LCS-6200 SERIES
WINCHESTER DISK CONTROLLER
USER'S MANUAL

CONTENTS

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          2. CCP/M-86: Digital Research, Inc.
          3. MS-DOS: Microsoft Corp.
          4. ST-506, ST-412: Seagate Technology.
          5. COMPAQ: Compaq Computer Corp.

CHAPTER 1

INTRODUCTION

1.1 GENERAL DESCRIPTION

The LCS-6200 Series Winchester disk controller is an IBM PC/XT compatible Winchester Controller board designed to interface up to two 5 1/4 inch Hard Disk drives, two 5 1/4 inch Floppy Disk drives and also provides for Streaming Tape backup. Hard Disk interface is via the Seagate ST-506/ST-412 interface. Floppy Disk interface is via the IBM PC standard floppy interface and Streaming Tape Backup is via the QIC-02 or SA-450 interface.

1.1.1 LCS-6210: A Winchester disk controller for IBM PC/XT computers.

FEATURES:

* Compatible with IBM PC/XT host bus.

* Controls up to 2 hard disk drives via the industry standard ST-506/ST-412 disk interface.

* On-board error checking and correction (ECC) to guarantee maximum data integrity.

* On-board reduced write current and write precompensation.

* On-board disk BIOS ROM with automatic booting.

* Automatic retries during disk access.

* Split mode which allows one physical drive to be split into two logical drives.

* High level command set supported.

* Up to 15 different drive types can be chosen.

* Drives that implement the "Servo Wedge" imbedded servo scheme at index can also be handled.

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1.1.2 Other Derivatives: Please refer to the controller specification.

LCS-6200 SERIES
Winchester Disk Controller Specification

	LCS-6210	LCS-6220	LCS-6228	LCS-6238
HOST I/F	IBM PC/XT			
FIXED DISK	1. Form Factor: 5¼" or 3½"x2 2. I/F: ST-506/ST-412 3. Data Rate: 5M Bits/Sec. 4. Cylinders: 1,024 Max. 5. Heads: 8 Max.			
FLOPPY DISK	—	5¼" x 2	—	5¼" x 2
STREAMING TAPE	—	—	QIC-02	QIC-02
ECC (11 Bits)	Standard			
SECTOR LENGTH	512 Bytes			
SPLIT MODE	Yes			
COMPATIBILITY	PC-DOS 2.0, 2.1, 3.0, 3.1, CCP/M-86 , CP/M-86			
DIAGNOSTICS	IBM Advanced Diagnostics V2.05	COMPAQ Advanced Diagnostics		
POWER + 5V	0.8A	1.0A	1.0A	1.4A
POWER + 12V	50mA			
SIZE (LmmxWmm)	170 x 100	317 x 122		352 x 122

* Specifications are subject to change without prior notice.

1.2 MINIMUM SYSTEM REQUIREMENTS

The following is the minimum set of hardware and software for operation of the system:

A. IBM 5150 Personal Computer (or compatibles).
B. One 5 1/4" floppy disk drive with IBM PC standard floppy interface.
C. An available system expansion slot in the computer.
D. One of LCS-6200 series controller.
E. Industry standard ST-506/ST-412 Winchester disk drive. Support drive types:
    (1) Capacities: 5MB, 10MB, 15MB, 20MB, 22MB, 32MB, 37MB & 42MB.
    (2) Cylinders: 306, 440, 612, 640, 695, 733, 855, 977.
    (3) Heads: 2, 4, 5, 6, 8.
    (4) Drives with different parameters can also be controlled through the Reserved Jumper Settings. Please contact the manufacturer for more details.
F. Appropriate cables to connect hard/floppy disk drives or streaming tape drive, if any.
    (1) 20-pin flat cable (1 piece per hard disk drive).
    (2) 34-pin cable or daisy chain cable for the hard disk drives.
    (3) 34-pin cable or daisy chain cable for the floppy disk drives.
    (4) 34-pin cable for the streaming tape drive.
G. IBM PC DOS V2.0, V2.1, V3.0 or V3.1 and appropriate documentation.
H. Power Requirement: The LCS-6200 series controller and your add-in drives must not draw more than the spare current capacity of the power supply in your PC/XT. The LCS-6200 series draws approximately 0.8 - 1.2 Amp at +5 volts and 40 - 50 mA at +12 volts. Check Hardware Reference Manuals for other equipment on your system to determine total current draw for the system, and compare with the capacity of your power supply.

