WANG

Model 2260BC/2260C
Disk Drive
User Manual

2200

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Disk Drive
User Manual

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HOW TO USE THIS MANUAL

This manual provides information concerning the operation of both the Model 2260BC and Model 2260C series disk drives. It is intended to be used in conjunction with either the Wang BASIC Disk Reference Manual or the Wang BASIC-2 Disk Reference Manual.

Chapter 1 discusses the concept of information storage and retrieval on the disk, including an overview of the disk hardware and the principles of disk operation. Chapter 2 provides specific operational data, including power-on and formatting procedures, etc.

Disk drive specifications and maintenance information are collected in the Appendices.

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CHAPTER 1
GENERAL INFORMATION

1.1 INTRODUCTION

The Model 2260BC and Model 2260C Fixed/Removable Disk Drives provide fast, reliable, high volume storage for the 2200 System. Both models are similar except that the 2260BC is contained in a free-standing cabinet enclosure and can be multiplexed, whereas, the 2260C is basically a table top unit (stand optional) and cannot be multiplexed. There are four (4) models of each unit: the 2200BC1/4, BC1/2, BC and BC-2, and the 2260C1/4, C1/2, C, and C-2. The storage capacities of these disk units (2.5, 5, 10 and 20 million bytes, respectively) are equally divided between fixed and removable disk platters.

The 2260C series disk drive is attached to the 2200 System Central Processing Unit (CPU) using a Model 22C12 Disk Control Module/Controller. The 2260BC series disk drive is attached to the CPU using a Model 22C13 Disk Controller Module and any disk controller. Normally the 2260BC and 22C13 are used with a 2230MXA multiplexer. The combination takes two slots in the CPU.

The Model 2260BC-2 (or Model 2260C-2) consists of two 10 million byte disk drives, cabled together in a "daisy chain" configuration which permits both disk units to be controlled by the same disk. The first disk unit in the daisy chain is connected to the Disk Controller Module in the CPU and is called the "master drive". The second drive unit is connected to the rear panel of the master drive and is called the "slave drive".

The Disk Drive contains a pair of disk platters mounted horizontally on a single drive shaft. The platters are mounted one above the other, somewhat as phonograph records are stacked on a record changer (see Figure 1-2). The upper disk platter can be removed from the disk unit and replaced; it is therefore referred to as the removable disk platter. Because it is contained in a sealed, cartridge-like case to protect it from damage when it is removed from the disk unit, the removable platter is also sometimes referred to as a disk cartridge. The lower disk platter is positioned about 1 1/2 inches below the removable platter on the shaft. It is an integral part of the disk unit and cannot be removed. It is therefore called the fixed disk platter. The shaft itself is coupled to a drive motor which spins both disk platters at a constant speed. The rotational speed of the Model 2260BC and Model 2260C is 2400 rpm.

Information is recorded on, or read from the surface of a disk platter via the read/write head. The read/write heads are attached to a comb-type access assembly consisting of four access arms (see Figure 1-3). The read/write head is fixed in position and cannot move independently of the access arm. When a disk statement or command is executed from the system CPU, the access assembly moves the read/write heads in or out over the disk platters as they rotate. A read/write head can then record information on a surface of a disk platter (write) or retrieve information from a platter (read) as the platter rotates past the head's position.
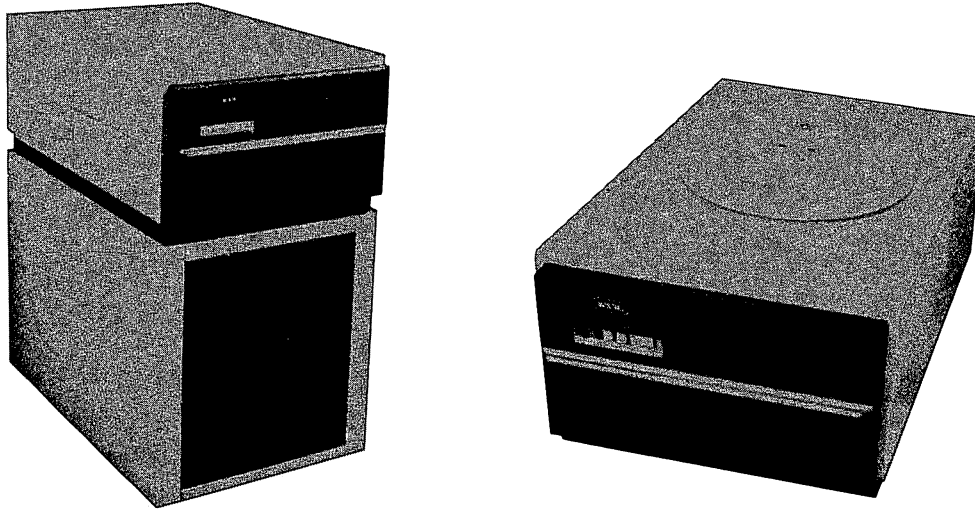
Figure 1-1.   Model 2260BC/Model 2260C Disk Drives
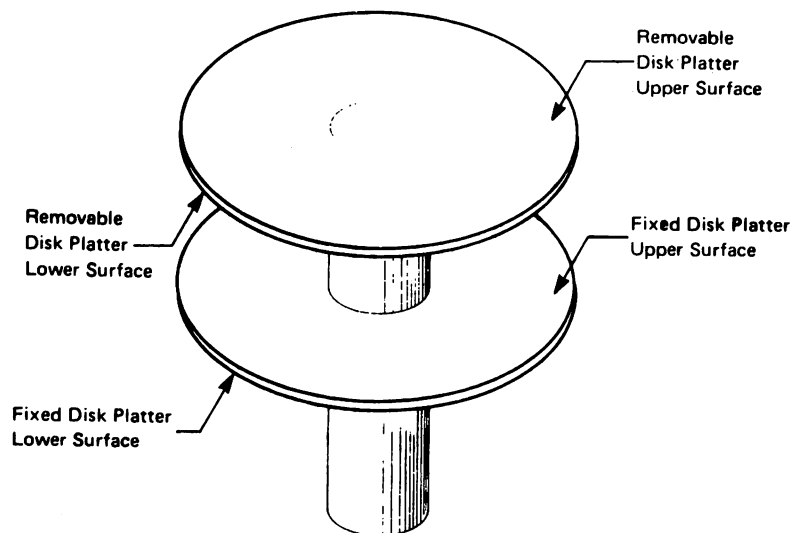
Figure 1-2.   Model 2260BC/Model 2260C Disk Platters
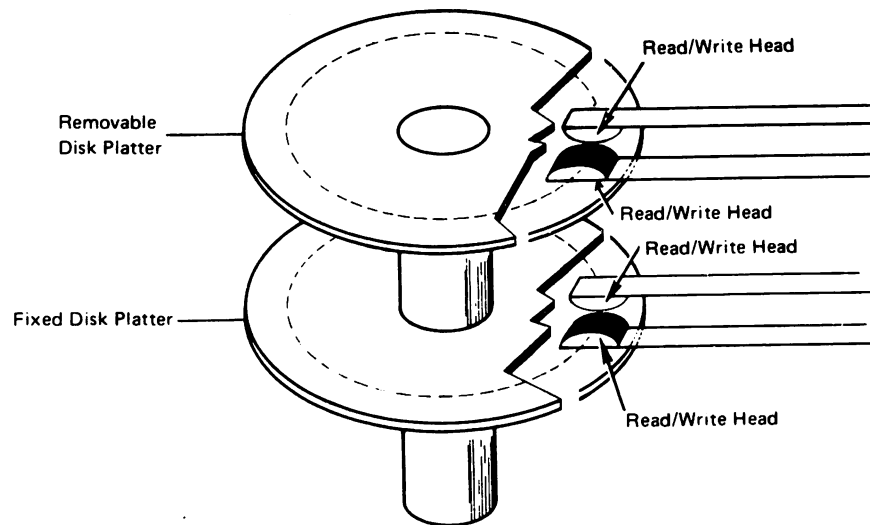
Figure 1-3.   Model 2260BC/Model 2260C Disk Unit Access
Assembly and Read/Write Heads

1.2   RANDOM ACCESS DATA STORAGE

The disk drive provides a high-volume of random access program and data storage with fast access speed.   Each storage location on the disk has a unique identification tag or address which can be directly accessed by the system.   Thus, unlike sequential-access storage devices (such as magnetic tape drives, punched tape, and card readers), the disk does not have to read sequentially through a file in order to locate a desired item of information. Instead, the disk can skip over all intervening records and directly access a specified location for data storage or retrieval.   Hence random-access devices are also referred to as direct-access devices.

