WANG

SYSTEM 2200

INTRODUCTORY REFERENCE MANUAL

MODEL 2210

HOW TO USE THIS MANUAL

This manual introduces the Wang Model 2210 Integrated Console to the user. It contains a description of the console and each of its three integral components, a CRT display, keyboard, and minidiskette drive(s). Specifications and options as well as operating and maintenance procedures are also discussed.

This manual is intended to be used in conjunction with the operator documentation of the user's specific System 2200 configuration. Such documents might include:

- 2200 System User (Reference) Manuals
- 2200 Basic Language Reference Manual
- 2200 Disk Memory Reference Manual
- The Programming in Basic Manaul
- Peripheral User (Reference) Manuals
- Software Application and Utility Manuals

This manual does not reference any specific CPU configuration in the 2200 series; however, the user CPU must support disk operations. The reader's general familiarity with the Wang System 2200, and BASIC Programming, is assumed.
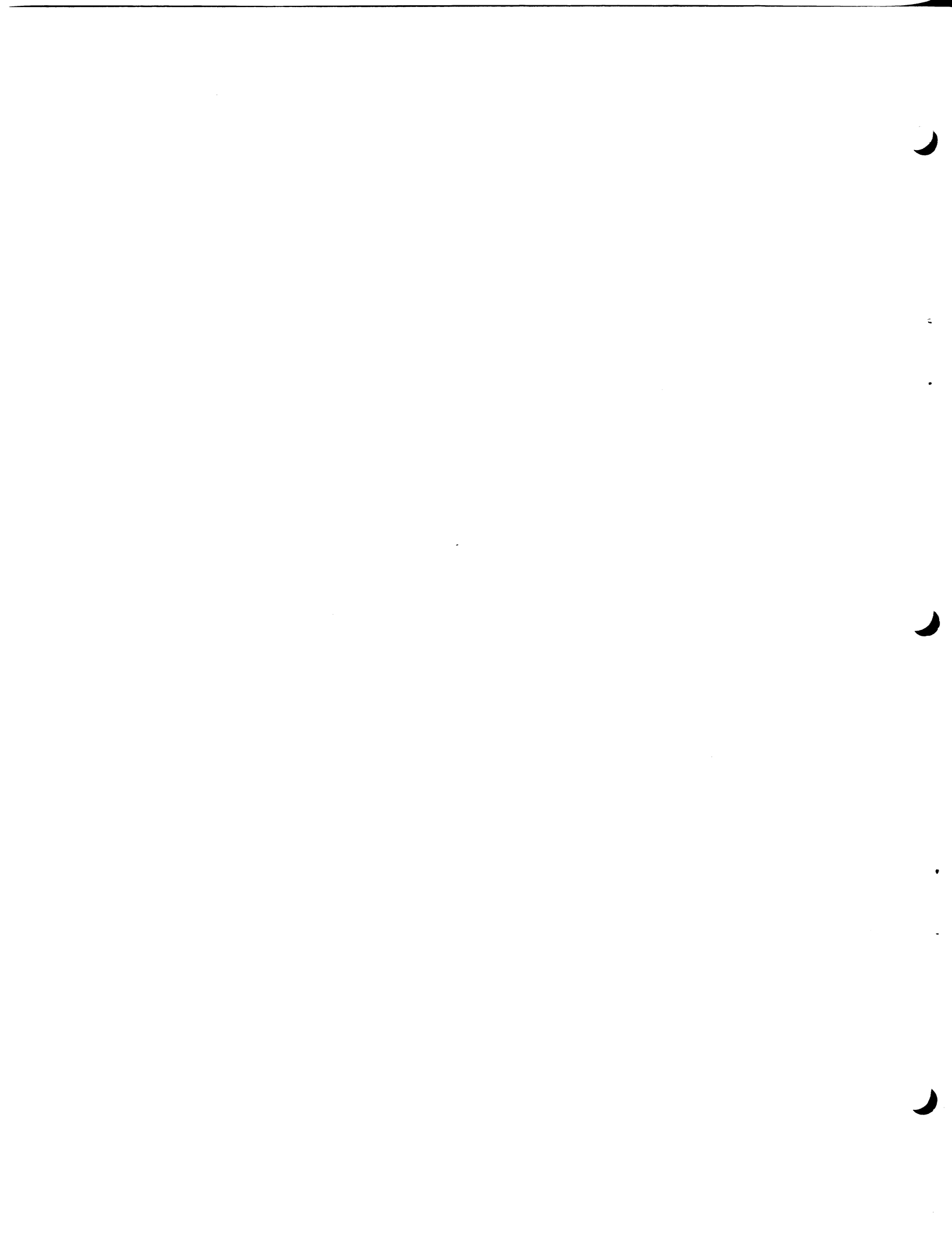
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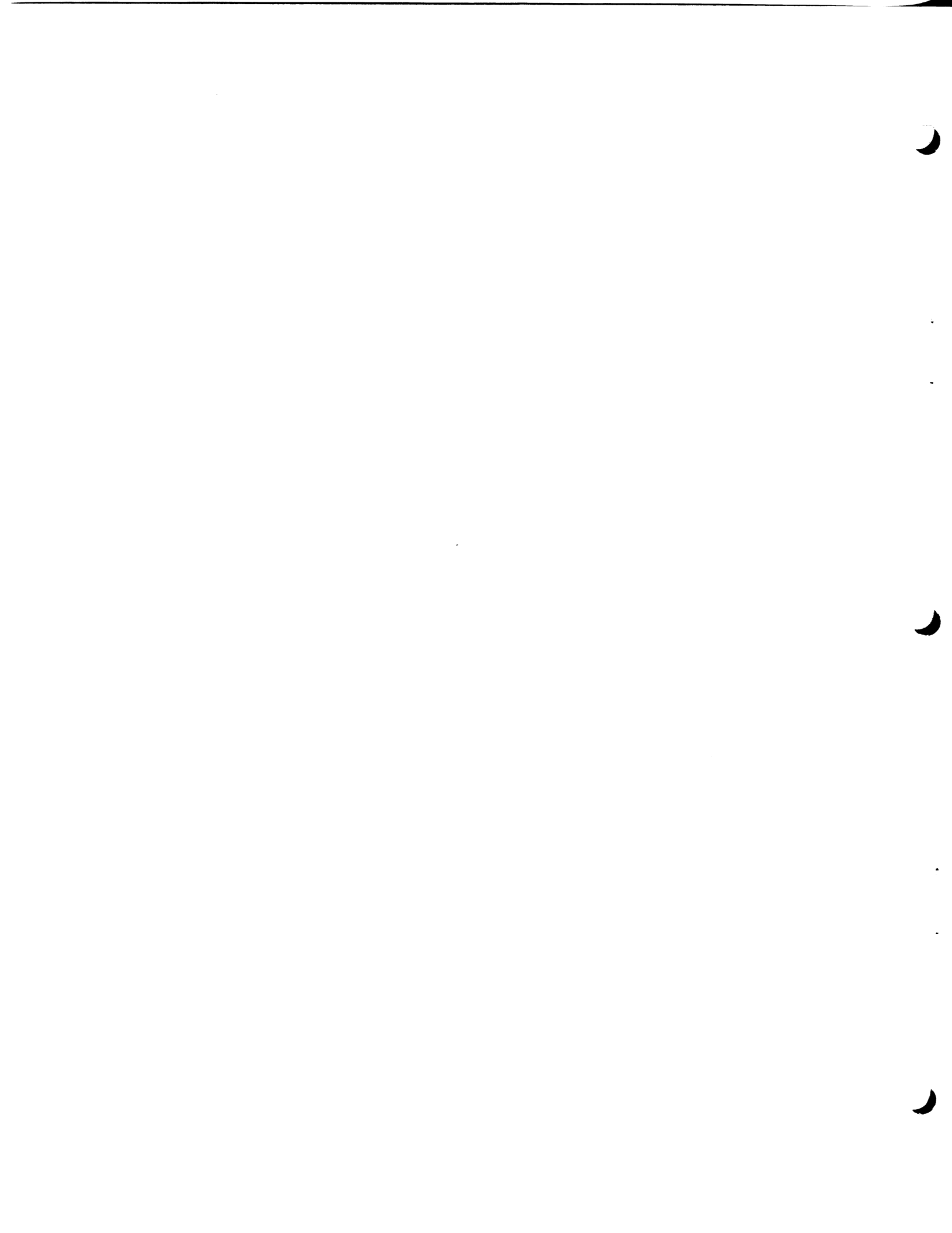
TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER 1: GENERAL INFORMATION

1.1 INTRODUCTION

The Wang Model 2210 Integrated Consoles provide the user with a convenient means of communicating with, controlling and storing information for the series 2200 systems.