1.3 OPTIONAL SOFTWARE REQUIREMENTS

LCS-6200 series controller can also be adapted to be used under CP/M-86 or Concurrent CP/M-86 Operating Systems.

CHAPTER 2

HARDWARE INSTALLATION

2.1 PRELIMINARY SETUP

A. Remove diskettes from all drives.
B. Power down any external system components.
C. Power down IBM PC.
D. Unplug all system components from wall sockets.
E. Disconnect all cables from the back of the IBM PC System Unit.

2.2 OPENING THE SYSTEM UNIT

A. Remove the two cover mounting screws found at the rear of the System Unit at the left and right bottom corners. Retain the screws.
B. Slide the top cover forward until it stops, and then tilt the front up and remove. Set the top cover aside.

2.3 INITIAL SETUP OF LCS-6200 SERIES BOARD

A. Plug the 34-pin (J1) cable in the 34-pin connector on the LCS-6200 series. If you are connecting two hard disk drives, use a daisy-chain cable which has connectors for two drives. The red stripe on the cable should be toward the bottom of the connector, corresponding to pin #1 on the controller (See Figure 1, Figure 2). The cable extends in the direction of the end of the board.
B. Plug the 20-pin (J2 or J3) cable into either one of the 20-pin connectors on the LCS-6200 series, also oriented with the red stripe on the bottom. If you are connecting two drives, plug in both 20-pin cables.
C. Plug the 34-pin (J4) cable in the 34-pin connector on the LCS-6220. If you are connecting two floppy disk drives, use a daisy-chain cable which has connectors for two drives. The red stripe of the cable should be directed to pin #1 on the controller.

RED STRIPE -->

J1

(To Floppy Disk Drive)
J4

JP1 ┃●●●●●●●┃
    1234567

<--- Pin 1

J2   J3

<-- Pin 1

RED STRIPE   (To Hard Disk Drive)
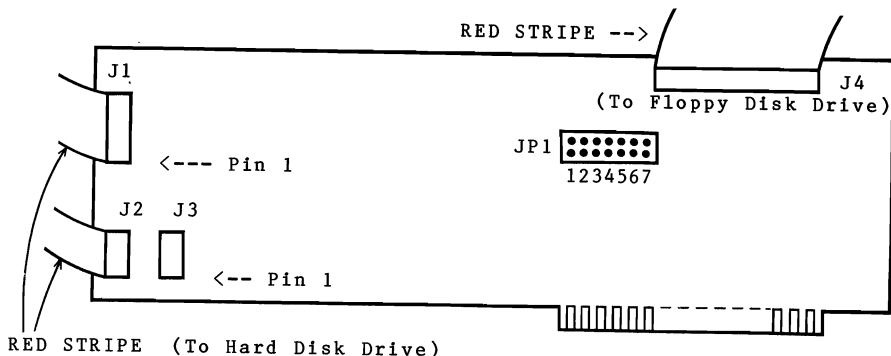
Figure 1. Location of Jumpers and Connectors on LCS-6220

Remarks:
   (1) The drive Logical Unit Number is determined by the switch setting on the disk drive, not by the choice of cable connector.
   (2) Jumper setting checking:
        Check JP1: JP1 must be set according to the characteristics of the drive(s) you will attach. Regarding jumper setting please refer to Appendix 1.