Random access capability is very valuable when interrogating or updating a large file, since in many cases the records are not accessed in sequential order.   Even in sequential-processing operations, however the disk is usually as fast or faster than most other external storage devices.

1.3   THE DISK PLATTER

The storage medium of all disk units is the disk platter.   A disk platter is a thin, flat, rigid circular plate.   It is coated on one or both sides with a magnetic material, usually iron oxide, and except that it has no apparent grooves, closely resembles a phonograph record.   The magnetic iron oxide on each recording surface is arranged in circular tracks. Information is stored on a track in the form of magnetized spots of iron oxide, much the same way it is stored on magnetic tape (see Figure 1-4).   Refer to Appendix B, Disk Platter Maintenance Information, for a complete discussion of handling and storage considerations for disk platters.

The rigid disk platter utilized on the Model 2260BC and Model 2260C is 15 inches in diameter (slightly larger than a 33 1/3 rpm phonograph record). It is coated with iron oxide on both sides, and both surfaces can be used to record data. The upper disk platter can be removed from the disk unit and replaced; it is therefore referred to as the removable disk platter.
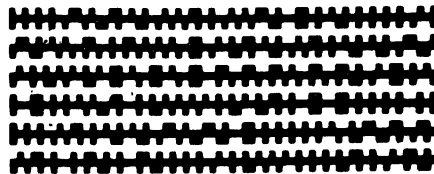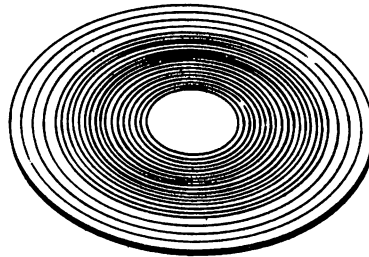
Figure 1-4. Concentric Tracks on a Disk Platter
and Enlarged View of Several Tracks
Showing How Information Is Stored

1.4   SECTORS ON THE DISK PLATTER

In general, it is desirable to be able to store and retrieve information in units smaller than an entire track. For this reason, each track is divided into a number of discrete segments called sectors. A sector is the smallest discrete unit of storage on the disk and has a fixed storage capacity of 256 bytes. Each sector carries its own sector address, and can be directly accessed by the system. On a Model 2260BC and Model 2260C Series disk platter, each track is divided into 24 sectors.

In addition to the 256 bytes in each sector reserved for data storage, the sector contains several bytes of system control information. The system control information consists of a two-byte sector address, a two-byte cyclic redundancy check (CRC) total, and a one-byte longitudinal redundancy check (LRC) total (see Figure 1-5). The sector address is, of course, needed to enable the system to uniquely identify and access each sector. The CRC and LRC totals are the results of checksum tests performed by the system to monitor the integrity of data stored in a sector. The LRC total is stored in a special byte in each sector. All system control information is created, interpreted and maintained solely by the disk controller, and is completely transparent and inaccessible to the user.

A different type of control information, called sector control information, or format control information, is automatically written by the system along with the user's data in the 256-byte data field of the sector. Because the format control information occupies several bytes of the 256-byte data field, the full 256 bytes are not available for data storage under normal conditions.

```
┌─────────────────────────────────────────────────────────────┐
│                    Note to 2200T Users                       │
│                                                              │
│  See Wang BASIC Language Disk Reference Manual, Chapter 4,    │
│  Section 4.6 for a discussion of format control bytes.  A    │
│  technique for writing data on disk without this format      │
│  control information is described in Chapter 6, Section 6.5.  │
└─────────────────────────────────────────────────────────────┘
```

```
┌─────────────────────────────────────────────────────────────┐
│                  Note to 2200VP/MVP Users                    │
│                                                              │
│  See Wang BASIC-2 Language Disk Reference Manual, Chapter 4,  │
│  Section 4.6 for a discussion of format control bytes.  A    │
│  technique for writing data on disk without this format      │
│  control information is described in Chapter 6, Section 6.5.  │
└─────────────────────────────────────────────────────────────┘
```

2-Byte Sector Address **256-Byte Data Field (User's Data and Format Control Bytes)** **2-Byte Cyclic Redundancy Check**

1-Byte Longitudinal Redundancy Check
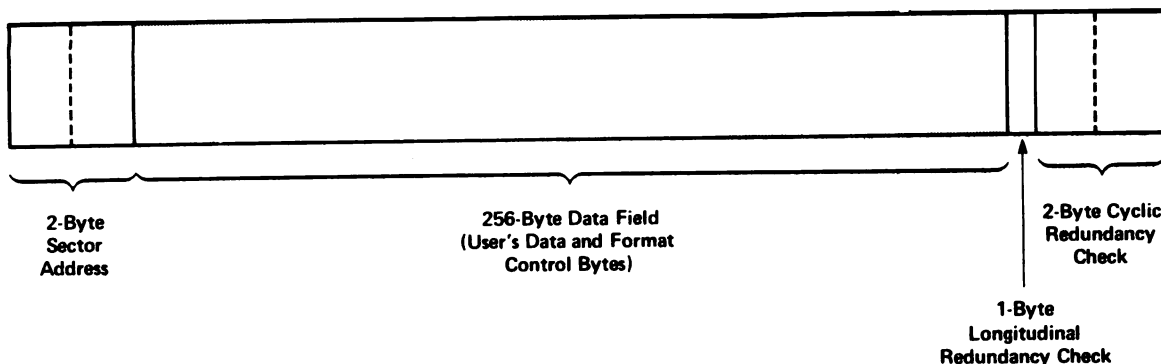
Figure 1-5. One Sector of a Track on a Disk Platter

1.5 TRACK AND SECTOR NUMBERING ON THE DISK PLATTER

The upper and lower surfaces of each disk platter are isomorphic - that is, they are mirror images of each other. For every track location on the upper surface, there is a corresponding track location on the lower surface, and vice versa. Track numbering is sequential on each platter, and alternates from one surface to another, starting with the outermost track on the lower surface (which is designated as track #0), and ending with the innermost track on the upper surface (which may be track #199, #407, or #815, depending upon the disk model; see Figure 1-6). All odd numbered tracks are located on the upper surface of a platter, and all even numbered tracks are located on the bottom surface. The tracks are numbered independently on each disk platter. Sectors are numbered independently on each platter and each track.

Figure 1-6. Cross-Section of a Disk Platter Showing Track
Numbering on the Upper and Lower Surface
(Model 2260BC 1/4 or Model 2260C 1/4)

Track #	Sector #
0	0 - 23
1	24 - 47
2	48 - 71
3	72 - 95
.	.
.	.
.	.
199	4776 - 4799

Figure 1-7. Sector Numbering on a Model 2260BC 1/4
(and Model 2260C 1/4) Disk Platter

1.6 DISK ACCESS TIME

When the disk platter is formatted, the sectors are numbered sequentially; however, when information is read-from or written-to the disk, the sector arrangement is staggered. Although it is useful for the programmer to understand how sectors are arranged within tracks and how the tracks are identified, the system itself does not recognize tracks as independent entities. All absolute addressing of data stored on the disk is done in terms of sector addresses. When presented with a sector address, the system automatically moves to the track which contains that sector. The use of sector addresses therefore minimizes access time for disk operations.

