aligning with Pin 1 of CN4.

Note: To work with ATAPI CD-ROM(s) the JP3 for DC-600CD/680CD must be properly set. Refer to Sec. 1.3 for details.

1.5 Cache DRAM Installation

The DC-6X0 features four SIMM sockets, arranged in two separate banks, for flexible cache DRAM installation. 256KB/1MB/4MB “fast page mode” SIMMs are required, with a minimum rated access of 80ns or faster, and can be mixed in any combination. **Bank-0 must be installed with DRAM for proper operation** and Bank-1 is optional. Beware that two SIMMs installed in the same bank must be of same size. *If your controller has two DRAM chips mounted on Bank-0 location already, you then have only two SIMM sockets for cache expansion on Bank-1 and can boot the system without installing any other SIMMs.*

SIMM specification: 256KB/1MB/4MB “fast page mode”
80ns or faster

Bank 0: (256KB x 2)/(1MB x 2)/(4MB x 2)

Bank 1: (0MB x 2)/(256KB x 2)/(1MB x 2)/(4MB x 2)

1.6 If I/O Card ROM Address Conflicts

For most installations, the factory default jumper settings will ensure proper operation. However, if the system contains a second hard or floppy controller, or other boards that use reserved memory (e.g. a network card), you may need to remove other card(s) first and configure the DC-6X0 to avoid potential address conflicts. Refer to ROM BIOS Address setting in the **Controller Option Select** module of ACM for further details.

1.7 Running the ECU (for DC-620B only)

Since DC-620B is an EISA card, the system would require you to run the ECU (EISA Configuration Utility), which shipped along with your mainboard, in order to register the DC-620B into the EISA system configuration.

To achieve this, you have to copy the file, !TRM0620.CFG, from the Novell driver diskette of DC-620B to the ECU diskette. Still, all other setups have to be done in the ACM (refer to the following two chapters). There is no functional discrepancy between running the ECU or not, except that a warning message, "Invalid configuration information for SLOT ??", will be issued by the system if not running the ECU and you won't be able to view the DC-620B information from the ECU.

Chapter 2: Quick Setup

Once the jumpers, cabling and cache DRAM have been properly installed, the DC-6X0 is ready to work in your system. If you are upgrading an existing IDE hard drive subsystem, it is advisable to do a complete file-by-file (as opposed to image) backup of your data to removable media.

The DC-6X0 requires a specific bus slot, depending on which model you're using, and, for most installations, can be treated as a direct replacement for an IDE hard bus controller (or "paddleboard"). If another IDE bus controller wants to coexist with the DC-6X0, then these two controllers must be set as **primary** and **secondary**, respectively (refer to the Sec. 3.2 for **Controller IO Port**). Also, only one of the two controllers can enable its floppy, and the other one must be disabled or removed. *If co-exists with another SCSI adapter, you must put the DC-6X0's ROM address prior to that of SCSI adapter.*

2.1 CMOS Configuration

When installing a **single** new IDE drive for the first time, it is necessary to configure the Drive C: in the system CMOS Setup to **type 1**. This enables the system to sense the presence of the DC-6X0, where the actual drive parameter tables are stored. Two drives linked or mirrored as a pair will be seen as a logical drive and needs only to set the Drive C: to **type 1**.

If two individual drives or link/mirror pairs are installed, you have to set both the Drive C: and D: to **type 1**.

If more than two individual drives, link/mirror pair treated as one logical drive, are installed, *the third drive or the fourth will be handled by the DC-6X0 BIOS*. Check More Than 2 Drives option of **Controller Option Select** module for details. Also, *the DRIVE TYPE C: & D: in CMOS Setup are only for the first two drives controlled by the Primary DC-6X0. You don't need to do anything about the third & fourth drives of the Primary DC-6X0 or those controlled by the Secondary one in the CMSO Setup.*

The following concludes the discussion above. Beware that link/mirror pair is treated as one single drive.

# of Drive(s)	System CMOS/Drive Type (Drive C:,D:)	More_than_2_drives Support (*)
1	1, Non-installed	Disabled
2	1, 1	Disabled
3	1, 1	Enabled
4	1, 1	Enabled

*: refer to **Controller Option Select** module

If necessary, refer to your motherboard or system manual for further instructions on configuring the system CMOS. If you are upgrading an existing IDE drive subsystem, the values previously stored in the system CMOS are unlikely to require modification.

2.2 Auto Setup

For most **single** new or used IDE drive installations, no additional steps are necessary to ensure proper operation of the DC-6X0 with your disk subsystem. Power up the system and ensure that the system POST (Power On Self-Test) is functioning properly. The DC-6X0 should display its own POST test and messages immediately below and after the system POST test and messages. An example screen is depicted below.

Primary xxx-Bus IDE Cache Controller
TEKRAM Technology Co., Ltd. (V2.00)

Press F2 or F6 to enter advanced configuration menu.
4096K bytes of CACHE DRAM installed.

If the DC-6X0 POST test and messages do not appear, there may be a ROM address or timing conflict between the DC-6X0 and other adapter cards in the system. Re-check the ROM address set for the DC-6X0 (ROM BIOS Address option of **Controller Option Select** module) against the ROM

address of any other adapter cards in the system for potential conflicts. If conflict did exist, you can adjust the ROM address of other card(s). Otherwise, you have to turn the power off, pull out other card(s), and then power up the system and enter the Advanced Configuration Menu (ACM) to select a proper location to avoid the conflict.