J1

JP2
┃●●●●●●●┃
1234567

<--- Pin 1

J2   J3

JP1 ┃●┃3
    ┃●┃2
    ┃●┃1

<-- Pin 1

RED STRIPE   (To Hard Disk Drive)
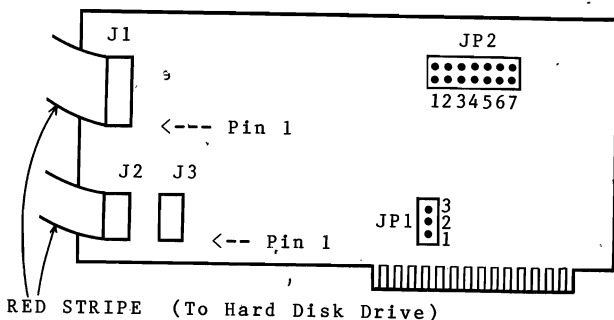
Figure 2. Location of Jumpers and Connectors on LCS-6210D

Remarks:

Jumper setting checking:

a. Address Selection:
   JP1: (1,2) Closed to select address E8000
   JP1: (2,3) Closed to select address C8000
b. Check JP2: JP2 must be set according to the characteristics of the drive(s) you will attach. Regarding jumper setting please refer to Appendix 1.

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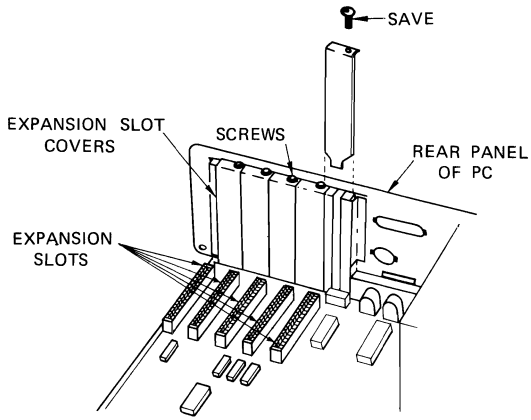
Figure 3. Expansion Slots in System Unit
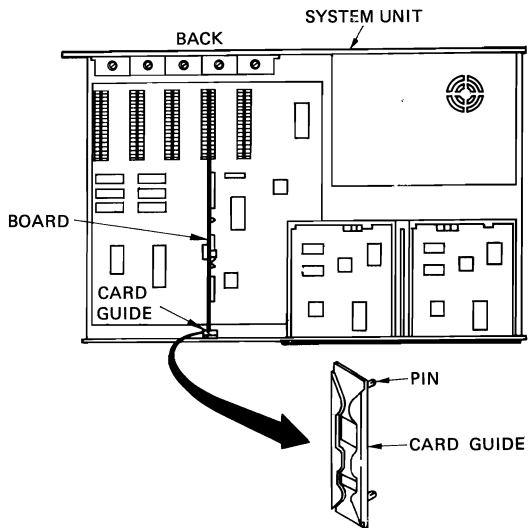
Figure 4. Installation of Card Guide for Expansion Slot

2.4 CONNECTION OF LCS-6200 SERIES IN SYSTEM UNIT

A. Look inside the System Unit. In the left rear are 5 or 8 expansion slots (See Figure 3). Some may already be filled. Choose one of the empty slots. But please be reminded cabling is easiest from the slots toward the right.

B. Remove the corresponding system expansion slot cover screw, and pull out the cover. Save both items.

C. Pop the plastic card guide into the predrilled holes in the front of the system unit which correspond to that expansion slot. (See Figure 4).

D. Slide the LCS-6200 series vertically into the expansion slot, using the card guide.

E. Replace the screw in the expansion slot cover attached to the LCS-6200 series thus securing the board into the System Unit.

2.5 SETUP OF HARD DISK DRIVE

A. Select the appropriate drive number on the hard disk drive(s). This usually takes the form of a jumper that connects two pins on the drive's PCB board. Consult the manufacturer's manual for the hard disk drive for the location of the jumper. For the standard case of a single hard disk drive, set up the drive as drive select 1 (DS1). If you have a second drive set it up as drive select 2 (DS2).

B. If mounting brackets or other physical modifications are required for the hard disk drive, install them at this time.

C. Your drive was ˉ probably shipped with a "tie-down" pin or clip on the positioning mechanism to prevent movement of the heads during shipping. Please remove the "tie-down" carefully at this time. But most of the hard disk drives will automatically restore upon power on.

2.6 SET UP FLOPPY DISK DRIVES

In a hard disk drive installed environment most of the time you need one or two floppy disk drives so that you can copy programs/data from the floppy disk to the hard disk or vice versa.