The Model 2210 integrated console features:

*A 12 in. (30.4 cm) CRT (cathode ray tube) video display for instantaneous viewing of programs and data text and its execution, data entry prompts and output formats. Two display capacities are available.

An alphanumeric keyboard for interactively controlling the system and entering programs, data, or system commands; and

A minidiskette drive(s) for on-line remote storage capability.

The Model 2210 may be fully utilized with any series 2200 CPU that supports disk and edit operations.

*The model designation for a 16 X 64 uppercase/lowercase CRT is 2210A.
 The model designation for a 24 X 80 uppercase/lowercase CRT is 2210B.

1.2   UNPACKING, INSPECTION AND INSTALLATION

Your System 2200 must be unpacked, inspected and installed by a qualified Wang Service Representative. Failure to follow this procedure will void your warranty.

Your Wang Service Representative will verify that your installation is operational when the following steps have been completed:

1. The Model 2210 console controller boards are properly installed in the chassis of the CPU.

    2210A and 2210B: two (2).   (1) For Minidiskette/Printer/ Keyboard and (1) for CRT.

    Dual Minidiskette drives: three (3).   Same as above plus (1) for second minidiskette.

2. The CRT, keyboard and minidiskette(s) are properly plugged into the controller boards, and the lock clips are up. (Locked position, see Figure 1-2.)

3. All system components (CPU, Console Peripherals) are connected to a dedicated, grounded AC power source.

Figure 1-3. illustrates the configuration of the Model 2210 console and Series 2200 CPU when installed. The Model 2210 includes two controller panels, one triple plug (keyboard/diskette/printer), one single plug (CRT) and the necessary cables. The optional second minidiskette drive (Drive #2) requires an additional controller panel (can be a triple plug controller).
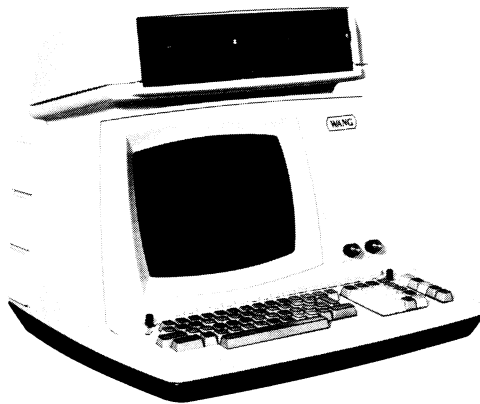
Figure 1-1.   Left 3/4 View   Right 3/4 View

POWER SWITCH   FUSE   MINIDISKETTE

AC POWER CORD

TO CRT

KEYBOARD
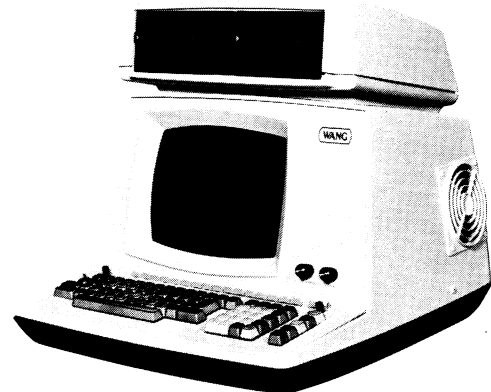
Figure 1-2.   Rear View of the Model 2210

PERIPHERAL CONNECTOR

LOCK CLIP LOCKED

LOCK CLIP UNLOCKED

CPU CONTROLLER BOARD JACK

CPU CHASSIS

POWER

CRT

DISKETTE

KEYBOARD

Figure 1-3. Model 2210/CPU Installation Configuration

1.3 ENVIRONMENTAL CONSIDERATIONS

The environment in which the Model 2210 operates will greatly affect its performance; therefore some preparation prior to delivery is necessary to select a suitable location for the system. An ideal environment is one in which the temperature and humidity are controlled; airborne dirt and contaminants are minimal; the ac power source is adequate, regulated and noise free. The room should have space for future expansion; and be easily accessible to operating personnel, yet sufficiently removed from the main traffic flow so as not to interfere with the system's smooth operation.

The Model 2210 is equipped with an exhaust fan on the right side and entry vents on the left (see Figure 1-1). These vents and fan should not be obstructed; therefore the console must not be placed immediately adjacent to file cabinets or other vertical surfaces whch might impede proper air flow.

The room temperature is an important factor to consider because it can vary significantly from day to day. The recommended operating temperature range is 65°F to 75°F (18°C to 24°C), but the allowable range is from 50° F to 90°F (10°C to 32°C). When these temperatures are exceeded, component failure rates are likely to increase. Additionally, high temperatures can cause loss of data through distortion of data storage materials.

Airborne contaminants can accumulate rapidly on the circuit boards and their components, forming a film which not only prevents adequate heat dissipation from the electronic elements, but also creates leakage paths, causing errors in the system signals. Additionally dust will cause excessive wear in the disk read/write heads and the oxide coatings of storage media. In order to prevent unnecessary failur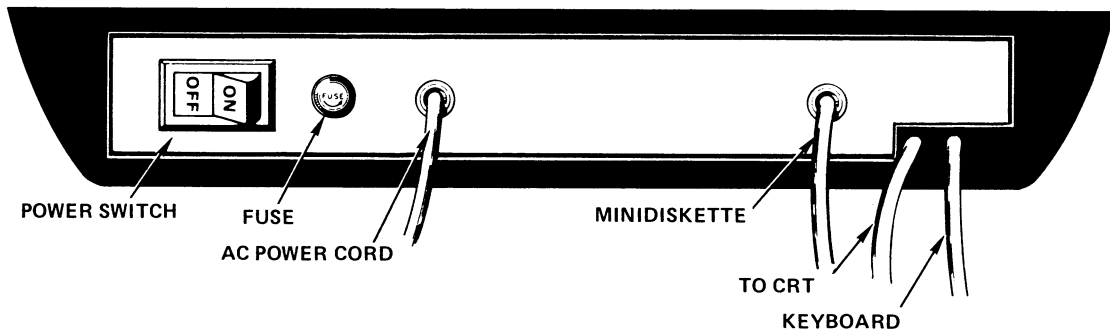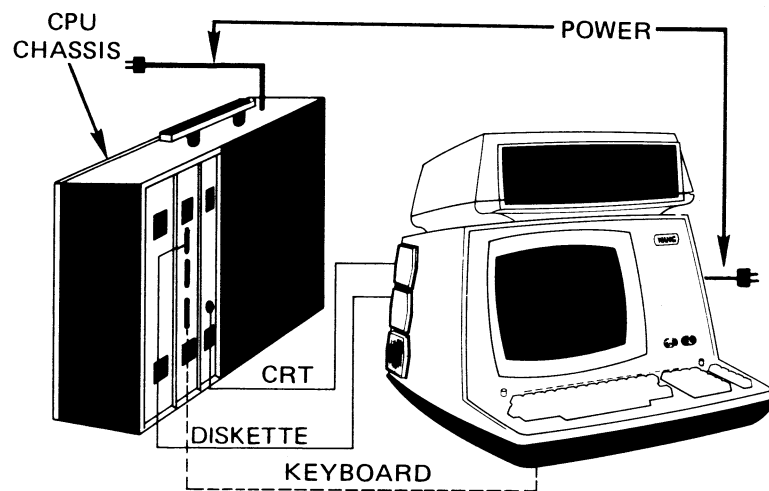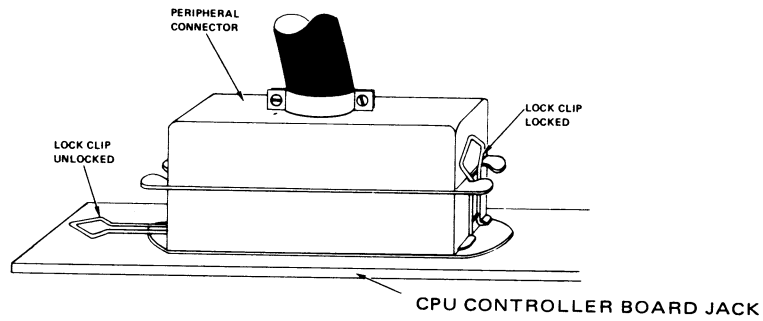e, the filters of all HVAC (heating, ventilation, air conditioning) equipment should be cleaned or replaced regularly. In areas where these filters do not sufficiently remove airborne contaminants, an electrostatic air filter should be installed.