In order to retrieve a piece of information from the disk, the system must determine on which disk platter the information is stored and which sector(s) on that platter contain the information. The access arm must then move the read/write head to the appropriate track and access the appropriate sector.

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There are, therefore, two distinct physical operations which must be carried out in order to access any particular sector on a disk platter:

1. The access assembly must move in or out to position the read/write head over the appropriate track on the appropriate platter. This operation is called the track access.

2. The read/write head must wait for the appropriate sector in the track to rotate beneath it as the platter revolves. This wait is known as the disk latency period.

The time required to perform the first of these operations is called the track access time. The time required to perform the second operation is called the disk latency time. The track access time is determined by the number of tracks which must be traversed by the access arm. The average track access time therefore increases somewhat with the size of the disk configuration. The disk latency time, on the other hand, is determined solely by the rotational speed of the disk unit. The time required for each operation must be included in the total time required to access a sector on a disk platter. (The latency time is normally not significant for sequential access operations; it may, however, be significant for random access operations.) Appendix A and B contains timing information for all disk models.

1.7   STAGGERED ARRANGEMENT OF SECTORS IN A TRACK

On the disk platter, consecutively numbered sectors are located 12 physical sectors (one-half track) apart within a track (Figure 1-8). This "staggered" arrangement of consecutive sectors in a track makes it possible for the disk to access two consecutive sectors in a single revolution of the disk platter during most multiple-sector read/write operations. In particular, the platter-to-platter MOVE and COPY operations are greatly accelerated by the capability to pick up multiple sectors in a single revolution. The staggered arrangement of sectors also speeds up the reading and writing of multi-sector records.
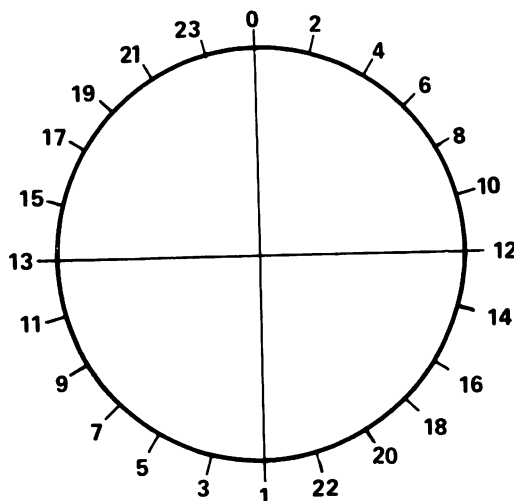
Figure 1-8.   Staggered Arrangement of Sectors on the
Model 2260BC/Model 2260C Disk Platter

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1.8   THE CYLINDER CONCEPT

Because the removable disk platter sits directly above the fixed disk platter, tracks 0 and 1 of the removable disk platter are directly above, or in the same vertical plane as, tracks 0 and 1 of the fixed disk platter. This plane is called a cylinder. It is so-called because if all four tracks in the same plane are connected by imaginary lines, a cylinder is formed (see Figure 1-9).
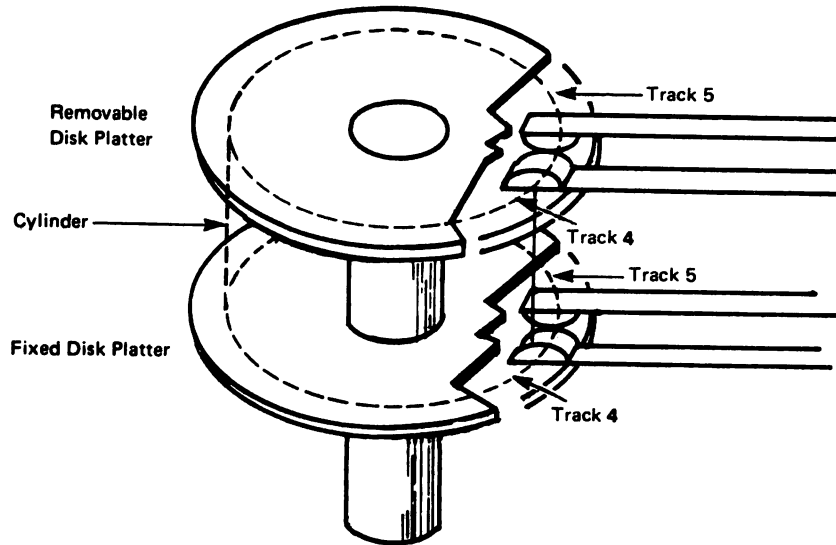
Figure 1-9.   The Cylinder Concept

The access assembly of the disk drive is designed to access one cylinder (four tracks) with each movement of the access arms. Since each track contains 24 sectors, four tracks contain 96 sectors. Thus a cylinder of information is the amount of information (256 x 96, or 24,576 bytes) which can be accessed with a single movement of the access assembly. Where large quantities of data are to be transferred to or from the disk, judicious use of cylinders can result in a significant savings in total track access time.

CHAPTER 2
LOADING AND FORMATTING INSTRUCTIONS

2.1   UNPACKING AND INSPECTION

Because the disk unit is a sensitive device, it is packed using special techniques to protect it from damage in shipping. It should be unpacked and inspected only by a qualified Wang Service Representative. Failure to follow this procedure may void the Wang equipment warranty.

2.2   INSTALLATION

The Wang Service Representative will check that the disk unit has been delivered, inspect it for possible shipping damage, connect it to the system, and turn it on to verify proper operation.

The following installation procedure should be observed for the disk unit:

1. Model 2260BC- Plug the two disk drive connector cables into the 22C13 Disk Control Module in the CPU chassis. Connect a short cable between the 22C13 and an appropriately labeled disk controller. After attaching the cables, secure them into place at the CPU with lock clips or screws.

   Model 2260C- Plug the two disk drive connector cables into the 22C12 Disk Controller. After attaching the cables, secure them into place at the CPU with lock clips or screws.

2. Plug the disk drive power cord into a grounded (three-hole) wall outlet. Input power requirements for the disk are 115 VAC, 9 amps, 50/60 Hz $\pm$ 1/2 cycle (or 220 VAC, 5 amps, 50/60 Hz $\pm$ 1/2 cycle by special request).

3. Plug the System power cord and the electrical power cords of all other peripherals into grounded wall sockets.
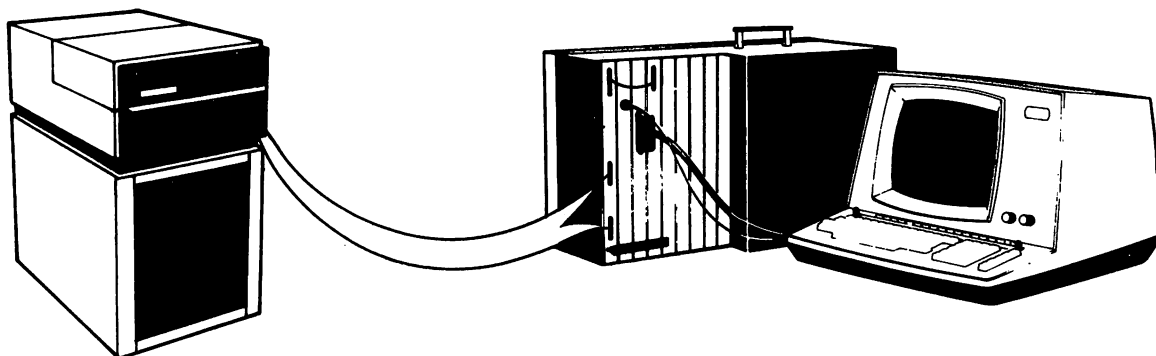
Figure 2-1. Model 2260BC System Configuration
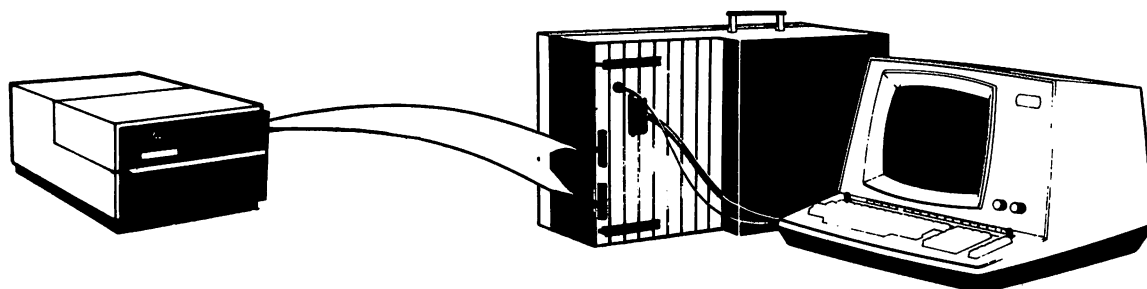
Figure 2-2. Model 2260C System Configuration

Note: If a ten megabyte disk drive is already installed in the system, it can be field upgraded to a dual drive system.