If the system contains a 16-bit VGA adapter with a **Fast address Decode** option, *disable* that feature. Due to its wider address decoding range, this feature might cause some potential conflicts with the DC-6X0 or any other cards implemented with 8-bit memory mapped I/O.

2.3 Drive Parameters

For most **single** new or used IDE drive installations, there is generally no need to access the ACM to ensure proper operation of the DC-6X0 with your IDE drive. The DC-6X0 obtains the correct drive parameters directly from the drive itself, by automatically issuing an *IDE Identify Drive* command. If you are upgrading a **single** existing IDE drive subsystem with the DC-6X0, the drive will function exactly as before. If you are installing a new IDE drive, the drive is now ready for operating system installation; refer to your operating system manual for further instructions.

Note: *IDE drives are factory low-level formatted. It is unnecessary and inadvisable to low-level format a NEW IDE drive.*

Some IDE drives either do not respond correctly to the *IDE Identity Drive* command, or respond with the physical parameters, rather than the manufacturer's recommended translation parameters. In such cases, the DC-6X0 will generally issue an error message similar to the one depicted below.

**=ERROR=
IDE BUS1 drive 0: Bad drive or drive parameter error!
Get the correct parameter from drive manufacturer & enter
Advanced Configuration menu to reconfigure the system.**

If you receive this message, you must enter the ACM and manually enter the correct drive parameters in the **Disk Parameter Setup** module. Refer to your

drive manual for the correct parameters of a new IDE drive. If you are upgrading an existing used IDE drive subsystem, the drive parameters previously stored in the system CMOS will be correct.

Once you have entered the correct drive parameters in the **Disk Parameter Setup** module, press <Esc> and save the updated parameters. The system will reboot and the new parameters will be checked by the DC-6X0 to ensure they are correct. If correct, a used IDE drive will function exactly as before, while a new IDE drive is now ready for operating system installation. If an error message is still displayed, you must verify and re-enter the correct drive parameters.

If necessary, refer to **Disk Parameter Setup** module in Chapter 3 for detailed instructions on entering correct drive parameters.

Chapter 3: Advanced Configuration Menu (ACM)

The Advanced Configuration Menu, or ACM, is the DC-6X0's setup and configuration program, and gives you control over drive arrangements and cache operations. The program (and default settings) are stored in an on-board EPROM and EEPROM, which allows you to save your own preferences as power-on defaults.

The ACM is accessible during the DC-6X0's POST test on powering up or resetting the system, when the following message appears on screen:

Primary XXX-Bus IDE Cache Controller
TEKRAM Technology Co., Ltd. (V2.00)

Press F2 or F6 to enter advanced configuration menu.
4096K bytes of CACHE DRAM installed

Pressing **[F2]** or **[F6]** at this time will access the ACM main menu, which is illustrated below.

Select the function for operation

Disk Parameter Setup
Controller Option Select
Display Drive Information
Low Level Format
Mirror Initialization or Repair
Mirror Drive Verification
Disk Image Copy
Disk Image Compare

Each option on the main menu takes you to a different module of the ACM, all of which are discussed in detail in this chapter.

3.1 Disk Parameter Setup

This module allows you to install, link and mirror drives. It is divided into three functional feature blocks, as depicted below, which control, respectively, physical drive information, logical drive information, and installed drive information.

Drive Parameter Setup					
	Cylinders	Heads	Sectors		Capacity
IDE BUS1 Drive 0 [D0]	683	16	38		202 MB
IDE BUS1 Drive 1 [D2]	0	0	0		0 MB
IDE BUS2 Drive 0 [D1]	2108	4	49		201 MB
IDE BUS2 Drive 1 [D3]	0	0	0		0 MB
Attribute	Cylinders	Heads	Sectors	Trk-Remap	Capacity
Drive C [D0]	683	16	38	Disabled	202 MB
Drive D [D1]	952	7	62	Disabled	201 MB
Drive E [D2]	0	0	0	Disabled	0 MB
Drive F [D3]	0	0	0	Disabled	0 MB
IDE BUS1 Drive 0	--- Maxtor 7213 AT				
IDE BUS1 Drive 1	---				
IDE BUS2 Drive 0	--- ALPS ELECTRIC Co., LTD. DR312C				
IDE BUS2 Drive 1	---				

Physical Drive Information

The first block displays the parameters (cylinders, heads and sectors) for each physical IDE drive connected to the DC-6X0. In this case, we see two drives, with capacity of 202MB and 201MB, separately connected to IDE BUS1 and IDE BUS2.

	Cylinders	Heads	Sectors	Capacity
IDE BUS1 Drive 0 [D0]	683	16	38	202 MB
IDE BUS1 Drive 1 [D2]	0	0	0	0 MB
IDE BUS2 Drive 0 [D1]	2108	4	49	201 MB
IDE BUS2 Drive 1 [D3]	0	0	0	0 MB

$$\text{Capacity} = (\text{Cylinders}) \times (\text{Heads}) \times (\text{Sectors}) \times 512 \text{ Bytes}$$

These parameters are normally read from the IDE drive and automatically updated without user intervention. However, if an IDE drive fails to respond to the *IDE Identify Drive* request issued by the DC-6X0, you may need to manually enter the correct parameters based on the manufacturer's recommendations.