The recommended humidity range is from 40% R.H. to 60% R.H., but 20% R.H. to 80% R.H. is allowable. Low humidity not only increases the certainty of static build-up, but also causes oxide shed in data storage materials. Humidifiers and dehumidifiers should be installed in the environment's heating, ventillation and air conditioning system as required. Both heating and air conditioning lower the humidity in the environment, thereby increasing the static charge imparted to carpets and clothing. When the operator comes in contact with the system, the resultant static discharge which is uncomfortable might also cause system errors or destruction of data.

If carpeting is to be installed, it should be a non-static variety. If carpeting already exists, and it is not non-static, it must be treated with non-static spray, or an electrically conductive mat must be installed to prevent static build-up. Carpets treated with non-static sprays must be thoroughly cleaned before the first treatment, and retreated at least once every three months thereafter. If a conductive mat is used, it should be installed under the system operating area and be properly connected to an earth ground.

Computers and peripherals are extremely susceptible to electromagnetic interference (EMI). EMI can enter the system by conduction through wiring and cabling or by direct radiation. To minimize such interference, an ac power line should be dedicated specifically to the system, and properly installed in steel conduit. Interference generating devices like office machines, fluorescent lighting, motors, HVAC units, etc., located in close proximity to the system, must be relocated, repaired, or filtered to prevent them from disturbing the system. If the source of interference cannot be found, an EMI filter with a cut-off frequency of roughly 10 kHz shoud be installed on the system's ac power line.

The Model 2210 requires two (2) amperes @ 115 VAC therefore, as with most Wang systems, a 20 ampere, 115 VAC power line properly grounded and regulated to within + 10% should be adequate depending on the other equipment on the line. Since it must be interference free, it is recommended that the system have a completely isolated line. In cases of high residual EMI, it may also be necessary to shield all peripheral cables.

Following a discussion of system turn-on procedures and operating modes, the operation of each interal component will be considered.

1.4   TURN-ON PROCEDURE

This section describes a general procedure used to power on most 2200 Systems. A slightly different procedure for the 2200VP is described in the 2200VP Introduction Manual. When your system is off, all programs and data in user memory in the CPU are cleared. A process called Master Initialization occurs whenever the system is turned on. Master Initialization sets default values for the length of a line the length of alphanumeric variables, and establishes a table containing the default addresses for the system peripherals. To turn-on your system:

. Verify that all system components have been properly connected to each other.

. Verify that all system components have been properly attached to the power source.

. Turn "on" the CPU power supply.

. Turn "on" the power supply for the Model 2210.

READY appears on the display in about 15 seconds. The system is now on, master initialized, and ready to use.

```
 READY
 :_
            The Cursor
```
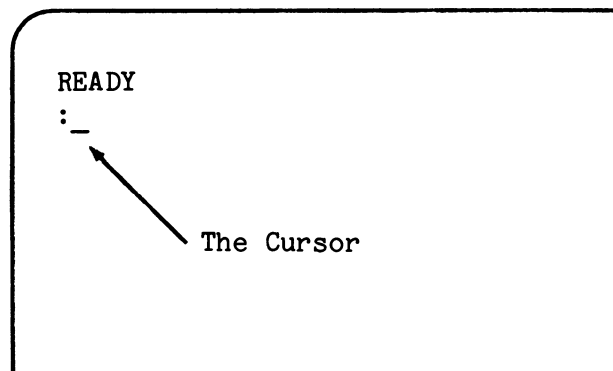
Figure 1-4.   Ready Display

```
                          NOTE:

If the READY display fails to appear, check the
brightness and contrast adjustments on the CRT.If the
READY display still does not appear, depress the RESET
button.  If READY still does not appear, Master
Initialize again. (Turn power off, then on again.) If
your Wang system still does not operate, check your
installation and try again. If normal operation cannot
be restored, call your Wang Service Representative.
```

CHAPTER 2: MODEL 2210 COMPONENTS

2.1 <u>OVERVIEW</u>

The Model 2210 console is used to communicate with and control the System 2200 (CPU and peripherals). It gives the operator the convenience of having a random access storage device (minidiskette) in addition to the essential I/O peripherals (keyboard, CRT) all conveniently housed in a single, compact desk-top console.

Input or Output peripheral devices such as the Model 2210 connected to the CPU via controller interface panels which are components of the CPU chassis comprise a computer system.

The Model 2210 console allows interaction with the CPU in the Immediate Mode and Program Mode. The CPU processes the text in immediate or program mode depending upon whether or not the text has line numbers.

System Commands are always entered without line numbers and cause immediate action. They perform some system defined operation on text from user memory RAM.

In Immediate Mode, the Model 2210 keyboard can be used as a powerful one-program-line calculator. Program lines are entered without a line number. Once a program line is entered and the RETURN(EXEC) Key is depressed, the CPU checks the line for syntax and, providing there are no syntax errors, immediately executes the line.

When entering lines in Program Mode, each line is saved in memory. Once the RETURN(EXEC) Key is depressed, the line is checked for syntax. If a syntax error is discovered, the appropriate error code (ERR..) is displayed, although the line has nonetheless been stored in memory. The line can be corrected by either reentering the line number and the program text or by using EDIT Mode with the Edit Keys.

2.2   THE CRT

The Model 2210 is ideal for interactive problem solving. The CRT (cathode ray tube) video display is the system's principle means of displaying information to the operator. The CRT can display up to 1920 characters of programs or data on the screen at any one time, allowing the user to easily write, review, modify and enter program text or data.

The screen measures 12 in. (30.4 cm) diagonally. The Model 2210A has a capacity of 1024 characters; 16 lines with each line containing 64 uppercase/lowercase characters. The Model 2210B has a 1920 character display, consisting of 24 lines of 80 upper/lowercase characters per line. Both CRT models can display the complete keyboard set, but the 24 x 80 display additionally offers foreign language characters, special symbols and underlining. (The complete character sets of both displays are shown in Appendix D). Lines are displayed sequentially on the screen. If more than the acceptable maximum of lines need to be displayed at any time, the new line is displayed at the bottom of the screen, all previously displayed lines move up one line and the top line leaves the screen.