2.3   LOADING AND UNLOADING THE REMOVABLE DISK PLATTER (DISK CARTRIDGE)

The disk unit contains two disk platters, one fixed and one removable. The fixed disk platter comes installed from the factory and cannot be removed from the disk unit. The removable disk platter, as its name indicates, can be taken out and replaced by the operator. The following instructions are for changing the removable disk platter.

Unloading the Disk Cartridge

Step 1   If the START lamp is on, depress the START/STOP switch and wait about 30 seconds for the lamp to extinguish (the spindle motor has shut off). (When the START lamp is illuminated the disk cartridge cannot be unloaded.)

Step 2   Open the cartridge bowl by pulling back the two holding clamps (Figure 2-3). If these clamps are locked in the closed position, do not force them. They are locked due to an interlock (see Section 2.6, "Machine Interlocks").
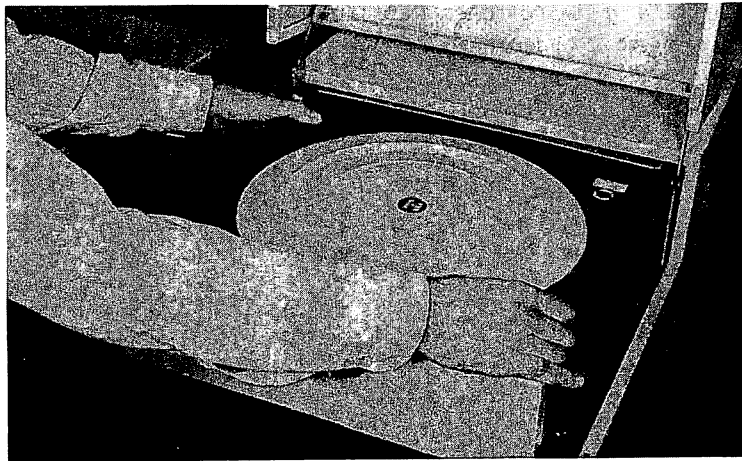
Figure 2-3.   Opening the Cartridge Holding Clamps

Step 3   Remove the dust cover (Figure 2-4).
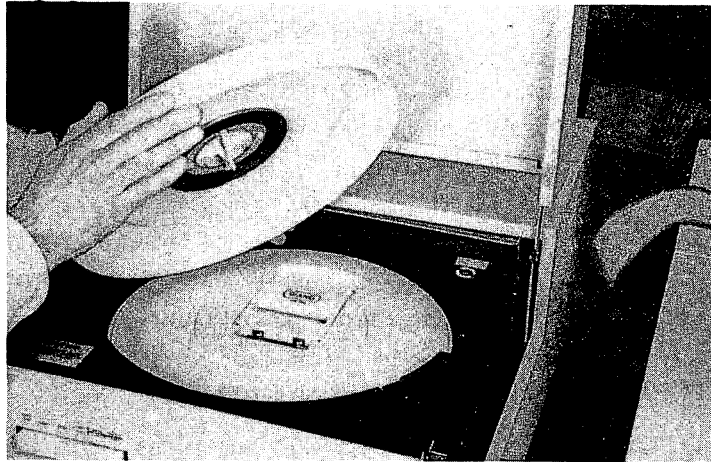
Figure 2-4. Removing the Dust Cover

Step 4   With the handle laying flat, slide the tab on the cartridge handle
to the left and hold the tab in place while raising the cartridge
handle   upright   (Figure   2-5).   This   action   separates   the   disk
cartridge from the disk drive, and the cartridge may be lifted out
of the cartridge bowl (Figure 2-6).
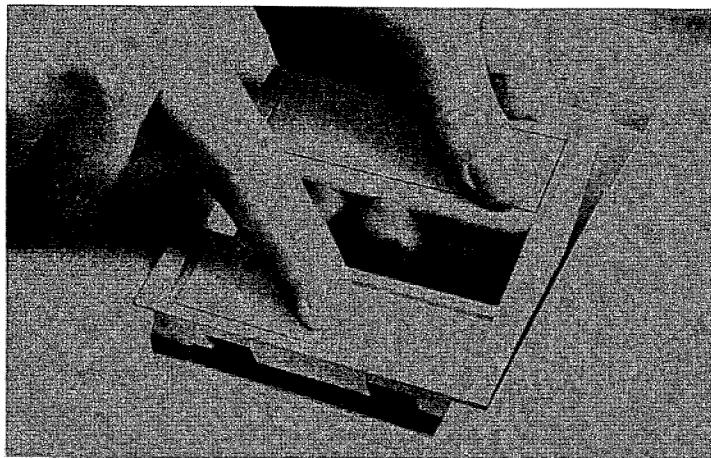
Figure 2-5.   Releasing the Cartridge Lock
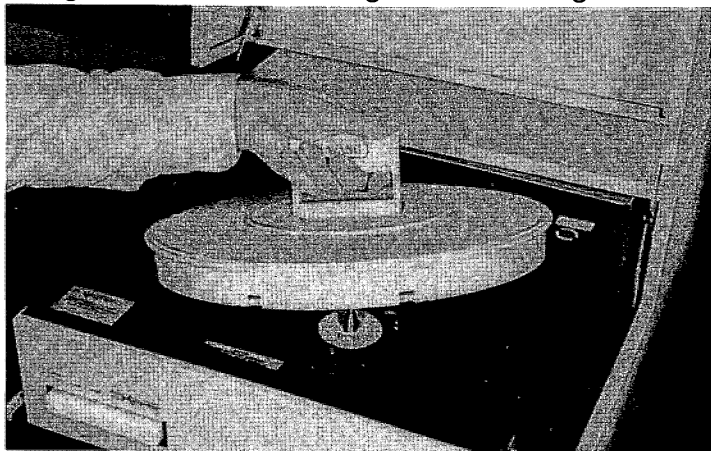
Figure 2-6.   Removing the Cartridge from the Cartridge Bowl