[D0] is short for IDE BUS1 Drive0 and [D2] is for Drive1. As for drives connected to IDE BUS2, [D1] is short for Drive 0 and [D3] is for Drive1. These short names will correspond to the next block of this module for further settings, such as link or mirror.

Logical Drive Information

The second feature block of this module displays the parameters of the four logical drives units supported by the DC-6X0 and presented to the operating system. The logical drive here maybe an individual drive, linking pair of two drives or mirroring pair of two drives.

The following block shows two individual drives installed:

Attribute	Cylinders	Heads	Sectors	Trk-Remap	Capacity
Drive C [D0]	683	16	38	Disabled	202 MB
Drive D [D1]	952	7	62	Disabled	201 MB
Drive E [D2]	0	0	0	Disabled	0 MB
Drive F [D3]	0	0	0	Disabled	0 MB

- Note:**
- 1. Drive C, D, E, and F shown in this block are for ordering purpose only and not related to system's drive ordering.** For example, if 201MB drive is installed on the IDE BUS1 Drive1, i.e., [D2], this block will display [D2] as Drive E. But from the system, it see [D2] as Drive D.
 - 2. If the drive's cylinder number shown in the top block is greater than 1024, the controller may translate the parameters into its format for proper operation.**

Attribute

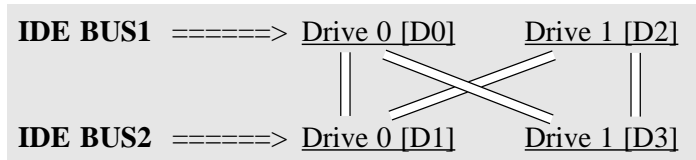
Initially, [D0] to [D3] shown in this column are corresponding to that of upper block. If you're working with individual drive(s) only, then no settings need to be done. If Linking or Mirroring is needed, this attribute will provide you necessary setting options for operation. **Beware that you must set one of the pair to [Non-installed] first to have the Link/Mirror option show for the other drive.**

The following full screen shows [D0] and [D1] are mirrored as a pair. The Linking case is similar.

Drive Parameter Setup					
	Cylinders	Heads	Sectors		Capacity
IDE BUS1 Drive 0 [D0]	683	16	38		202 MB
IDE BUS1 Drive 1 [D2]	0	0	0		0 MB
IDE BUS2 Drive 0 [D1]	2108	4	49		201 MB
IDE BUS2 Drive 1 [D3]	0	0	0		0 MB
Attribute	Cylinders	Heads	Sectors	Trk-Remap	Capacity
Drive C [D0 mirror D1]	952	7	62	Disabled	201 MB
Drive D [Non-installed]	0	0	0	Disabled	0 MB
Drive E [D2]	0	0	0	Disabled	0 MB
Drive F [D3]	0	0	0	Disabled	0 MB
IDE BUS1 Drive 0	--- Maxtor 7213 AT				
IDE BUS1 Drive 1	---				
IDE BUS2 Drive 0	--- ALPS ELECTRIC Co., LTD. DR312C				
IDE BUS2 Drive 1	---				

Note: 1. To select the proper attribute for **Mirroring**, you must set one of the drive to [**Non-installed**], in this case [D1], and then set the other drive to [D? mirror D?], in this case [**D0 mirror D1**]. The capacity shown in this block will be the one with smaller capacity. To optimize the performance of dual channel design, the mirroring function requires you to work with two drives connected to two individual buses, i.e., IDE BUS1 and IDE BUS2.

Cannot do mirroring for two linking pairs on the two buses, either. Four possible linking pairs, from physical drive point of view:



2. The setting for **Linking** is similar to Mirroring, except the Linking function would require you to work with two drives on the same bus, either IDE BUS1 or IDE BUS2. So there are two possible linking pairs for each controller. The capacity shown in this block will be the summation of the two mirroring drives.

3. To properly set the attribute, you are able to boot from different drive each time. For example, you have two drives installed with different operating systems and would work with them from time to time. If you work with DOS at the beginning, the setting may look like this:

Attribute	System
DRIVE C [D0] DOS drive	C: ==> Boot Drive
DRIVE D [D1] (no disk)	
DRIVE E [D2] SCO UNIX drive	D:
DRIVE F [D3] (no disk)	

If you would work with SCO UNIX next time, the setting may change like the following. *If you're not able to change to the desired options, you can try to set attribute(s) to [Non-installed] for some of them. This makes more options for the drive you want to work with.*

Attribute	System
DRIVE C [D2] SCO UNIX drive	C: ==> Boot Drive
DRIVE D [D0] DOS drive	D:
DRIVE E [D1] (no disk)	
DRIVE F [D3] (no disk)	

4. If more than two drives, link/mirror pair treated as one, are installed, you have to enable the More Than 2 Drives option of **Controller**

Option Select module. Please also refer to the same section for two DC-6x0 installed.

Trk-Remap

This Track-Remapping function is *disabled* by default and **should be enabled only when capacity of the following partitions used by the logical drive exceed 528MB: 1. DOS, 2. OS/2 (FAT File System) & 3. Windows NT (FAT File System).**

Note: The INT13 BIOS Selection option in the **Controller Option Select** module has to be set to *Enhanced INT13 (Shadowed* or not).