The CRT display speed is approximately 65 microseconds/character. Display brightness and contrast can be adjusted by means of two controls located on the front panel adjacent to the screen.

A special display character resembling an underscore is used to indicate the location in the display at which the next character entered will appear. This special character is called the cursor. As characters are entered into the display, the cursor automatically advances to the next character entry position. In EDIT mode, the cursor can be positioned to any location in the display where character insertion or deletion is to take place. (EDIT mode is discussed in Section 3.5, The CRT Keyboard.) The cursor may also be moved to any display position under program control, a useful feature for prompting operator entry of data. In this case, cursor movement is controlled by the programmer with special HEXADECIMAL codes called "cursor control codes".

HEXIDECIMAL CODE	COMMAND
01	home cursor
03	clear screen, home cursor
05*	cursor on
06*	cursor off
08	cursor left
09	cursor right
0A	cursor down
0C	cursor up
0D	carriage return

*Model 2210B 24 X 80 CRT only.

For example PRINT HEX (03) clears the CRT and places the cursor in the home position (upper left corner of the screen) (see the Wang BASIC Language Reference Manual and the BASIC 2 Language Reference Manual).

The screen should be cleaned periodically with a mild soap and water using a soft cloth. Do not use an alcohol pad or abrasive compound which could cause damage to the screen and adjacent areas.

```
+------------------------------------------------------------+
|                          WARNING                           |
|                                                            |
|  Do not attempt to remove the cover  of  your  console  for|
|  any reason due to the danger of high voltage.   Call  your|
|  Wang service personnel if any maintenance is required.    |
+------------------------------------------------------------+
```

2.3   THE KEYBOARD

The Model 2210 keyboard is designed for users who are already familiar with standard typewriter and numeric keypads. The keyboard is the operator's means of interactively communicating with and controlling the system. It permits the operator to enter data, write programs, perform calculations and enter commands to the processor. Note: Keyboard key functions are detailed in the User's System Introduction Manual.

The keyboard has two modes of operation, selected by means of a toggle switch labeled "Keyword/A" and "A/a" at the upper left corner of the keyboard (see zone 4).

The "Keyword/A" mode is specifically designed for use in program creation. When the keyboard is in "Keyword/A" mode, the BASIC keywords that appear atop the alphabetic characters can be entered with a single keystroke simply by simultaneously depressing <u>SHIFT</u> and the desired key. Uppercase alphabetic characters are produced without shifting. "Keyword/A" mode is convenient whenever you desire only uppercase letters. Note that only those keys with keywords are affected by the mode switch.

The "A/a" mode causes the keyboard to function like a standard typewriter. Depressing <u>SHIFT</u> and the desired character simultaneously, yields an uppercase character. A lowercase character is produced if <u>SHIFT</u> is not depressed. This mode must be used if lower case data entry is desired. Wherever the shift key is depressed the SHIFT indicator lamp to the left of zone 4 illuminates.
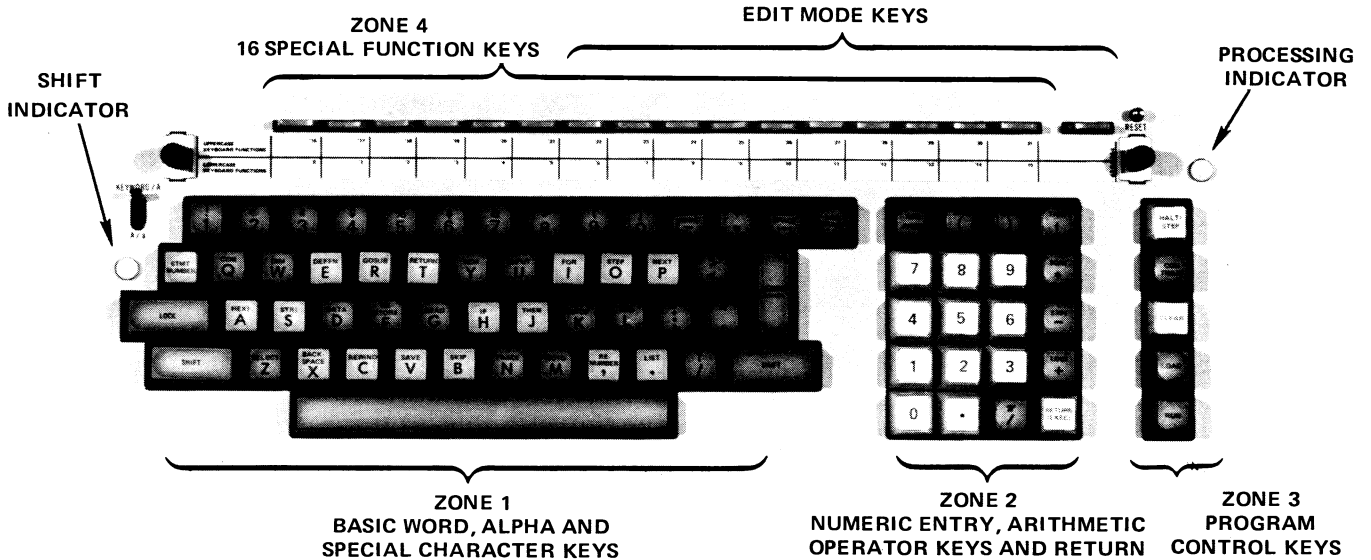
Figure 2-1.   The Model 2210 Keyboard

The keyboard is divided into four zones as follows:

Zone 1 - The Alphanumeric Zone

The alphanumeric zone is designed for rapid entry of alphanumeric and special character expressions. Similar to a standard typewriter, this zone not only contains alphanumeric and special characters (e.g., #, $, %, etc.), but many BASIC keywords (e.g., DIM, HEX, FOR, etc.) and operator keys (e.g., STMT NUMBER, TRACE, RENUMBER, LIST, etc.) as well.

Zone 2 - The Numeric Zone

The numeric zone is designed like a standard 10 key numeric pad for rapid entry of numeric characters. The PRINT key in the upper-left corner facilitates the use of the computer as a powerful on-line calculator. The numeric keys are grouped here for convenience. Digits may be entered by using the numeric keys in the numeric zone or those in the alpha zone. Additionally, this zone contains the mathematical function keys (Arc, Sin, Cos, etc.), the arithmetic operators (+, -, *,) and RETURN(EXEC).

Zone 3 - System Command Keys

The column of command keys at the right provide single keystroke entry of some of the more commonly used command verbs (e.g., HALT/STEP, RUN, LOAD, CONTINUE and CLEAR). Above these keys slightly to the right is a lamp which illuminates when the processor is in operation.

Zone 4 - Special Function/EDIT Keys

Across the top of the keyboard are 16 Special Function Keys. These keys are user programmable. Since each of these keys may be depressed in conjunction with the SHIFT key, an effective total of 32 Special Function Keys is available. The keys are numbered 0-15 and 16-31. Simultaneously depressing a key numbered 0-15 along with SHIFT accesses the keys from 16-31. To be used, a Special Function Key must be defined by the user with a DEFFN' statement in the currently loaded program. Special function keys can be used to start program or subroutine execution or display a text string.

Depressing the EDIT key (to the right of the special function keys) places the system in EDIT mode. This shifts the eight rightmost special function keys from user designated S.F. keys to system designated EDIT keys. The EDIT mode provides powerful one-line editing capabilities for program creation and data entry. Alphanumeric characters in a line of program text resident in memory or in the line of text currently being entered can be altered, inserted, or deleted without retyping the entire line. Once the text line is entered (by depressing RETURN(EXEC), the system automatically leaves EDIT mode.