Step 5   Turn the dust cover over and set the disk cartridge into it (Figure 2-7). When the cartridge handle is lowered, it locks the dust cover onto the disk cartridge. Both cover and cartridge can be carried as a unit by lifting the handle again without touching the tab (see Figure 2-8).
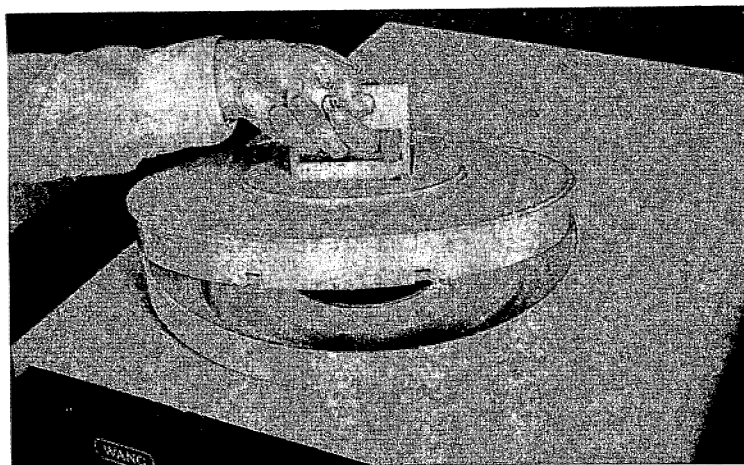
Figure 2-7. Locking the Cartridge onto the Dust Cover
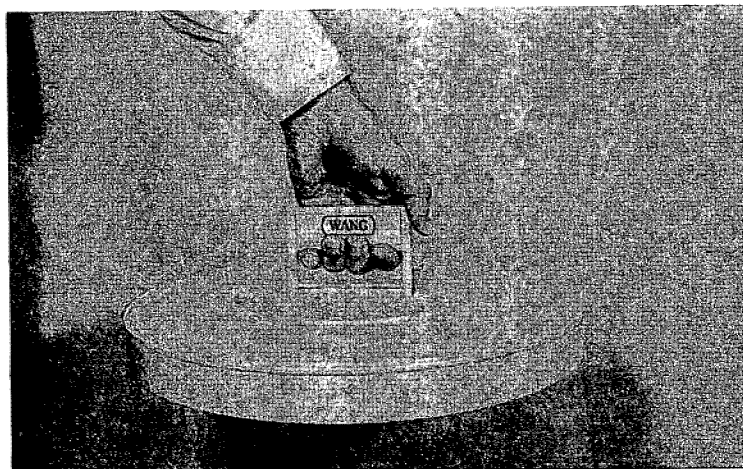
Figure 2-8. Carrying a Sealed Cartridge

Step 6   After a disk cartridge is removed from the disk unit, a replacement cartridge should be loaded into its place immediately. See "Loading A New Disk Cartridge".

Loading a New Disk Cartridge

Step 1   Make certain that the disk power is ON, and the START lamp is extinguished. A disk cartridge cannot be loaded if the disk is in the RUN mode (START and READY lamps illuminated).

Step 2   Open the cartridge holding clamps on the disk bowl (see Figure 2-3). If these clamps are locked in the closed position, do not force them; they are locked due to an interlock (see Section 2.6, Machine Interlocks).

Step 3   Remove the new disk cartridge from its dust cover by sliding the tab on the cartridge handle to the left and holding it in position while lifting the handle (Figure 2-5). This action separates the disk cartridge from the dust cover, and enables you to lift the cartridge away from the cover (Figure 2-9).
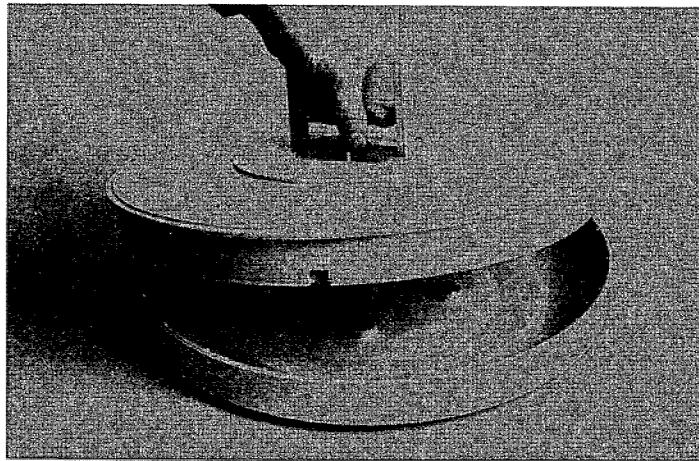
Figure 2-9.   Separating a Cartridge from the Dust Cover

Step 4   Place the disk cartridge over the spindle hub in the cartridge bowl. Position the cartridge so that the cartridge opening for the head entry is located at the rear of the cartridge bowl (Figure 2-10).
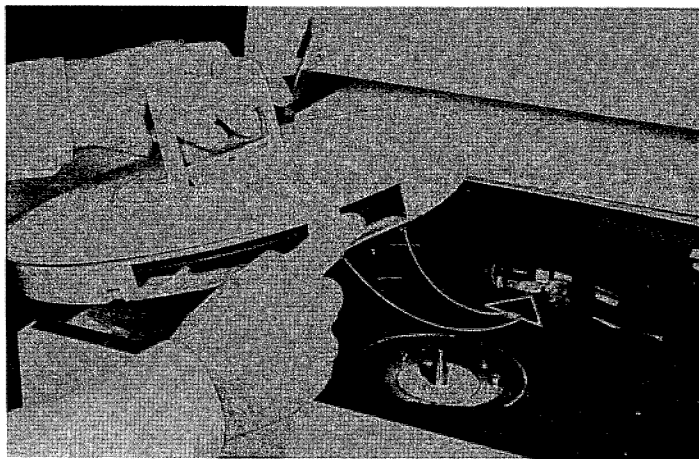
Figure 2-10.   Aligning a Cartridge in the Cartridge Bowl

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Step 5   Rotate the cartridge until it locks. When the cartridge is correctly located, it sets squarely in position and does not wobble or rotate. Lower the cartridge handle to lock the cartridge onto the spindle (Figure 2-11).
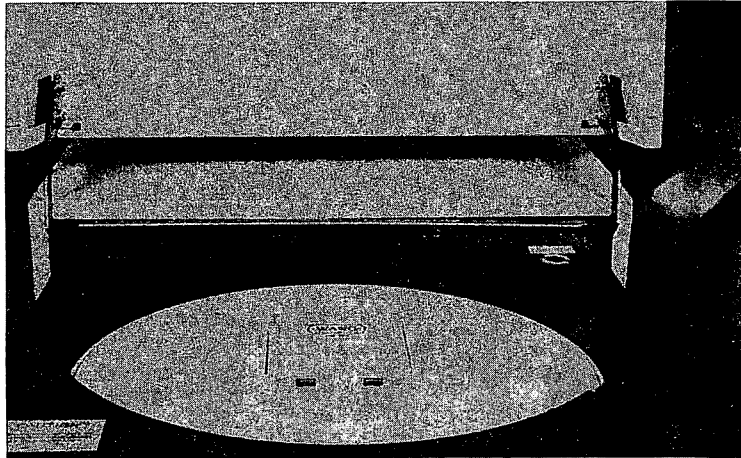
Figure 2-11. Cartridge Loaded in Disk Unit

Step 6   Place the dust cover, open end down, over the disk cartridge, and close the two holding clamps (Figure 2-12).
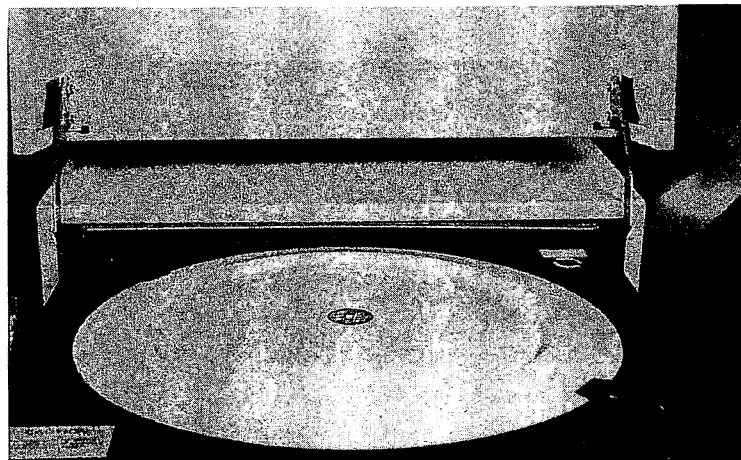
Figure 2-12. Cartridge Sealed and Locked in Disk Unit

2.4   HANDLING AND STORAGE OF THE REMOVABLE DISK PLATTER

Refer to Appendix C, "Disk Platter Maintenance Information", for a complete discussion of the handling and storage of disk platters.