2.6.1 For LCS-6210

You can install the floppy disk drives according to the "Guide to Operations" which came with your IBM PC.

2.6.2 For LCS-6220

LCS-6220 allows you to install up to two
floppy disk drives in the PC system. Please set the
related dip switches according to 2 floppy disk
drives environment (See Figure 5).
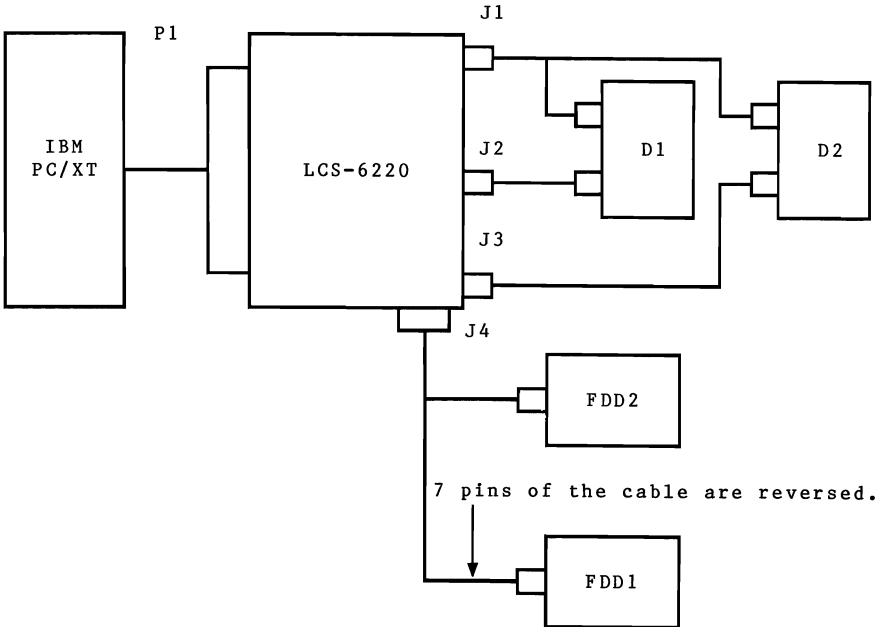
D1 & D2 --> 5 1/4" Hard Disk Drives
J1 --> Drive Control Connector
J2 & J3 --> Read/Write Connector
J4 --> Floppy Disk Connector
P1 --> IBM XT Edgecard Connector
FDD1 & FDD2 --> 5 1/4" Floppy Disk Drives

**Figure 5.   Connection of Cables for 2-Hard Disk
& 2-Floppy Disk Drives System**

2.7 INSTALLATION OF HARD DISK UNIT

There are 2 kinds of installation of the hard disk unit:

1. Internal installation
2. External Installation

2.7.1 Internal Installation

This section contains instructions for placing a hard
disk drive within the IBM PC System Unit cabinet, in
the place normally held by the right-hand floppy disk
drive. Follow these instructions only if:

- the size of the hard disk drive is appropriate to
  fit in.
- The PC System Board is configured for either a one
  floppy or two floppies system.
- Compatibility with the IBM PC power supply has
  been calculated.

A. Route cables around the other expansion cards,
    then around the back of the left-hand floppy disk
    drive, and into the area behind the hard disk (See
    Figure 6). Carefully bend the cables as necessary
    to allow access to the rear of the hard disk drive.
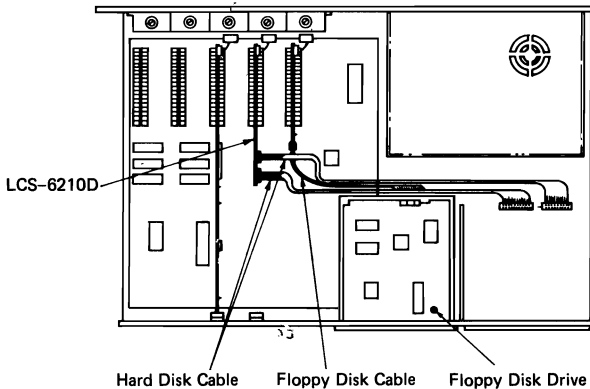
Figure 6. Routing of Cables for Internal Mounting

B. On the inside of the black metal panel which
    covers the front of the empty area, there are two
    metal clips which hold it in place. The clips
    slide off easily if rotated to a vertical position.
    Rotate and remove the clips. Remove the panel.