The RESET button, located to the right of the EDIT key, immediately stops program execution, listing and I/O operations, clears the CRT, homes the cursor, signals ready and returns control to the console user (Console Input Mode).

RESET is a "last resort" means of terminating execution and generally should not be used to end program execution; HALT/STEP should be used for this purpose.

Each of the keywords on the integrated alphanumeric/BASIC keyword keyboard is described in the Wang BASIC Language Manual in detail. Note that there are two keys labeled RETURN(EXEC), one in zone 1 and another in zone 2. They can be used interchangeably.

EDIT	used to enter EDIT mode. When in EDIT mode, the following edit functions are available on the 8 rightmost Special Function keys.
RECALL	used to recall a program line from memory for edit.
◄─ ─ ─	moves the cursor five spaces to the left.
◄──	moves the cursor a single space to the left.
─ ─ ─►	moves the cursor five spaces to the right.
──►	moves the cursor a single space to the right.
INSERT	expands a line for additional text and data entry by inserting a space character at the current CRT cursor position.
DELETE	deletes the character at the current CRT cursor position.
ERASE	erases a line from the current CRT cursor position to the end of the line.

In addition to the above Edit Mode Functions, the 2200 VP offers:

BEGIN	moves the cursor to the beginning of the current text line.
END	moves the cursor to the end of the current text line.
↑	moves the cursor up to the previous CRT line (current text line must occupy more than one line on the CRT)
↓	moves the cursor down to the next line on the CRT (current text must occupy more than one line on the CRT).

2.4   THE MINIDISKETTE DRIVE

The Model 2210 minidiskette drive provides easily accessible high-speed, direct access, on-line storage capacity. The storage capacity of each minidiskette platter is 89,600 bytes. The off-line storage capacity is limited only by the number of diskette platters on hand.

With the optional dual drive of the Model 2210, the on-line storage capacity of the system is doubled to 179.2K bytes. Furthermore, dual drives assure adequate file backup, since the entire contents, or any specific portion of one minidiskette can be copied onto a second. Typically, in the dual configuration, one minidiskette is used to store program files while the others would contain the data files.

A single minidiskette is horizontally mounted in each drive. Each drive contains a drive shaft and drive motor (which rotates the diskette at a constant speed of 300 rpm), as well as an access assembly with an attached read/write head. The read/write head is affixed to a carriage which moves it back and forth across the recording surface of the diskette in response to commands from the controlling System 2200. The access assembly carriage moves the head in or out over the surface of the spinning disk, until it is positioned at the proper location for reading or recording data.

To minimize wear and extend the operating life of the minidiskette, the drive motor automatically shuts off whenever the drive remains idle for a period of about ten seconds. When the drive is subsequently accessed, there is a start-up delay of about one second while the drive motor attains the proper operating speed.

THE MINIDISKETTE PLATTER

The storage medium of the minidiskette unit, is a thin, flat, circular, flexible platter which is coated with a magnetic material, usually iron oxide, and which has no apparent grooves. The easily replaceable diskettes are about 5 1/4 in. (13.2 cm) in diameter about the size of a saucer.

On the recording surface, the magnetic recording material is arranged in concentric circular tracks. Information recorded on the disk is stored in the form of magnetized spots of iron oxide within a track, much the same way it is stored on magnetic tape (see Figure 2-3). This magnetic surface is protected from dust and abrasion by a permanently mounted flexible plastic envelope, with only enough of the recording surface exposed to permit reading and writing operations.

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." Each sector has a fixed storage capacity of 256 bytes and is identified by a unique number called the "sector address," which can be directly accessed by the system. In addition to the 256 bytes in each sector reserved for data storage, the sector contains several bytes of system control information, written into the secxtor at the time the platter is formatted. A sector address is, of course, needed to enable the system to uniquely identify and access each sector. All system control information (the sector address, format control, the CRC and LCR Bytes) are created and maintained solely by the disk controller, and is completely transparent and inaccessible to the user. (See fig. 2-3.) The magnetic recording surface contains 350 sectors(35 concentric circular tracks, each track divided into 10 sectors). Each sector, numbered sequentially from 0 to 349 can store 256 bytes giving the diskette a total capacity of 89,600 bytes. The minidiskette can be protected from accidental overwriting or erasure with a write-protect feature.

A small notch punched along the edge of the minidiskettes plastic jacket controls the Write Protect mechanism. When this notch is uncovered, the minidiskette is write-protected. No information can be recorded on a protected minidiskette, nor can it be formatted. Information already stored on the diskette can, however, be read in the normal fashion. Any attempt to write on a protected diskette elicits an ERROR. Any attempt to format a protected diskette causes the lamp beside Drive #1 to blink.

The Write Protect feature is inhibited by covering the Write Protect notch with a folded tab of opaque tape (tabs are provided with each minidiskette for this purpose). The minidiskette may then be protected again at any time simply by removing the tab.

Minidiskette data reliability is assured by a Cyclic Redundancy (CRC) and Longitudinal Redundancy Checks (LRC) performed automatically on every sector of the disk as it is being read. Any errors found by this automatic error checking are signalled to the operator immediately. In addition, an optional read-after-write verification test can be specified by the operator with the appropriate BASIC statements.

Information is transferred to and from the minidiskette at a rapid speed. The total time required to read or write data on a minidiskette can be divided between two components - the track access time and the disk latency time.

The track access time is the time required to position the READ/WRITE head to a specified track on the diskette platter. The "average access time" is the time required for the READ/WRITE head to move from track 0 to the middle track on the platter. For the minidiskette the average access time is 533 ms (about 0.5 sec). When information is written or read from sequential tracks on a platter, the access time is minimized.

The Disk Latency Time is the time required for the desired sector on the track to rotate to the READ/WRITE head. The "Average Latency Time" is the time required for a sector which is one-half track (5 sectors) away from the READ/WRITE head to rotate under it. At 300 rpm, the platter makes one complete revolution every 200 ms, the Average Latency Time is one-half of this time, or 100 ms (0.1 sec). The staggered arrangement of sequential sectors on a track (which is transparent to the user software) makes it possible to read or write multi-sector records with a significant savings in total latency time (see Figure).

The minidiskette is similar to the larger, flexible diskettes; for a complete discussion of the disk I/O instructions used to read and write on minidiskettes and additional reference information, see the System 2200 Disk Memory Reference Manual or the 2200VP Disk Memory Reference Manual.

Track
Sequence

Staggered
Sector
Sequence
(Read/Write)

Sequential
Sector
Sequence
(Formatting)