2.5   OPERATING PROCEDURES

Power ON Procedure

1. Be sure that the disk START/STOP switch is in the STOP position (retracted). (Never power ON or OFF with the START/STOP switch in the START position (depressed). Note: Each drive in a dual drive configuration has its own START/STOP switch.

2. Switch ON the power for the terminal (if the Model 2260BC is multiplexed, switch on the terminal connected to the system with the 2230MXA board). Then turn on all other peripherals, including the disk. In a dual drive configuration there is a power switch on both the master drive and the slave drive.

3. Switch ON the main power switch for the CPU. This Master Initializes the system.

4. Depress the START/STOP switch (the switch remains depressed and the START lamp illuminates). After about 60 seconds, the READY lamp illuminates.

5. The disk is now ready to be used, or possibly formatted.

Controls and Indicators

The power switch is located in the rear of the disk drive. Switches and indicators on the control panel are described below.
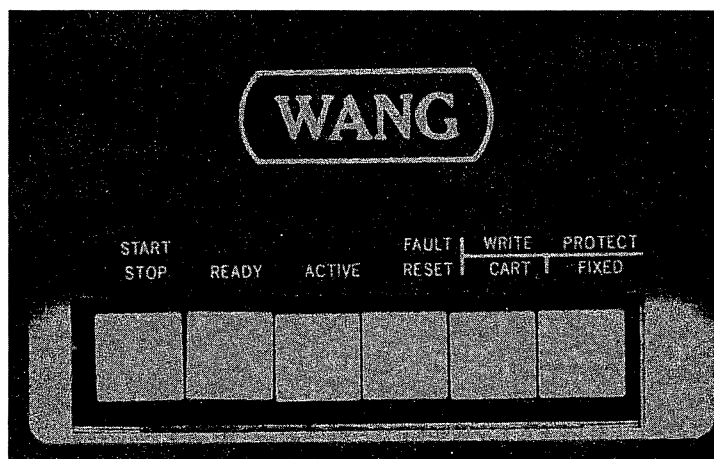
Figure 2-13.   The Disk Drive Control Panel

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Control or Indicator	Function
START/STOP Switch	This dual-action switch energizes the spindle motor and initiates the disk operating mode in the START position (START lamp illuminated). It also permits the disk platter to be loaded or removed in the STOP position.
READY Indicator	The READY indicator illuminates when the unit is ready for use. This indicator is extinguished during fault (error), when STOP is depressed and during disk loading operations.
ACTIVE Indicator	The ACTIVE indicator illuminates whenever the disk unit is receiving or transmitting data to the CPU.
FAULT Indicator RESET Switch	This indicator illuminates when any disk hardware error (fault) exists (e.g., write failure, servo failure, etc.). Press RESET to turn off the FAULT indicator lamp. Consult the error codes in Appendix A of the appropriate Disk Reference Manual and correct the error; then execute the disk operation again.
WRITE PROTECT CART/FIXED	The WRITE PROTECT switches cannot be activated.

2.6   MACHINE INTERLOCKS

The cartridge holding clamps cannot be operated while the read/write heads or disk cleaning brushes are positioned over the disk surfaces (i.e., while the START and READY lamps are illuminated, or when equipment power is OFF.

The disk cannot be accessed if the cartridge dust cover is not installed, or if the cartridge holding clamps are open.

```
┌─────────────────────────────────────────────────────────────────┐
│                             NOTE:                                 │
│                                                                   │
│  To ensure continuous proper disk operation, the air filter      │
│  in the disk unit must be checked by a Wang service              │
│  representative every three months.  If your disk is under       │
│  service  contract,   maintenance   checks   will   be   made    │
│  automatically on a regular basis.  If your disk is not          │
│  under  service  contract,   it  is  your  responsibility  to    │
│  contact a Wang serviceman to perform a maintenance check        │
│  at three-month intervals.  Disk failures which result from      │
│  lack of proper preventive maintenance may not be covered        │
│  under the warranty.                                              │
└─────────────────────────────────────────────────────────────────┘
```

2.7   FORMATTING INSTRUCTIONS

Before either the fixed or removable disk platter can be accessed and used, it must be formatted. Formatting involves assigning a unique address to each sector on the disk platter, along with certain control information which helps the system maintain the disk and keep a check on the validity of information written to and from it. Zeros are then written into the remaining area in each sector.

Formatting is a software function in the Model 2260BC and Model 2260C. To format the platters, the user need only instruct the disk controller to begin formatting by issuing a prescribed $GIO sequence. The formatting processes are performed automatically under software control. When all sectors on the platter are formatted, the platter is ready to store programs and data.

Wang provides a utility program with each disk drive which can be used to format the disk platters. This utility requests the operator to identify the platter which is to be formatted, and then automatically issues the appropriate $GIO sequence to format and verify the designated platter. In general, users will find it convenient to use the Wang supplied utility for platter formatting. (See utility listing on Page 20.)

In order, however, to permit the programmer to develop a customized formatting routine, the $GIO sequence used to perform the formatting operation is described below.

```
┌─────────────────────────────────────────────────────────────────┐
│                             NOTE:                                 │
│                                                                   │
│  Press RESET on the keyboard to initialize the drive and         │
│  controller.  READY is displayed on the CRT.  Check also         │
│  that the READY indicator on the disk unit illuminates.  The     │
│  disk   must   be   in   RUN   mode   (START  and  READY  lamps   │
│  illuminated) prior to initiating the formatting procedure.      │
│  The fixed and removable platters in a disk unit must be         │
│  formatted individually.                                          │
└─────────────────────────────────────────────────────────────────┘
```

To Format the Fixed Platter:

```
10   $GIO/xyy  (0600 0700 70A0 68C0 7040 6820
                6802 4270 8B67, G$):  IF
                STR (G$, 6, 3)< > HEX (000000) THEN 100:   STOP
                "FORMAT COMPLETE"

100  PRINT "FORMAT ERROR":  HEXPRINT STR (G$,6,3)
```

To Format the Removable Platter:

```
20   $GIO/xyy  (0600 0700 70A0 68C0 7040 6830
                6802 4270 8B67, G$):  IF STR
                (G$, 6, 3)< > HEX (000000) THEN 200:   STOP
                "FORMAT COMPLETE"

200  PRINT "FORMAT ERROR":  HEXPRINT STR (G$,6,3)
```

where:

/xyy = the disk address.

STR(G$,6,3) = the error/return status bytes (three bytes of variable G$)

If the format is properly executed, STOP FORMAT COMPLETE is displayed on the CRT (STR(G$,6,3)=HEX(000000). When a format error occurs, FORMAT ERROR and the error code are displayed (STR(G$6,3)< > HEX(000000). Press RESET on the console keyboard, then consult the following table to determine the procedure necessary to correct the problem and retry the format. If after several attempts a removable platter cannot be formatted, try another platter. If the fixed platter cannot be formatted, call the Wang Service Representative. A sample error display similar to that which occurs on the CRT is shown below:

```
                    FORMAT ERROR
                    a b c d e f
```

where:

abcdef = 000000   No format error - format complete

ab	= 01	Sector not on disk	(ERR I 98,	ERR 64)
	02	Disk Hardware Error	(ERR I 91,	ERR 61)
	04	Format Switch engaged	(ERR I 94,	ERR 66)
cd	= 01	Seek error	(ERR I 95,	ERR 71)
	02	Format error	(ERR I 93,	ERR 67)
	04	CRC error	(ERR I 96,	ERR 72)
ef	= 04	Echo error	(Retry immediately.)	