Installed Drive Information

This block indicates physical bus connection of drive(s) controlled by the DC-6X0. The following shows two drives connected to IDE BUS1 and IDE BUS2, respectively.

IDE BUS1 Drive 0	---	Maxtor 7213 AT
IDE BUS1 Drive 1	---	
IDE BUS2 Drive 0	---	ALPS ELECTRIC Co., LTD. DR312C
IDE BUS2 Drive 1	---	

3.2 Controller Option Select

This module gives you access to the advanced features supported by the DC-6X0. The following is the main screen for **DC-690C/CD** only.

Controller Option Setup		
Cache Line Size -----	0.5K	-- Default
More Than 2 Drives -----	Disabled	-- Default
INT13 BIOS Selection ---	Enhanced INT13 Shadowed	-- Default
Cache Function -----	Enabled	-- Default
Controller IO Port -----	Primary	-- Default
Controller IRQ -----	Legacy Header	-- Default
ROM BIOS Address -----	C800H	-- Default
Green Cache Mode -----	Disabled	-- Default
CD-ROM Port (At 170H) -	Enabled	-- Default

The main screen for other DC-6x0 would look like:

Controller Option Setup		
Cache Line Size -----	0.5K	-- Default
More Than 2 Drives -----	Disabled	-- Default
INT13 BIOS Selection ---	Enhanced INT13 Shadowed	-- Default
Cache Function -----	Enabled	-- Default
Controller IO Port -----	Primary	-- Default
Floppy Controller -----	Enabled	-- Default
ROM BIOS Address -----	C800H	-- Default
Green Cache Mode -----	Disabled	-- Default

Cache Line Size

Five options available in kilobytes: 0.5 (default)/1/2/4/8. Normally, there is no need to change to options other than the default one. You are allowed to try other options for your specific application. For example, you may like to choose 4K for NetWare system if the block size of its File System is also 4KB.

More Than 2 Drives

The "drive" here means logical drive, which may be an individual drive, linking pair or mirroring pair. This option supports more than two logical drives under DOS 5.0 and the above versions. It's also applicable to Windows and NetWare. *If there is another DC-6X0 working as **Secondary controller**, you must **enable** this option on it to make the drive(s) controlled by the Secondary controller accessible under the above mentioned operating systems.* In this way, **you're able to control up to eight individual drives**. For *OS/2* and *Windows NT*, you must install the driver to support **Secondary Controller** and **More Than 2 Drives** features.

- Note:**
1. To activate this function, you still have to set another option, INT13 BIOS Selection, in the same module to **Enhanced INT13** (*Shadowed* or not).
 2. To support More than two drive function for other operating systems, you have to install their respective drivers.

3. If another DC-6x0 is added to be the Secondary Controller, you are able to control up to 8 IDE drives in total (4 for each controller). Several things needed to be taken care of:
 - * More Than 2 Drives option must be **Enabled**
 - * INT13 BIOS Selection option must be set to **Enhanced INT13 (shadowed)** or not
 - * Controller IO Port option must be set to **Secondary**
 - * ROM BIOS Address option must be set to be higher than the Primary Controller. In this case, the address of Secondary Controller (**CC00H**) is high than that of Primary Controller (**C800H**).

The following is a sample setup screen for the Secondary DC-6X0:

Controller Option Setup		
Cache Line Size -----	0.5K	-- Default
More Than 2 Drives -----	Enabled	
INT13 BIOS Selection ---	Enhanced INT13 Shadowed	-- Default
Cache Function -----	Enabled	-- Default
Controller IO Port -----	Secondary	
Floppy Controller -----	Enabled	-- Default
ROM BIOS Address -----	CC00H	
Green Cache Mode -----	1 minute	

INT13 BIOS Selection

INT 13 BIOS allows you to select the INT 13 handler, a DOS software interrupt used to control hard disk I/O (read/write operations). Three options exist: Enhanced INT13 shadowed to system RAM (default), Enhanced INT13 and Mainboard INT13.

Enhanced INT13 Shadowed: This option takes that portion of the controller's ROM which normally handles INT 13, and remaps it to conventional memory

(0-640KB), where it occupies 1KB (639KB-640KB). This option is provided, and enabled by default, to ensure compatibility with some early system BIOSes, which may otherwise experience timing problems with the DC-6X0 (and IDE drives generally).

Enhanced INT13: It functions like the previous option except it instructs the controller to handle INT 13 from its ROM address in reserved memory and doesn't occupy 1KB from the system memory.

Mainboard INT13: This option assigns the handling of INT 13 to the system BIOS instead of the controller BIOS. Some system BIOSes also support the remapping to conventional memory of the INT 13 BIOS handling routines; consult your system manual for details.

Note: *Enhanced INT13 (Shadowed* or not) option must be set to work with (1). More Than 2 Drives environment & (2). DOS partition greater than 528MB per drive with Trk-Remap option enabled.

Cache Function

This function allows you to set the cache as *Enabled* or *Disabled*. The cache is *Enabled* by default, but you may find it necessary to temporarily disable the cache (e.g. when installing a new operating system or hardware). When Cache status is *disabled*, data transfer requests and commands are passed directly to the drive itself.