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C. Carefully insert the rear of the hard disk drive
    through the hole where the panel was. Slide it
    in most of the way.
D. In the right rear of the System Unit is a metal
    box with a fan hole in the top. This is the IBM
    PC power supply. On the left side of the box is a
    bundle of wires. Find the set of four wires (red,
    black, black, yellow) which is not in use (There
    is a similar set connected to the floppy diskette
    drive). This is the power cable for the drive.
    The power connector is keyed so as to only allow
    the correct mating with the connector on the drive.
    Plug the IBM PC power cable into the connector on
    your hard disk drive. If the plug does not go in
    easily, try turning it over.
E. Connect the two cables (one 34-pin and one 20-pin)
    from the LCS-6200 series controller to the hard
    disk drive. Be very careful of their orientation!
    The red stripe must correspond to pin number one
    on each connector.
F. Carefully slide the hard disk drive the rest of
    the way into the System Unit.
G. Fasten the drive in place with the two side screws
    (See Figure 7.)

POWER SUPPLY

SLIDE IN →

BACK OF
SYSTEM UNIT

POWER SW.

THESE SCREWS HOLD
DISK DRIVE IN PLACE
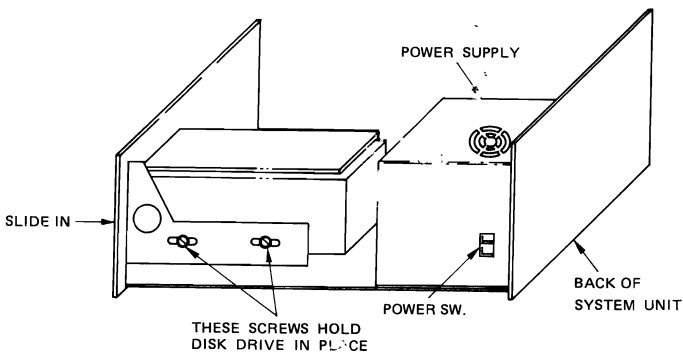
Figure 7. Fastening Internally-Mounted Drive in Place

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2.7.2 External Installation

This section gives instruction for external installation assuming the use of ribbon cables.

A. Bend the flat cables to exit from the top of the expansion slot area.
B. Run each cable horizontally over the expansion cards, so that the cables come out of the back of the System Unit above the expansion slot cover area.
C. Connect the 20-pin and 34-pin cables from the LCS-6200 series Board to the hard disk drive. Be very careful of their orientation! The red stripe must correspond to pin number one on each connector. If you are installing two hard disk drives, each gets its own 20-pin cable (it does not matter which one), and the 34-pin cable is connected to both drives (See Figure 5).
D. Connect power cables to the hard disk drive from an external power supply if necessary. Consult the instruction manual for your particular disk drive for additional information.

2.8 CLOSING THE SYSTEM UNIT

A. Put the top cover of the System Unit back on its tracks.
B. Slide the cover toward the rear of the unit until it is back in place. TAKE CARE THAT IT DOES NOT CATCH ON THE RIBBON CABLES.
C. Replace the two cover screws which you removed in step 2.2A.

2.9 RECONNECTION OF CABLES TO EXTERNAL DEVICES

A. Reconnect all cables which you removed in step 2.1. Refer to IBM's Guide to Operations Section 2, "Setup", if you have trouble recabling the system.

CHAPTER 3

INITIAL POWER-UP

A. Place a copy of your normal PC-DOS 2.0 in disk drive A.

B. Power up the system in the normal sequence. If you have an external power supply for the hard disk, be sure it is on too.

C. Does the system come up with a message indicating the correct number of hard disks (such as "1 Hard Disk Installed"), followed the DOS 2.0 prompt?
   YES: proceed with Chapter 4, Formatting the Disk
   NO : check:
     - appropriate switches (wall switch, CRT) on
     - recabling of system correct
     - appropriate diskette installed in disk drive

   If this step cannot be successfully completed, do not continue!