> **NOTE:**
>
> The formatting procedure causes all data previously stored on the disk platter to be erased.

```
10   REM FORMAT , RELEASE 1-1, (11/01/78), THIS PROGRAM IS A COPYRIGHT PRODUCT OF
 WANG LABORATORIES INC., UNAUTHORIZED REPRODUCTION OR USE IS PROHIBITED.
20   REM -- $GIO SEQUENCE FOR FORMATTING 2260C DISK DRIVE --
30   REM -- T/VP/MVP VERSION -- COMPATABLE VP/MVP OPERATING SYSTEM --
40   REM -----------------------------------------------------------
50      COM D$3,G$10,Y
60      DIM A$1,A$(1)2,B$(1)36,C$(4)64,E$3,N$4
70      ON ERROR E$,N$ GOTO 760
80      IF Y > 0 THEN  470
90   REM -----------------------------------------------------------
100     PRINT HEX(03);,"2260C DISK DRIVE FORMAT UTILITY"
110     PRINT HEX(0A0A0A0A0A0A0A);,"FOR USE ON:"
120     PRINT ,"-----------------"
130     PRINT ,"2200 T"
140     PRINT ,"2200 VP   (OS 1.8)"
150     PRINT ,"2200 MVP  (OS 1.3)"
160  REM -----------------------------------------------------------
170  REM ENTER ADDRESS AND CHECK VALIDITY
180     INIT(20)A$,D$,G$
190     PRINT HEX(010A0A);TAB(60);" ";HEX(0D)
200     INPUT "ENTER DISK ADDRESS TO FORMAT",D$
210     IF LEN(D$)>3 THEN 180
220     B$(1)="310B10320B20330B30350B50360B60370B70"
230     MAT SEARCH B$(),=STR(D$,1,3) TO A$() STEP 3
240     X=(VAL(STR(A$(1),2,1))-1)/3+1
250     ON X GOTO 280,290,300,310,320,330,340,350,360,370,380,390
260     PRINT "RE-ENTER"
270     GOTO 180
280     SELECT #1 310: GOTO 420
290     SELECT #1 B10: GOTO 420
300     SELECT #1 320: GOTO 420
310     SELECT #1 B20: GOTO 420
320     SELECT #1 330: GOTO 420
330     SELECT #1 B30: GOTO 420
340     SELECT #1 350: GOTO 420
350     SELECT #1 B50: GOTO 420
360     SELECT #1 360: GOTO 420
370     SELECT #1 B60: GOTO 420
380     SELECT #1 370: GOTO 420
390     SELECT #1 B70
400  REM -----------------------------------------------------------
410  REM PREPARE G$ WITH $GIO INFORMATION
420     STR(G$,1,1)=HEX(20)           : REM INDICATES FIXED DRIVE
430     IF STR(D$,1,1)="3" THEN 470
440     STR(G$,1,1)=HEX(30)      : REM INDICATES REMOVABLE DRIVE
450  REM -----------------------------------------------------------
460  REM OPERATOR CHECK / ABORT OPPORTUNITY
470     PRINT HEX(03);,"2260C DISK DRIVE FORMAT UTILITY"
480     PRINT HEX(010A0A0A0A0A0A0A0A);,"FORMAT PLATTER /";D$
490     PRINT HEX(010A0A);TAB(60);"·";HEX(0D)
500     INPUT "DO YOU WANT TO FORMAT THIS PLATTER (Y/N)",A$
510     IF A$="Y" THEN 560
520     IF A$="N" THEN 670
530     GOTO 480
540  REM -----------------------------------------------------------
550  REM CHECK FOR PRESENCE OF DEVICE
560     PRINT HEX(010A0A);TAB(63);HEX(0D);,"DISK NOT RESPONDING"
570     INIT(20)E$
580     DATA LOAD BA T#1,(Y,Y) C$()
590  REM -----------------------------------------------------------
```

```
600   REM EXECUTE AND CHECK FORMAT OF PLATTER
610        PRINT HEX(010D0A0A);,"FORMATTING...        ";
620        $GIO #1 (0600 0700 70A0 68C0 7040 6A10 6802 4270 8B67,G$)
630        IF STR(G$,6,3)<>HEX(000000) THEN 700 : REM ERROR RETURN
640   REM ------------------------------------------------------------
650        PRINT HEX(0D);,"FORMATTING COMPLETE"
660        PRINT ,"SHOULD HAVE REQUIRED 1 MINUTE"
670        COM CLEAR D$
680        STOP
690   REM ------------------------------------------------------------
700        PRINT HEX(0D);,"FORMAT ERROR, RETURN CODE = ";
710        HEXPRINT STR(G$,6,3)
720        PRINT ,"TO TRY AGAIN  KEY 'RESET','RUN',AND 'RETURN'"
730        STOP
740   REM ------------------------------------------------------------
750   REM VP/MVP ERRORS
760        IF E$="I90" THEN 850
770        IF E$="I91" THEN 850
780        IF E$="I92" THEN 850
790        IF E$="P48" THEN 850
800   REM T ERRORS
810        IF E$="61" THEN 850
820        IF E$="65" THEN 850
830        GOTO 610
840   REM WRONG DISK SPECIFIED
850        PRINT HEX(010A0A);,"PROBLEM WITH DISK   "
860        PRINT ,"CHECK:"
870        PRINT ,"1 - 2260C DISK DRIVE ONLY"
880        PRINT ,"2 - DRIVE IN 'READY' MODE"
890        PRINT ,"DISK READ ERROR, RETURN CODE = ";E$
900        Y = Y+1
910        GOTO 720
```

APPENDIX A   MODEL 2260BC SPECIFICATIONS

STORAGE CAPACITY

DISK MODEL	SECTORS PER PLATTER	TOTAL SECTORS	BYTES PER PLATTER	TOTAL BYTES
2260BC 1/4	4,800	9,600	1,228,800	2,457,600
2260BC 1/2	9,600	19,200	2,457,000	4,915,200
2260BC	19,584	39,168	5,013,504	10,027,008
2260BC-2	19,584	78,336	5,013,504	20,054,016

LEGAL SECTOR ADDRESSES

DISK MODEL	SECTORS PER PLATTER	LOWEST LEGAL ADDRESS	HIGHEST LEGAL ADDRESS
2260BC 1/4	4,800	000	4799
2260BC 1/2	9,600	000	9599
2260BC	19,584	000	19,583
2260BC-2	19,584	000	19,583

PERFORMANCE

Rotation Speed

    All configurations . . . . 2400 rpm

Access Time (Position Head to Track)

    Minimum (one track) . . . . 7.5 ms

    Average (across one-half available tracks)

        2260BC 1/4 . . . . 20 ms

        2260BC 1/2 . . . . 28 ms

        2260BC . . . . 40 ms

        2260BC-2 . . . . 40 ms

Maximum (across all available tracks)

    2260BC 1/4 . . . . 40 ms

    2260BC 1/2 . . . . 56 ms

    2260BC . . . . 80 ms

    2260BC-2 . . . . 80 ms

Latency Time (Platter Rotation to Sector on Track)

    Average (one-half revolution) . . . . 12.5 ms

Read/Write Time

    One 256-byte sector (including CPU/controller

    overhead) . . . . 10 ms

Raw Transfer Rate . . . . 312,500 bytes/sec
(Disk to Disk Control Module)

Move/Copy Time (Entire Disk Platter)

    2260BC 1/4 . . . . Approx 2.5 min

    2260BC 1/2 . . . . Approx 5 min

    2230BC . . . . Approx 10 min

    2260BC-2 . . . . Approx 10 min

Physical Dimensions

      Height . . . .   36 in. (91.4 cm)

      Width. . . . .   20.5 in. (52 cm)

      Depth. . . . .   32 in. (81.6 cm)

Weight . . . .   176 lb (78 kg)

Power Requirements

      Voltage: 115 or 230 VAC $\pm$ 10%

                  50 or 60 Hz $\pm$ 1 cycle

      Power: 800 watts start-up

                  325 watts running.

Cabling

      10 ft (3m) controller cable to the CPU.

      8 ft (2.44 m) cable to power.