Controller IO Port

Two options: *Primary* => port address (1F0-1F7) --> default
Secondary => port address (170-177)

The option *secondary* will be quite useful when another IDE card is installed in the same system. *Remember to enable the More Than 2 Drives option to make the drive(s) controlled by the Secondary controller accessible. You are allowed to put two DC-6X0 controllers in the system and thus can control up to eight individual drives.* For operating systems other than DOS, device drivers are needed.

Controller IRQ (for DC-690C/690CD only)

The default option, **Legacy Header**, is for using the paddleboard, which complies to the specification defined by PCI Special Interest Group, to work with your DC-690C.

If your mainboard can work without adding the paddleboard, you would need to properly select the right option, **INTA-D#**, to work with the mainboard. Please check with the mainboard menu for detailed information on INTA-D# setting.

Floppy Controller (not for DC-690C/690CD)

This option is able to set as Enabled (default) or Disabled. Note that only one floppy controller can be enabled in the system.

ROM BIOS Address

It has six options: DC00:0, D800:0, D400:0, D000:0, CC00:0, & C800:0 (default). *The ROM BIOS address of DC-6x0 should NOT be SHADOWED in the mainboard's CMOS setup, if available.*

Once an I/O ROM address conflicting happens between or among add-on cards installed in the system, you have to switch the ROM addresses on those cards to different locations. One way is to adjust other card's ROM address to avoid conflicting. The other way is pulling out the other card(s) first, entering this module to adjust the right position, and then plugging back the other card(s) for system operation. Note that *the DC-6X0's ROM address is always prior to that of other SCSI adapter(s)*. Also, if **two DC-6x0s installed**, *the Primary one should have lower ROM BIOS address than the Secondary one.*

Green Cache Mode (Power Saving)

It is also called **Power Saving** mode. If enabled, the DC-6X0 will start to monitor the access activities to the storage subsystem. If the duration of IDLE state exceeds the time limit defined in this mode, the DC-6X0 will then turn the drive(s) and controller itself into MOTOR OFF and SLEEPING modes, respectively, in order to save power. The following are eight options available: Disabled (default), 1/2 to 30 minutes.

CD-ROM Port (At 170H) (for DC-690CD only)

To enable this option, the DC-690CD would allow you to install up to four hard drives (on the Primary port) and two ATAPI CD-ROM drives (on the Secondary port: 170H).

If you install two DC-6x0 in a single system, then you cannot use the ATAPI interface on either board. This is due to the fact that each board requires a primary or secondary port address. Once the secondary port address 170H is used for the ATAPI connector, there will be no additional port address for one of the boards. So you must disable this option to install two DC-6x0 in a single system.

3.3 Display Drive Information

This module displays information auto scanned from the physical drives attached to the DC-6X0. Note that not all drives respond to the *IDE Identify Drive* request, and, among those that do, not all respond with the same quantity of information; some also respond with the physical parameters, rather than the manufacturer's recommended translation parameters.

A sample screen is depicted below:

IDE BUS1 Drive 0	
Drive model	Maxtor 7213 AT
Firmware revision	5ADF1750
Serial #	B10F4JBS
Cylinders	683
Heads	16
Sectors	38
Buffer type	dual port multiple sector with look ahead
PIO timing	Mode 0 : 600 ns cycle time
Read write multiple	32 sectors per interrupt

Switch to another screen to view the information of the other drive:

IDE BUS1 Drive 0	
Drive model	Maxtor 7213 AT
Firmware revision	5ADF1750
Serial #	B10F4JBS
Cylinders	683
Heads	16
Sectors	38
Buffer type	dual port multiple sector with look ahead
PIO timing	Mode 0 : 600 ns cycle time
Read write multiple	32 sectors per interrupt

3.4 Low Level Format

IDE drives are factory low level formatted for optimum performance, and readied for operating system installation, when shipped by the manufacturer. Under normal circumstances, it is both unnecessary and inadvisable to low level format an IDE drive. In the event that a low level format seems necessary (e.g. multiple bad sectors), contact your dealer or drive manufacturer before proceeding. Some IDE drive manufacturers build low level format routines into the drive itself, and supply special model-specific software programs for this purpose.

If you choose to execute a low level format from the ACM, enter the manufacturer's recommended drive parameters or obtain the parameters from the **Display Drive Information** module of the ACM. IDE drives normally support 1-to-1, or non-interleaved, operation.

Note: If enabled, Linking or Mirroring pair of two drives will be formatted together.

A sample screen is depicted below:

Select a drive for low level format	
IDE BUS1 Drive0	Maxtor 7213AT
IDE BUS2 Drive0	ALPS ELECTRIC Co., LTD. DR312C

Warning: Performing a low-level format causes all information and data on the drive to be lost.

3.5 Mirror Initialization or Repair

The pair of mirroring drives are defined in the attribute option of **Disk Parameter Setup** module. This module will help you prepare the necessary procedures before performing disk mirroring and restore the data once one of the mirror-pair drives is in trouble. By executing this initialization utility, you are able to make an exact duplicate of the *Source* drive.

Select the mirror drive for initialization or repair	
	Status
IDE BUS1 Drive0 -- Maxtor 7213AT	U
IDE BUS2 Drive0 -- ALPS ELECTRIC Co., LTD. DR312C	U

Status column is to indicate the status of mirror pair and will show only after the attribute of **Disk Parameter Setup** module is properly set. It could be any one of the three:

- U:** Un-Initialized Drive (before mirror initialization is done)
- O:** Drive OK (once mirror initialization or repair is completed)
- D:** Drive Damaged (any one of the mirror pair is crashed)

The mirror initialization always duplicates the *Source Disk* to the *Target Disk*. You can try to adjust the proper Source-Target relation by pressing the <Space Bar> to put things in order.