D. If you select the "split mode" (please refer to Appendix 1 for jumper setting) then you can get available 2 logical drives with equal capacity for 1 physical drive if the number of R/W heads is even. If the number of R/W heads is odd, then the first logical drive will have one more disk surface capacity assigned to it. The greeting message will be as follows:

```
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*                                                                 *
*    --> SPLIT DISK                                               *
*                                                                 *
*    2 HARD DISKS INSTALLED                                       *
*                                                                 *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
```


E. If further troubleshooting is required, remove power from the system. Open the cabinet. Check cable orientation. Check switch and jumper settings on LCS-6200 series. If this does not allow the system to operate, remove the LCS-6200 series from the expansion slot and see if the system is back to normal. This will isolate the problem to the LCS-6200 series or the hard disk drive.

WARNING! Always remove power from any piece of equipment in your computer system before modifying it.

CHAPTER 4

FORMATTING THE WINCHESTER DISK

Before formatting the Winchester disk, please prepare a new system diskette PC-DOS 2.0 on the machine you just set up. This new system diskette will be used in the following steps.

A. Boot your system: Insert your new system diskette PC-DOS 2.0 and boot directly from the floppy disk drive.

B. Pre-formatting: Key in `DEBUG` and press <CR> and proceed as follows:

```
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*                                                                 *
*   A>  DEBUG     <CR>                                            *
*       -----                                                     *
*       -G=C800:5      <CR>                                       *
*       --------                                                  *
*       Which drive to be formatted (Drive 0/1) ? 0     <CR>      *
*                                                                 *
*       CAUTION:                                                  *
*                                                                 *
*       Data on cylinders 0 to XXX of the specified drive         *
*       will be destroyed.                                        *
*       Are you sure (Y/N) ? Y      <CR>                          *
*                                                                 *
*       Pre-formatting . . .                                      *
*                                                                 *
*       PRE-FORMAT COMPLETE                                       *
*                                                                 *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
```

Note: 1. The underlined characters are the ones you must type.
       2. <CR> means you must press the `ENTER` key.
       3. The `XXX` is the number of cylinders of your hard disk drive, i.e., 306, 612, etc.

Upon the last <CR> being pressed, the LED on the Hard Disk drive will light on.

Now the hard disk drive is being pre-formatted. Pre-formatting takes about 1-4 minutes, depending on what Hard Disk capacity you have. After the pre-formatting is completed the LED will be off and the prompt `-` will appear again. Press `Q` and you exit to PC-DOS system.

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C. **Storage Partition:**   You can divide your Hard Disk storage into
                                             up to 4 partitions and run up to 4
                                             different operating systems on your IBM
                                             PC/XT.   Please   key in `FDISK´ and   press
                                             <CR> and the screen will appear:

```
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*                                                           *
*   CHOOSE ONE OF THE FOLLOWING:                            *
*                                                           *
*   1.   CREATE DOS PARTITION                               *
*   2.   CHANGE ACTIVE PARTITION                            *
*   3.   DELETE DOS PARTITION                               *
*   4.   DISPLAY PARTITION DATA                             *
*                                                           *
*   KEY IN  1     <CR>                                      *
*           ---                                             *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
```

```
TYPE :     1       <CR>
           ---
```

The screen will display:

```
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*                                                           *
*   CREATE DOS PARTITION´                                   *
*   DO YOU WISH TO USE THE                                  *
*   ENTIRE FIXED DISK FOR DOS                               *
*   (Y/N) ?      Y    <CR>                                  *
*                ---                                        *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
```

If you want to use the entire Hard Disk storage for DOS only,
then just type `Y´ and press <CR>. If you also want to
configure for other operating system please select `N´ and
proceed according to the IBM DOS MANUAL V2.00 Chapter 4.
Preparing Your Fixed Disk.

After `Y´ is selected, the screen will become:

```
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*                                                           *
*   INSERT DOS DISKETTE IN DRIVE A:                         *
*   PRESS ANY KEY WHEN READY .....                          *
*                                                           *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
```

Press any key and `FDISK´ will be finished.