WANG

actual
size
miniDiskette
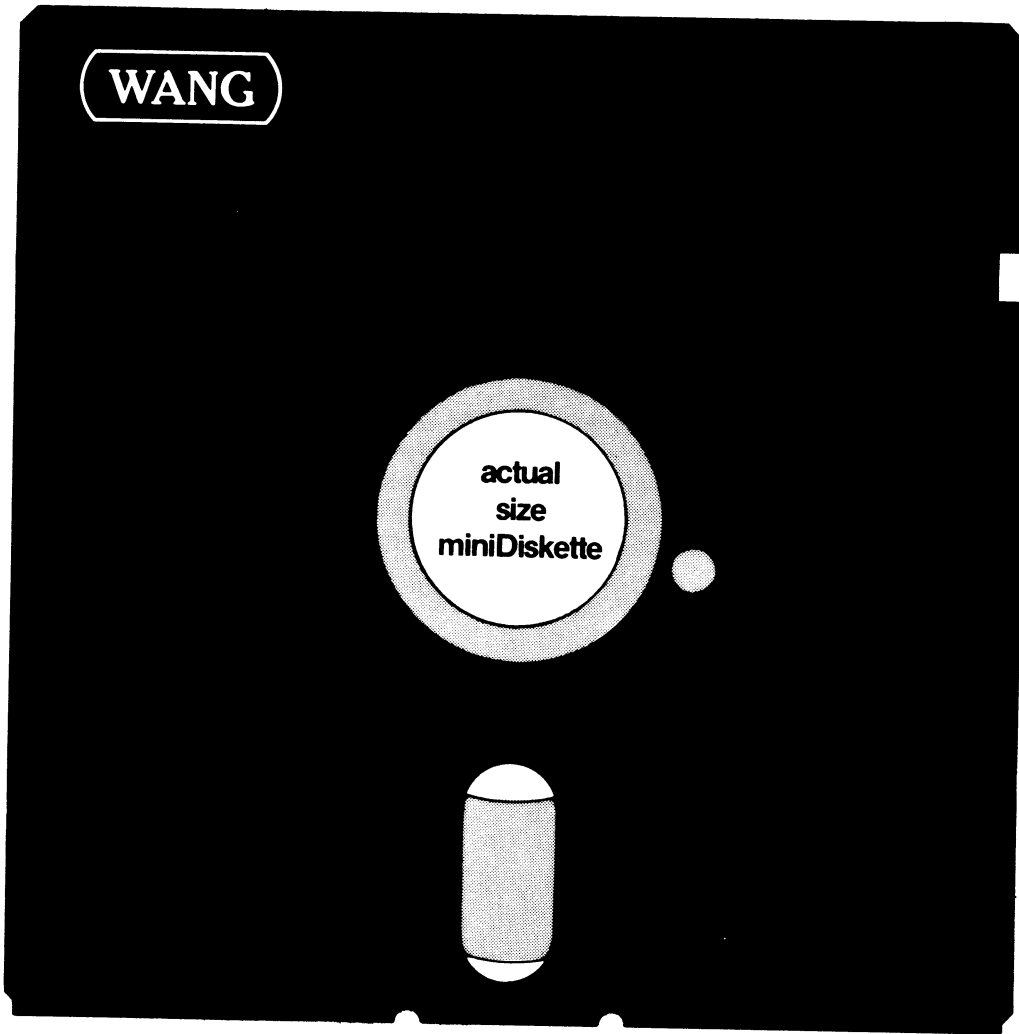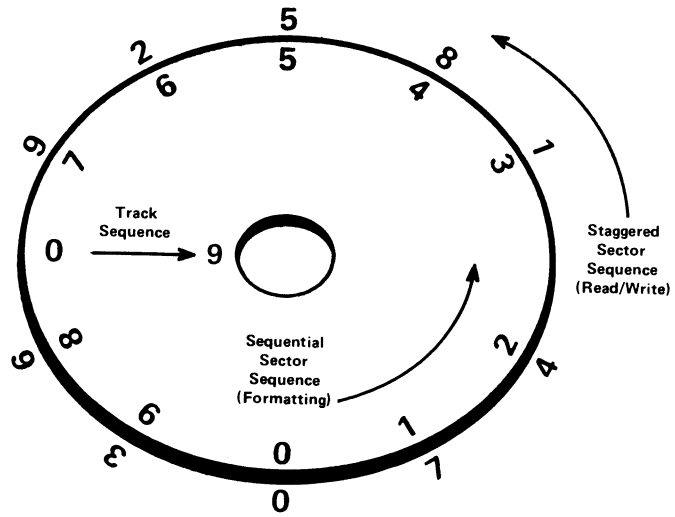
Figure 2-2. The Minidiskette Platter

| 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

One Sector of a Track on a Disk Platter

Concentric Tracks on a Disk Platter

Enlarged View of Sections of Several Tracks Showing How Information Is Stored on a Disk Platter

Figure 2-3.   Concentric Tracks on the Minidiskette Platter

OPERATING THE MINIDISKETTE

A new unused diskette must be <u>formatted</u> and <u>scratched</u> before it can be used. To write on, scratch, or format a diskette, a write tab must be on the write protect notch. The formatting procedure is executed entirely by the system once initiated by the operator. During formatting, the system divides the diskette into sectors and writes the appropriate control information.

Diskettes containing Wang software packages can be used immediately with no preparation. Follow the procedure specified under loading and using a minidiskette.

Minidiskettes containing permanent information must never be formatted or scratched because these processes will destroy any information previously recorded on them. Before loading them into the drive make sure the write protect notch is uncovered.

LOADING A MINIDISKETTE

- Verify that the platter moves freely within the jacket.

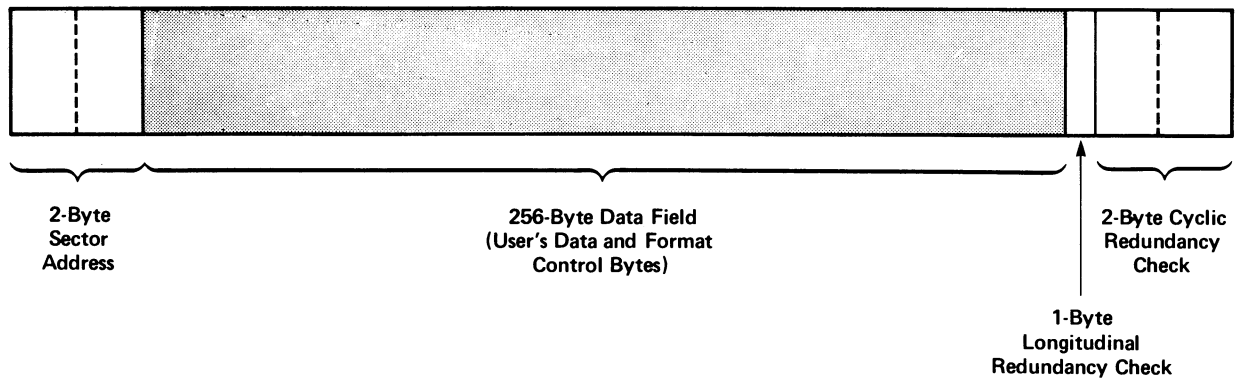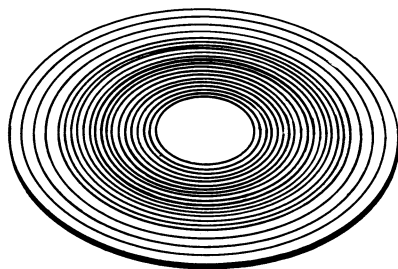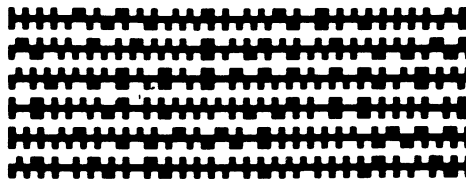- Verify that the write protect notch is in the proper mode for your operation.

- Insert the minidiskette into the drive slot making sure it is firmly seated (arrows on the minidiskette define the proper orientation).

- Close the drive latch.

FORMATTING A MINDISKETTE

A switch-selectable automatic sector formatting feature causes the system to format each sector on a disk platter. In addition, the formatting procedure assigns a unique address to every sector on the platter. Each sector is formatted into four basic sections: a two-byte sector address, two bytes reserved for a CRC value, one byte reserved for an LRC value, and 256 bytes reserved for user's data (and format control information). The sector address, CRC, LRC, and format control bytes, transparent to the user's software, and are employed by the system for data identification and verification. To format a minidiskette:

- Load the minidiskette into the default drive (left drive).

- Depress the RESET button (Zone 3) or key Reset Return(EXEC).

- Depress the FORMAT button located on the web between the two drive ports (the format switch is recessed to prevent accidental use).

- The lamp on the diskette unit should remain illuminated 40 to 50 seconds.

. When the lamp extinguishes, formatting has been properly completed.

. If the lamp remains illuminated or begins to flash, formatting has not been properly concluded.

. Try again, making sure the minidiskette posesses a Write Protect Tab.