Select the mirror drive for initialization or repair	
	Status
IDE BUS1 Drive0 -- Maxtor 7213AT	U Source
IDE BUS2 Drive0 -- ALPS ELECTRIC Co., LTD. DR312C	U Target

After the Mirror Initialization is completed, Status should display **O** for both mirroring drives, which signifies they are ready to work as a mirror pair.

Select the mirror drive for initialization or repair		
		Status
IDE BUS1 Drive0 -- Maxtor 7213AT	O	Source
IDE BUS2 Drive0 -- ALPS ELECTRIC Co., LTD. DR312C	O	Target

If one of the drives in the Mirror-Pair is **malfunctioning** or **crashed**, the mirroring beeper will start to issue alarms, if JP2 is properly connected. The real cause for a mirroring problem may lie in Bad Cable Connection, Bad Drive, Bad Power Supply ... etc, and all these will cause inconsistency between two drives of the mirror pair. You may then back to this module to check which drive is damaged.

Select the mirror drive for initialization or repair		
		Status
IDE BUS1 Drive0 -- Maxtor 7213AT	O	Source
IDE BUS2 Drive0 -- ALPS ELECTRIC Co., LTD. DR312C	D	Target

After clarifying the problem, you should be able to restore the mirror pair back to its working condition. *Beware that you must set the drive marked as **D to Target** and the one marked as **O to Source**.* The beeping alarm will cease right after the Mirror Repair is completed.

3.6 Mirror Drive Verification

This module performs a **disk comparison** between the two drives of the same mirror pair. You may need to re-do the Mirror Initialization if incorrect data found in one of the drives.

Select the mirror drive for Verification		
		Status
IDE BUS1 Drive0 -- Maxtor 7213AT	0	Source
IDE BUS2 Drive0 -- ALPS ELECTRIC Co., LTD. DR312C	0	Target

3.7 Disk Image Copy

This module copies the data from the *Source Disk* to the *Target Disk* on a drive-to-drive basis. Still, you have to set the copy-pair drives, one to **Source Disk** and the other to **Target Disk**, by pressing the <Space Bar>.

Select source and target disks for image copy		
IDE BUS1 Drive0 --	Maxtor 7213AT	Source
IDE BUS2 Drive0 --	ALPS ELECTRIC Co., LTD. DR312C	Target

3.8 Disk Image Compare

This module compares the data of the *Source Disk* with that of the *Target Disk* on a drive-to-drive basis. Still, you have to set the compare-pair drives, one to **Source Disk** and the other to **Target Disk**, by pressing the <Space Bar>.

Select source and target disks for image compare		
IDE BUS1 Drive0 --	Maxtor 7213AT	Source
IDE BUS2 Drive0 --	ALPS ELECTRIC Co., LTD. DR312C	Target

Chapter 4: Driver Installations

You may need drivers to gain 32-bit power when running under assorted operating systems, such as DOS, Windows (& Windows for WorkGroup), Windows NT, UNIX, NetWare, and OS/2. These software drivers are stored in two diskettes, except the DOS driver which resides in DC-6X0's ROM already (refer to INT13 BIOS Selection option of **Controller Option Select** module). Before installing, please browse the "README" directory of *Novell driver diskette* for specific driver installation procedures. ***Beware that UNIX driver diskette is UNIX formatted and cannot be read from DOS environment.***

The following are driver installation for some of the operating systems supported by your controller. Please also refer to the <README> in the driver diskette for other driver installations and updated information, if there is any.

<Windows 3.x> (& Windows for WorkGroup 3.x)

This driver requires you to install Windows 3.x (or Windows for WorkGroup 3.x) in the system before driver installation.

(A). Driver Installation:

1. Execute the file "\WINDRV\SETUP.EXE" from the floppy drive
or
2. Enter your Windows and run the same file "\WINDRV\SETUP.EXE"

(C). Driver Removal:

1. During the driver installation, the original SYSTEM.INI under your Windows directory will be renamed as SYSTEM.001. Rename SYSTEM.001 back to SYSTEM.INI, you'll have the driver removed.

<NETWARE.40x>

This subdirectory contains the NETWARE V4.00/4.01/4.02/4.1 device drivers, IDENV40.DSK and IDENV40.DDI. The following explains major procedures during driver installation:

After seeing a message block showing "**Scanning for available drivers ...**" during the installation, you'll find a list of default supported drivers.

Press <Ins> key to install the driver, IDENV40.DSK, from drive A:.

Press <F3> key to specify the path: >A:\NETWARE.40. Select the **IDENV40.DSK** and press the <Enter> for loading this driver.

Press another <Return> key to proceed the setting for **I/O port address** and **IRQ**.

<NETWARE.31x>

This subdirectory contains the NETWARE V3.11/3.12/SFT-III device driver, IDENV31X.DSK. The installation procedure is the same as V31, except the driver loaded here is IDENV31X.DSK.