D. Formatting: When `FDISK` has been completed, perform the
following:

TYPE: FORMAT C:/S   <CR>

The screen will be:

```
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*                                                           *
*   PRESS ANY KEY TO CONTINUE:                              *
*                                                           *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
```

Press <CR> and the Hard Disk will start to be formatted.   It
takes about 5 minutes.

Remarks:

1. It   happened that PC-DOS 2.0 and 2.1 has a bug in   its   FORMAT
   program.   The program is supposed to flag any media defects on
   the   hard disk.   However,   it can only correctly map out   any
   defects on the disk up to a maximum capacity of 16MB per drive
   When   you   want to use larger capacity drives (over 16MB)   you
   may take caution when using PC-DOS 2.0 or 2.1.   Defects in the
   area   past   16MB may cause errors in execution of   the   FORMAT
   program.

2. The   LCS-6200 series allows one physical drive to be splitted
   into two logical drives.   This will make one drive look like
   both C: and D: drives to PC DOS. Since each will be half the
   total   capacity,   a single drive with up to 32MB can be   used
   safely with this feature,   using the PC-DOS 2.0 or 2.1 FORMAT
   program.

CHAPTER 5

LOCKING BEFORE MOVING

The Winchester disk drive is a very complicate and delicate mechanism and it may probably be damaged by violent shock or vibration during transportation. So be sure to lock the read/write heads of your hard disk drive to prevent any hurts on either the heads or the disk plates before shipment.

There is always a proper landing zone that is recommended by the hard disk manufacturer for locating the R/W heads before moving. This location is sometimes different but usually at the innermost cylinder. (Refer to user's manual of hard disk drive)

Always use the standard DOS utility "DEBUG" to move the R/W heads into the shipping zone before shipping.

```
Type :  DEBUG     <CR>
        -----
```

Your screen will show:

```
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*                                                                 *
*  -G=C800:4B0     <CR>                                           *
*  ----------                                                     *
*  Which drive to be locked (0/1) ?    0          <CR>           *
*                                      ---                        *
*  Enter the desired cylinder to be locked (in decimal) XXX <CR> *
*                                                       ---       *
*  Drive locked in the specified cylinder.                        *
*                                                                 *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
```

Turn off the power supply of the drive and the R/W heads are now locked. The drive is ready for shipping.

Note: 1. XXX = The desired cylinders to be locked.
       2. The hard disk drive will be automatically unlocked upon power on.

APPENDIX 1

JUMPER SETTINGS FOR DIFFERENT DRIVE TYPES

LCS-6200 series controls up to 2 fixed disk drives. The following table guides you to set jumpers according to what types of fixed disk drive you want to install with the LCS-6200 series disk controller.

```
Note: OP ---> OPEN (OFF)
      CL ---> CLOSED (ON, JUMPER INSTALLED)
      Jumper 1, 2, 3, 4 identify the Drive #0
      Jumper 5, 6, 7   identify the Drive #1
```

```
                    ***************
                    *  TABLE #1   *
                    ***************
```

Jumper Settings for Drive #0

TYPE	CAPACITY	HEAD	CYL	STEP RATE	1	2	3	4
1	10MB	4	306	17.6us	OP	OP	OP	OP
2	10MB	4	306	200.0us	CL	OP	OP	OP
3	10MB	2	612	17.6us	OP	CL	OP	OP
4	10MB	2	612	200.0us	CL	CL	OP	CL
5	20MB	4	612	17.6us	OP	OP	CL	OP
6	20MB	4	612	200.0us	CL	OP	CL	OP
7	20MB	8	306	17.6us	OP	CL	CL	OP
8	21MB	4	640	17.6us	CL	CL	CL	OP
9	22MB	6	440	200.0us	OP	OP	OP	CL
10	30MB	5	695	17.6us	CL	OP	OP	CL
11	32MB	6	640	17.6us	OP	CL	OP	CL
12	32MB	5	733	17.6us	CL	CL	OP	CL
13	40MB	8	612	17.6us	OP	OP	CL	CL
14	42MB	5	977	17.6us	CL	OP	CL	CL
15	5MB	2	306	17.6us	OP	CL	CL	CL
16	40MB	6	820	17.6us	CL	CL	CL	CL