. Remove the minidiskette from the drive and proceed to format any others.

Generally, format errors result from three causes:

(a) Drive latch not tightly closed
(b) Write protect notch not covered
(c) Faulty minidiskette

If the formatting procedure aborts repeatedly with several different minidiskettes, there may be a hardware problem with the minidiskette drive. Contact your Wang Service Representative.

NOTE:

A minidiskette must be formatted in order to be used for storage. If a faulty minidiskette cannot be formatted, it should be discarded.

SCRATCHING A MINIDISKETTE

Scratching establishes a catalog index of any number of sectors specified, beginning at sector #0, which allows file accessing by file name only; and a catalog area, where the files are physically stored, immediately following the index area.

. Load a formatted diskette into the default drive (left drive).

. Key (for example)

SCRATCH DISK F LS=10, END=349 (EXEC).

This statement specifies 10 sectors are to be reserved for the catalog index (LS=10) and that sector on the disk number 349 is to be the last sector used by the catalog (END=349). The number of sectors allocated for the index and storage can vary (see System 2200 Disk Memory Reference Manual "Automatic File Cataloging Procedures").

. Repeat steps 1 and 2 for any other minidiskettes.

. The diskette is now ready to store program and data files.

ACCESSING THE MINIDISKETTE PLATTERS

The Model 2210 can have up to two minidiskette drives. The System 2200 uses three parameters - the 'F' parameter, the 'T' parameter and the 'R' parameter - to uniquely identify the individual drives. The 'F' parameter accesses the platter loaded in the left drive, Drive #1 (the default drive) while the 'R' paramter accesses the right drive, Drive #2. The 'T' parameter can be used to select either drive.

The 'T', 'F' or 'R' parameter must be included in a disk statement or command to reference a particular disk platter. For example, the statement

        10 LOAD DC F "PROG 1"

loads the BASIC program named "PROG 1" from the platter currently mounted in Drive #1 of a Model 2210. Alternatively, the same program might be loaded from a platter in Drive #2 of a Model 2210, with the following statement:

        20 LOAD DC R "PROG 1"

The above statement is, of course, illegal for a Model 2210 which contains only one minidiskette drive, always identified with the 'F' or 'T' parameter.

USING A MINIDISKETTE

The minidiskette can be used for on line or off line storage. For previously recorded software, data files, or scratched disks:

- Load minidiskette into the accessed drive

- Key LOAD DCF " _ _ _ _ _ _ _ _ " EXEC RUN EXEC
  This loads the contents of disk into memory and executes it.
  (" _ _ _ _ _ _ _ _ " is the file name, it can be up to eight characters, e.g., "START," "TP10432," etc.)

- Or key SAVE DCF " _ _ _ _ _ _ _ _ "

- This loads the program in memory onto the minidiskette and stores it under the specified file name.

2.5   DISKETTE FILE OPERATIONS

AUTOMATIC FILE MAINTENANCE

Program and Data files can be maintained on a minidiskette in one (or both) of two modes: Automatic File Cataloging mode and Absolute Sector Addressing mode. The BASIC instructions in neither of these modes require an additional software package, but the CPU must support disk operations. For additional information concerning disk operations see the System 2200 Disk Memory Reference Manual and the 2200VP Disk Memory Reference Manual.

Automatic File Cataloging

This mode includes 16 BASIC statements which provide rapid, easy access to cataloged files on the minidiskette. Catalog mode permits the user to save and load program and data files by name, without concern for where or how the files are actually stored on the disk. The system itself automatically keeps track of the size and location of each file. The BASIC instructions available in Catalog mode are listed below. The "DC" parameter selects automatic file cataloging mode.

- SCRATCH DISK is used to create a catalog on a minidiskette platter. The catalog consists of two parts, a Catalog Index which contains the name and location of each file on the minidiskette and a Catalog Area (where the files are stored).

- MOVE END is used to alter the size of the catalog containing each file name and its location area after it has been created with SCRATCH DISK.

- LIST DC enables the operator to list out the names and locations of all cataloged programs and data files.

- SAVE DC is used to name and save BASIC programs on the minidiskette.

- LOAD DC, when executed as a command, is used to load a named program from the minidiskette into the System 2200. When executed in a program, LOAD DC can be used to chain or overlay programs from diskettes.

- DATASAVE DC OPEN is used to create, name and open a new data file on the minidiskette (as many as seven cataloged files may be open simultaneously).

- DATALOAD DC is used to read a logical data record from a currently open file on a minidiskette. Multiple-sector records are read automatically.

- DATALOAD DC OPEN is used to reopen an existing data file on minidiskette. The file is referenced by name.

- DATASAVE DC is used to store a logical data record in a currently open file on a minidiskette. Multiple-sector records are written automatically.

- DATASAVE DC CLOSE is used to close one or all currently open files on a minidiskette.

- DSKIP and DBACKSPACE enable the programmer to skip forward and backward over data records within a cataloged data file.

- SCRATCH is used to "scratch" program or data files from a minidiskette which are no longer needed. The disk space occupied by a scratched file can be reused for a new file.

- **MOVE/COPY** are used to copy the entire catalog (the Catalog Index as well as the Catalog Area) from the left (default) platter to the right (optional) platter, or vice versa. MOVE also automatically deletes all scratched files from the catalog.

- VERIFY performs special validity checks on specified sectors to ensure that the data stored in them is correct. VERIFY is normally used following a MOVE to ensure that the catalog has been copied accurately.

- LIMITS enables the programmer to examine the beginning, ending, and current sector addresses of a specified file, as well as the total number of sectors used in the file.

Absolute Sector Addressing

This mode consists of eight BASIC statements which permit the programmer to address specific sectors on the disk directly, thus enabling him to design his own disk operating system. Two of the eight Absolute Sector Addressing mode instructions are special statements which can be used to read or write one sector (256 bytes) of unformatted data. These special statements enable the programmer to write his own control information on individual sectors. The BASIC instructions available in Absolute Sector Addressing mode are listed and explained below. The "DA" parameter specifies a system control mode (direct address, automatic sector formatting) with 3 control bytes per 256 byte sector. The "BA" parameter specifies 256 bytes of continuous unformatted data.

- SAVE DA is used to store programs on a minidiskette at a specified starting sector location.

- LOAD DA, when executed as a command, is used to load programs from a minidiskette into the System 2200. When executed within a program, LOAD DA can be used to chain or overlay programs from a disk. In either case, the starting sector address of the program must be specified.

- DATASAVE DA is used to save data records on the minidiskette. The address of the first sector in which the record is to be stored must be specified. Multiple-sector records are written automatically.

- DATALOAD DA is used to read data records stored on minidiskette. The address of the first sector in which the record is stored must be specified. Multiple-sector records are read automatically.

- DATASAVE BA is a special statement which writes one sector (256 bytes) of unformatted data in a specified sector on minidiskette. (Both DATASAVE DC and DATASAVE DA automatically insert format control information in each record; this information is not automatically inserted by DATASAVE BA.)

- DATALOAD BA is a special statement which reads one sector (256 bytes) of unformatted data from a specified sector on the minidiskette.

. COPY is used to copy the contents of a specified range of sectors from one platter to the corresponding sectors on the other platter.

. VERIFY performs a validity check on specified sectors to ensure that the data stored in them is correct. VERIFY is generally used following a COPY to ensure that all information is copied accurately.

NOTE:

See the BASIC Language Reference Manual or BASIC-2 Reference Manual; and System 2200 Disk Memory Reference Manual or 2200VP Disk Memory Reference Manual for syntax specifics.