<NETWARE.31>

This subdirectory contains the NETWARE V3.1 device driver, IDENV31.DSK. The following explains the installation procedures:

For One card installation

STEP 1 ==> Install the DC-6X0

- . Remove other add-on cards that may conflict with DC-6X0's ROM space
- . Select this card as primary
- . Select the ROM space of DC-6X0
- . Enable floppy diskette

STEP 2 ==> Plug another add-on card if necessary

STEP 3 ==> Running the NETWARE server up to the prompt ":" appeared

STEP 4 ==> load IDENV31

For duplexing is required

- STEP 1 ==> Install the secondary DC-6X0 first
- . Remove other add-on cards that may conflict with DC-6X0's ROM space
 - . Select this card as secondary
 - . Select the ROM space of DC-6X0
 - . Disable floppy diskette
- STEP 2 ==> Install the primary DC-6X0
- . Select this card as primary
 - . Select the ROM space of DC-6X0
 - . Enable floppy diskette
- STEP 3 ==> Plug another add-on card if necessary
- STEP 4 ==> Running the NETWARE server up to the prompt “:” appears
- STEP 5 ==> load IDENV31
- STEP 6 ==> load IDENV31

<NETWARE V2.15>

This diskette is also labeled as DSK_DRV_003 and two files IDENV2XX.DSK and IDENV2XX.OBJ in the root directory are used as hard disk device driver for NETWARE V2.15 and V2.2. Follow the NETWARE V2.15 and V2.2's installation guide to install the server.

<OS/2 v2.X/Warp_3.X>

- (A). Driver Installation:
1. Insert the driver diskette into Floppy Drive A:
 2. Under OS/2 V2.X install the driver by keying the following command:
[C:] ddinstal
This command copies the file, OS2_32.ADD, from driver diskette to C:\OS2 directory. The old CONFIG.SYS will be re-named as CONFIG.1, which also resides in the C:\ root directory.
 3. Re-boot the system

(B). Driver Removal:

1. During the driver installation, the original CONFIG.SYS under your C:\ directory will be re-named as CONFIG.1. Rename CONFIG.1 back to CONFIG.SYS, you'll have the driver removed.

[C:] COPY CONFIG.1 CONFIG.SYS

2. Re-boot the system

<Windows NT v3.X>

(A). Driver Installation:

1. Enter your Windows NT and login with "Administrator"
2. Run SETUP.EXE from the drive that contains this driver
3. Follow NT's SHUTDOWN procedures to re-boot the system for completing the driver installation

(B). Driver Removal:

1. Enter your Windows NT and login with "Administrator"
2. Run UNINSTAL.EXE from the drive that contains this driver
3. Follow NT's SHUTDOWN procedures to re-boot the system for completing the driver removal (O.S. default driver will be loaded and used from now on)

Appendix A: Technical Specifications

Performance

- Hardware *disk mirroring* support for all O.S.
- **Green Cache**: Power saving supports for both controller and drive(s)
- Effective disk seek time: < 0.3 msec
- Maximum DTR (Disk-to-Cache): 5MB/sec
- Maximum DTR (ISA Bus-to-Cache): 5MB/sec
- Sustained DTR (CoreTest):
 - DC-600C/CF/CD: 2.6MB/sec
 - DC-620B: 9MB/sec
 - DC-680T/C/CD: 14MB/sec (33MHz) & 19MB/sec (50MHz)
 - DC-690C/CD: 12MB/sec (33MHz)
- Cache memory hit ratio: cache memory dependent

Technical

- Microprocessor: 80C188 (DC-620B), 80C186 (DC-680T), 80C286 (DC-600C(F)/CD, DC-680C/CD & DC-690C/CD)
- Bus standard: 16-bit ISA Bus (DC-600C(F)/CD); 32-bit Bus (EISA: DC-620B, VL: DC-680T/C/CD, PCI: DC-690C/CD)
- Cache DRAM: 80ns (or faster) 256KB/1MB/4MB SIMMs & can be mixed
- Flexible cache expandability: from 512KB to 16MB
- Maximum I/O bus speed: 12MHz (DC-600C(F)/CD); 8.33MHz (DC-620B); 25-50MHz (DC-680T/C/CD: same as mainboard clock); 33MHz (DC-690C/CD)
- Maximum 4 IDE drives for each controller (& 2 ATAPI CD-ROMs for DC-6x0CD), Maximum two controllers
- Maximum 4GB capacity per drive
- Maximum floppy drives supported: 2 (not for DC-690C/CD)
- ROM addressing: on-screen selectable

Functional

- **Jump-less** design & **auto drive parameter scanning** make **Plug-&-Play** possible
- Compatible with all major operating systems & 32-bit driver supports
- WD-1003 Emulation mode support
- Booting drive can be switchable among multiple drives controlled by your controller
- **Track-Remapping** support for drive capacity over 528MB under DOS environment
- Enhanced INT 13 BIOS relocation
- Track remapping and automatic type table creation
- Caching algorithms: fully associated LRU, automatic read ahead, deferred write back, & elevated seeking
- Direct replacement for standard AT Bus interface card without reformatting the drive(s)

Appendix B: Product Support Form

The following information should be provided to your supplier in writing to obtain technical support assistance:

0. Ever try General Troubleshooting Tips in Appendix C and without success? Yes? ____ No? ____

1. DC-6X0 Information

Model # : _____

Serial # : _____

Purchase Date : _____

Firmware Version # : _____

BIOS Version # : _____

2. System Hardware Configuration (please list the manufacturer/model/chip)

Motherboard Speed : _____

M/B DRAM/SRAM : _____

Video card : _____

Hard disk/Floppy card : 1. _____
2. _____

Network card : _____

Hard disk drive(s) : 1. _____

- 2. _____
- 3. _____
- 4. _____

Floppy drive(s) : 1. _____
2. _____

Other devices (SCSI/ESDI) : 1. _____
2. _____
3. _____
4. _____

3. System Software Configuration (please list the version)

Operating System :

Application Program:

4. Detailed description of error messages and symptoms:

Appendix C: Error Messages and General Troubleshooting Tips

Error codes may be generated at various stages in the DC-6X0's BIOS initialization procedure. If an error occurs, the BIOS will display a message accompanied by one of several error codes, which are listed below.