Operating Environment

      50°F – 95°F (10°C – 35°C)

      20% – 80% Relative Humidity

APPENDIX B   MODEL 2260C SPECIFICATIONS

STORAGE CAPACITY

DISK MODEL	SECTORS PER PLATTER	TOTAL SECTORS	BYTES PER PLATTER	TOTAL BYTES
2260C 1/4	4,800	9,600	1,228,800	2,457,600
2260C 1/2	9,600	19,200	2,457,600	4,915,200
2260C	19,584	39,168	5,013,504	10,027,008
2260C-2	19,584	78,336	5,013,504	20,054,016

LEGAL SECTOR ADDRESSES

DISK MODEL	SECTORS PER PLATTER	LOWEST LEGAL ADDRESS	HIGHEST LEGAL ADDRESS
2260C 1/4	4,800	000	4,799
2260C 1/2	9,600	000	9,599
2260C	19,584	000	19,583
2260C-2	19,584	000	19,583

PERFORMANCE

Rotation Speed

    All configurations . . . . 2400 rpm

Access Time (Position Head to Track)

    Minimum (one track) . . . . 7.5 ms

    Average (across one-half available tracks)

        2260C 1/4 . . . . 20 ms

        2260C 1/2 . . . . 28 ms

        2260C . . . . 40 ms

        2260C-2 . . . . 40 ms

Latency Time (Platter Rotation to Sector on Track)

      Average (one-half revolution) . . . . 12.5 ms

Read/Write Time

      One 256-byte sector (including CPU controller overhead) . . . . . 10 ms

Raw Transfer Rate . . . . 312,500 bytes/sec

Move/Copy Time (Entire Disk Platter)

      2260C 1/4 . . . . Approx 2.5 min

      2260C 1/2 . . . . Approx 5 min

      2260C . . . . Approx 10 min

      2260C-2 . . . . Approx 10 min

GENERAL SPECIFICATONS

Physical Dimensions

      Height . . . . 10.3 in. (26.2 cm)

      Width . . . . 18.95 in. (48.1 cm)

      Depth . . . . 30.7 in. (77.8 cm)

      Weight . . . . 150 lb (68 kg)

Power Requirements

        Voltage: 115 or 230 VAC $\pm$ 10%

                           50 or 60 Hz $\pm$ 1 cycle

        Power: 800 watts start-up

                           325 watts running

Cabling

        10 ft (3m) controller cable to the CPU.

        8 ft. (2.44m) cable to power.

Operating Environment

        $50^\circ F - 95^\circ F$ ($10^\circ C - 35^\circ C$)

        20% - 80% Relative Humidity

Heat Output

        1050 BTU/hr.

Optional Equipment

        Model 2297 Disk Stand

APPENDIX C   DISK PLATTER MAINTENANCE INFORMATION

In order to maintain the original high quality of disk platters, it is important that proper care be observed in their handling and storage. This Appendix lists several recommended procedures for the operation, handling, and storage of the disk cartridge, proper attention to which will ensure its continued dependable and efficient performance.

1.   <u>General Handling Precautions</u>

The following general precautions apply:

a)   Reassemble cartridges when they are not installed in the disk drive to prevent unnecessary dust buildup and protect the recording surface.

b)   Clean the covers and cartridge cases periodically with a clean, lint-free cloth to remove any buildup of dust.

c)   Replace cracked, worn, distorted, or otherwise damaged covers so that they will provide maximum protection to the platter.

d)   Keep food, beverages, tobacco, and smoking accessories off the disk unit, and away from the disk platters to prevent unnecessary contamination.

e)   Clean the equipment room daily using a vacuum cleaner or damp mop. Avoid raising dust with cleaning implements such as brooms or feather dusters.

f)   Do not expose the disk cartridge to intense magnetic fields such as those generated by high-current bus bars, cables, and welding transformers. A field intensity of more than 50 gauss may cause loss of information.

g)   Do not store the cartridge in direct sunlight, and avoid temperature or humidity extremes as this may deteriorate the recording surface.

h)   If you drop a disk cartridge, have it inspected by a Wang Service Representative before attempting to use it on a disk drive.

i) Do not touch or attempt to clean the recording surface. It is very sensitive to any abrasion which may cause a loss of data stored on it.

j) Keep and accurate service record on the disk drive, and the age of all disk media. The equipment should be serviced (depending upon frequency of use and environmental conditions) according to the recommended service schedule.

2. Carrying

The disk platters can be carried flat or on the side. To carry the cartridge flat, simply grasp the cartridge handle. To carry a cartridge on its side, hold it with your fingers in the recessed handle compartment, with your thumb gripping the beveled edge on the bottom cover.

3. Labeling

Disk platters should be marked for identification with a felt tip pen on an adhesive label. Wang recommends that the top surface of the disk cartridge be used as the labeling surface. You may want to duplicate the label on the outside of the bottom cover to facilitate identification. However, you should refer to the label on the top surface of the cartridge for positive identification of information contained on the cartridge.

Use the following labeling precautions:

a) Use only good quality adhesive labels. Inferior labels could work loose while the cartridge is loaded, and cause severe damage to the read/write heads or the disk surface, or leave a sticky residue which traps dust and dirt.

b) Mark the label with a pen before you put it on the platter. Do not use pencil.

c) Remove old labels completely. To alter a label replace it, never use an eraser.

4. Operating Environment

Disk platters that are frequently used should be stored in the equipment room or in a similar environment. Platters that have not been stored in the machine room should be conditioned to machine room temperature for two hours prior to use. The conditioning time is necessary to ensure accurate track registration, data recording, and data retrieval.

The operating requirements are:

Temperature: 50°F (10°C) to 95°F (35°C)
Relative Humidity: 20% to 80%

5. Storage

A disk cartridge, locked in its bottom cover, form adequate short term storage containers. Unless platters are to be stored for a long period of time, no further protection is required. Cartridges may be stacked on top of each other (no more than five high) or stored on their sides. Clean, dust-free cabinets made of metal or other fire resistant material are recommended for long-term storage of disk platters.

If the disk platters are to be stored for a long period, they should be repacked in their original shipping containers before storing. This protects the covers from excessive dust and/or dirt accumulation.

6. High Security Storage

Store platters containing vitally important data or duplicate master records in a cabinet or storeroom that provides protection against catastrophic damage. The cabinet or storeroom should be insulated to prevent the internal temperature from rising above 150 F (66 C) in case of fire.

7. Storage Environment

a) For short term requirements, the platter can be stored in the equipment room or similar environment.

b) Long term storage:

Temperature: -40°F to 150°F (-40°C to 66°C)
Relative Humidity: 8% to 80%

If stored under other than real operating conditions, condition the cartridge to the machine room environment for two hours prior to use.

8. Shipping and Receiving

Disk cartridges are protected in transit by packaging assemblies designed to withstand normal shipping abuse. Upon receiving a cartridge, examine the shipping container for possible shipping damage. If you find any, have a Wang Service Representative inspect the platter prior to using it in a disk drive. This will eliminate the possibility of damaging the drive or further damaging the cartridge.

APPENDIX D   EQUIPMENT GUARANTEE AND PREVENTIVE MAINTENANCE INFORMATION

GUARANTEE

The equipment is guaranteed from defects in materials and workmanship for a period of ninety days (one year for State and Federal Governments).

MAINTENANCE

It is recommended that equipment be serviced semi-annually. Wang Laboratories offers a Maintenance Agreement which automatically ensures proper servicing. If no Maintenance Agreement is purchased, all servicing must be requested by the customer. A Maintenance Agreement protects your investment and offers the following benefits:

Preventive Maintenance:

Semi-annually, the equipment is inspected for worn parts, lubricated, cleaned, and updated with engineering changes, if any. Preventive maintenance minimizes "downtime" by anticipating repairs before they are necessary.

Fixed Annual Cost:

When you buy a Maintenance Agreement, you issue only one purchase order for service for an entire year and receive one annual billing, or more frequent billing, if desired.

Further information regarding a Maintenance Agreement can be obtained from your local Wang Sales/Service Office.

NOTE:

Wang Laboratories, Inc. can neither guarantee nor honor maintenance agreements for any equipment modified by the user. Damage to equipment incurred as a result of such modification becomes the financial responsibility of the user.

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