TYPE	CAPACITY	HEAD	CYL	STEP RATE	5	6	7
1	Drive 1 not connected				OP	OP	OP
2	The parameters of Drive 1 is the same as drive 0.				CL	OP	OP
3	10MB	4	306	17.6us	OP	CL	OP
4	10MB	2	612	17.6us	CL	CL	OP
5	20MB	4	612	17.6us	OP	OP	CL
6	20MB	4	612	200.0us	CL	OP	CL
7	Reserved for non-standard Drive (Contact seller for further information)				OP	CL	CL
8	Split mode (Drive #0 is splitted into 2 logical drives)				CL	CL	CL

```
**************
*  TABLE #2  *
**************
```

TYPE	CAPACITY	HEAD	CYL	STEP RATE	MODELS	
1	10MB	4	306	17.6us	CMI	CM-5412
					COGITO	CG-912
					EPSON	HD-850
					FUJITSU	M 2233
					NEC	D-5124
					NEI	RD-4127
					NPL	NP03-13
					SEAGATE	ST-212
					SHUGART	SA-712
					TANDON	TM-502
					TEAC	SD-510
					TOKICO	DK503-2
2	10MB	4	306	200.0us	CMI	CM-3206
					MICROSCIENCE	HH-612

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3	10MB	2	612	17.6us	MINISCRIBE 3012	
					NEI	RD-3127
					SEAGATE	ST-213
					TANDON	TM261
						TM361
4	10MB	2	612	200.0us	BASF	6188-R1
					MICROSCIENCE HH-712A	
5	20MB	4	612	17.6us	BASF	6188-R3
					CMI	CM-3426
					EPSON	HD-860
					MINISCRIBE 3425	
					NEC	D-5126
					NEI	RD-3255
					SEAGATE	ST-225
						ST-4026
					TANDON	TM262
						TM362
						TM-702AT
					TEAC	SD-520
6	20MB	4	612	200.0us	COGITO	PT-925
					MICROSCIENCE HH-725	
7	20MB	8	306	17.6us	CMI	CM-5826
					NEI	RD-4255
8	21MB	4	640	17.6us	CMI	CM-6426
					NPL	NP02-26S
9	22MB	6	440	200.0us	BASF	6185
10	30MB	5	695	17.6us	TANDON	TM703
11	32MB	6	640	17.6us	CMI	CM-6640
12	32MB	5	733	17.6us	SEAGATE	ST-4038
					TANDON	TM703AT
13	40MB	8	612	17.6us	NEC	D-5146
14	42MB	5	977	17.6us	SEAGATE	ST-4051
15	5MB	2	306	17.6us	NEC	D-5114
					NPL	NP03-6
					SHUGART	SA-706
16	40MB	6	820	17.6us	SEAGATE	ST-251

APPENDIX 2

DIAGNOSTICS ABOUT LCS-6200 SERIES

From the PC/XT supplier you can get an Advanced Diagnostic Program
2.08 diskette. This program can be used to test the functionality
and compatibility of each board of the IBM PC/XT. It also can be
used to test the reliability of the complete system by running the
program multiple times and keep the error log for later study.

LCS-6200 series is surely able to pass the IBM PC/XT Advanced
Diagnostic Program 2.08. This proves its functionality and
compatibility.

Besides, LCS-6200 series can also be used with IBM PC/XT
compatibles such as Compaq, Sanyo, ITT, Super board,
Megaboard...etc. LCS-6200 series can also pass the Compaq
Advanced Diagnostic program.

APPENDIX 3

ABOUT CONCURRENT CP/M-86

LCS-6200 series can be used under the Concurrent CP/M-86 as well as under PC-DOS. The related procedure is in ´FDISK´. The PC-DOS takes one of the partitions and CCP/M takes another partition. The hard disk utility in CCP/M-86 is ´HDMAINT´. The details please refer to the User´s Manual regarding the Concurrnet CP/M-86 Operating System.