Code	Message	Description
1	Controller Failure!	Extended command enabled
2	Controller Failure!	Query controller information
3	Cache Operation Failure!	Write back cache to drive and flush cache
4	Cache Operation Failure!	Disable cache
5	Cache Operation Failure!	Write cache DRAM
6	Cache Operation Failure!	Read cache DRAM
7	Controller Failure!	Query controller information error during DRAM test
8	Cache RAM Error at Bank 0	DRAM error at bank 0
9	Cache RAM Error at Bank 1	DRAM error at bank 1
10	Cache RAM Error at Bank 2	DRAM error at bank 2
11	Cache RAM Error at Bank 3	DRAM error at bank 3
12	No Cache RAM Installed!	No DRAM installed
13	Controller Failure!	Read EEPROM
14	Controller Failure!	Write EEPROM
15	Controller EPROM Checksum Error!	Controller EPROM checksum error

On powering up the system, if the DC-6X0 issues the message Error Code = 1 with no further details, one of four possibilities exist:

- Controller is not functional
- No Cache DRAM is installed
- TAG SRAM test failure
- Parity error on cache DRAM

Power off the system, wait a few moments and then power the system back on. Some system BIOSes may issue a HDD Controller Failure message if no cache DRAM is installed.

General Troubleshooting Tips

Most controller errors are traceable to external factors, such as conflicts with other installed cards, bad or incorrectly configured drives, loose cables or other installation errors.

When a trouble happens in your system, you can always try to verify the possible causes by changing various components in your system, such as I/O card, motherboard, DRAM SIMM, or CPU. The following are general guidelines for some specific error conditions:

0. The LED connected to JP1 flashes some diagnostics right after power-up. The following shows the flash frequency of each fatal error condition:
 - One short flash: No Cache DRAM installed
 - Two short flashes: CPU error
 - Three short flashes: SRAM error
 - Four short flashes: Timer error

1. no BIOS message from DC-6X0, i.e. <Press F2 or F6 ...>, appears on the screen:
 - ROM address conflicting with other I/O card(s) -> check the ROM addresses of all the I/O cards and make sure no conflicting.
 - VGA card with "Fast Address Decode" option enabled -> this may cause all I/O cards that employ 8-bit ROM BIOS, DC-6X0 included, not to be recognized. Please disable this option, if available.

2. missing operating system:
 - Could be the parameters scanned by the DC-6X0, directly from the drive itself, differ from drive supplier's -> enter the Drive Parameter Setup module of ACM and key in the parameters provided by drive supplier manually.

3. System hang after running a while:
 - ROM BIOS might be “shadowed” by motherboard -> check the setup of your motherboard and disable the “shadow” option on DC-6X0’s ROM address.
 - Cabling (error condition varies)
4. FDC error:
 - Could be more than one FDC enabled: make sure only one FDC is allowed to be enabled.
5. Cannot access HDD:
 - Check if the HDD type in your system’s CMOS is set to “1”.
6. Cannot recognize the HDD's parameters or cannot save them correctly:
 - Try to place the jumper cap over JDR0, i.e., short, if the HDD is connected to the FIRST IDE BUS. If connected to SECOND IDE BUS, then short the JDR1.
7. Possible incompatible conditions for default option (Enhanced INT13 Shadowed) of **INT13 BIOS Selection**:
 - The default option gains the optimal performance. Due to its nature of occupying 1KB (639KB-640KB), some software programs may issue false alarms, such as virus-protection software. The above problems can be avoided by choosing another option "Mainboard INT13".
 - Due to the same nature of 1KB occupancy, the default option may have conflict during executing the OS/2. Since the OS/2 would only employ its disk I/O routines, the above problem can also be avoided by choosing another option "Mainboard INT13" without degrading any performance.
 - Since the Enhanced INT13 options are for DOS (Windows) and not related to UNIX, it is recommended to choose the "Mainboard INT13" to operate under these environments.
8. Not able to execute Power-Saving function for your HDD that is capable of:
 - Can try to set the **Green Cache Mode/Controller Option Setup** to a desired timing first. If fails, then try to choose the **INT13 BIOS**

Selection/Controller Option Setup option to "**Mainboard INT13**" and set the proper option during the mainboard CMOS setup.

9. The capacity of HDD shown is much smaller than it should be:
 - Check if your HDD is for DOS partition with capacity over 528MB, because there is DOS constraint forbidding you to cross that limitation. The DC-6x0 provides a solution to overcome it by enabling the "Trk-Remap" feature in Disk Parameter Setup module of ACM. Refer to Sec. 3.1.