APPENDIX A

Available Options:

        - AN ADDITIONAL MINIDISKETTE DRIVE -
        Option 31 - Audio signal
        Option 32 - Keyboard clicker

        +---+
        | NOTE: |
        | |
        | Peripheral compatibility is determined by the CPU |
        | the 2210 consoles can control any peripheral whose |
        | operation is supported by the available CPU. |
        +---+

23

APPENDIX B

Preventive Maintenance Information

MAINTENANCE INSTRUCTIONS:

It is recommended that your equipment be serviced semi-annually. A Maintenance Agreement is available to assure this servicing automatically. If no Maintenance Agreement is acquired, any servicing must be arranged for by the customer. A Maintenance Agreement protects your investment and offers the following benefits:

Preventive Maintenance

Your equipment is inspected semi-annually for worn parts, lubricated, cleaned and updated with any engineering changes. 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. More frequent billing can be arranged, if desired.

Further information regarding Maintenance Agreements can be acquired from your local Sales-Service Office.

NOTE:

Wang Laboratories, Inc. does not honor Maintenance Agreements for nor guarantee any equipment modified by the user. Damage to equipment incurred as a result of such modification is the financial responsibility of the user.

APPENDIX C

SPECIFICATIONS

Unit Dimensions

    Height..................18 3/4 in. (47.7 cm)
    Depth...................20 1/2 in. (52 cm)
    Width...................19 3/4 in. (50.2 cm)

Approximate Net Weight

    51 lb (23 kg)

Display

    Approximate Size.........................12 in. (30.4 cm)
    Capacity 2210A, 1024 characters; 16 lines, 64 char/line
             2210B, 1920 characters; 24 lines, 80 char/line

Character Size

    Model 2210A
        Height..................0.20 in. (0.51 cm)
        Width...................0.12 in. (0.30 cm)
    Model 2210B
        Height............... 0.16 in. (0.41 cm)
        Width................ 0.09 in. (0.23 cm)

Keyboard

    Upper/Lowercase Alphanumeric/BASIC Keyword Keyboard with full typewriter
    and numeric pads, mathematical function keys, arithmetic operator,
    special function and edit keys.

Minidiskette

    5-1/4 in. (13.3 cm) diameter with write-protect notch

    Sectors.................................350
    Tracks..................................35
    Bytes...............................89,600
    Sectors/Track...........................10
    Bytes/Sector...........................256
    Average Access Time.................533 ms
    Average Latency Time................100 ms
    Speed...............................300 rpm
    Transfer Rate...............125k bits/sec.

Power Requirements

    115 or 230 VAC + 10%
    50 or 60 Hz + 1 Hz
    150 Watts

Cable

       One 8-ft. (2.4m) 3-prong AC Power Cord
       Three 8-ft. (2.4m) controller cords
       (One 8-ft. (2.4m) controller cord for second minidiskette Model 2210B)

Operating Environment

       50 F to 90 F (10 C to 32 C)
       20% to 80% Relative Humidity
       35% to 65% Recommended Relative Humidity

Fuses

       1A @ 220 VAC
       2A @ 115 VAC

CRT CHARACTER SET

The following chart shows the character set and control codes for the 16 x 64 CRT of the Model 2210A.

Model 2210A

High Order Hexadecimal Digit of Code

		0	1	2	3	4	5	6	7
	0	NULL		SPACE	Ø	@	P	prime	p
	1	HOME (CRT)	X-ON	!	1	A	Q	a	q
	2			"	2	B	R	b	r
	3	CLEAR SCREEN (CRT)	X-OFF	#	3	C	S	c	s
	4			$	4	D	T	d	t
	5			%	5	E	U	e	u
	6			&	6	F	V	f	v
	7	BELL		' (apos)	7	G	W	g	w
	8	BACKSPACE (CRT CURSOR ←)		(	8	H	X	h	x
	9	HT (TAB) or (CRT CURSOR →)	CLEAR TAB	)	9	I	Y	i	y
	A	LINE FEED (CRT CURSOR ↓)	SET TAB	*	:	J	Z	j	z
	B	VT (VERTICAL TAB)		+	;	K	[	k	{
	C	FORM FEED OR REV. INDEX (CRT CURSOR ↑)		,	< or [	L	\	l	|
	D	CR (CARRIAGE RETURN)		–	=	M	]	m	}
	E	SO (SHIFT UP)	¢	.	> or]	N	↑ or ∧ or !	n	∿
	F	SI (SHIFT DOWN)	° (DEGREE)	/	?	O	← or _	o	■

Low Order Hexadecimal Digit Of Code

CRT CHARACTER SET

The following chart shows the character set and control codes for Model 2210B 24x80 CRT. All characters with hex codes in the range 10 to 7F may be printed with underlining by adding hex 80 to the character's hex value.

CONTROL CODES					
HEX	ACTION	HEX	ACTION	HEX	
00	NULL	06	CURSOR OFF	0A	CURSOR↓
01	HOME CURSOR	07	AUDIBLE TONE	0C	CURSOR↑
03	CLEAR SCREEN, HOME CURSOR	08	BACKSPACE	0D	CARRIAGE RETURN
05	CURSOR ON	09	NON-DESTRUCTIVE SPACE		

CHARACTERS							
HEX	CHAR	HEX	CHAR	HEX	CHAR	HEX	CHAR
10	â	30	0	50	P	70	p
11	ê	31	1	51	Q	71	q
12	î	32	2	52	R	72	r
13	ô	33	3	53	S	73	s
14	û	34	4	54	T	74	t
15	ä	35	5	55	U	75	u
16	ë	36	6	56	V	76	v
17	ï	37	7	57	W	77	w
18	ö	38	8	58	X	78	x
19	ü	39	9	59	Y	79	y
1A	a	3A	:	5A	Z	7A	z
1B	e	3B	;	5B	[	7B	ƒ
1C	u	3C	<	5C		7C	£
1D	Ä	3D	=	5D	]	7D	e
1E	Ö	3E	>	5E	↑	7E	⟨
1F	Ü	3F	?	5F	←	7F	⌀
20	SPACE	40	@	60	`	80	NULL
21	!	41	A	61	a	81	◆
22	"	42	B	62	b	82	▶
23	=	43	C	63	c	83	◀
24	$	44	D	64	d	84	-
25	%	45	E	65	e	85	_
26	&	46	F	66	f	86		
27	'	47	G	67	g	87	..
28	(	48	H	68	h	88	'
29	)	49	I	69	i	89	`
2A	*	4A	J	6A	j	8A	∧
2B	+	4B	K	6B	k	8B	■
2C	,	4C	L	6C	l	8C	‖
2D	−	4D	M	6D	m	8D	:
2E	.	4E	N	6E	n	8E	β
2F	/	4F	O	6F	o	8F	⩴

APPENDIX E

HANDLING AND STORAGE OF MINIDISKETTES DISKETTES

Minidiskettes are light and compact, and may be easily stored in filing cabinets, on shelves, in boxes, etc., either lying flat or standing on edge. A minidiskette should always be stored in its envelope to inhibit the accumulation of dust on the recording surface.

The following suggestions apply to the handling and storage of diskettes:

1. Replace storage envelopes when they become worn, cracked, or distorted. Envelopes are designed to protect the minidiskette.

2. Keep minidiskettes away from magnetic fields and from ferromagnetic meterials which might become magnetized. Strong magnetic fields (greater than about 50 oersteds) may distort recorded data on a disk.

3. Do not write on the plastic jacket with a ballpoint pen or lead pencil. Use a felt-tip pen.

4. Do not expose a diskette to high temperature or humidity, or to direct sunlight for prolonged periods. Temperature range for storage of diskettes is 50 F to 125 F (10 C - 52 C), and range of relative humidity is 8% - 80%.

5. Do not smoke when handling diskettes. Heat and contamination from a carelessly dropped ash can damage the diskette.

6. Do not touch or attempt to clean the diskette recording surface. Abrasion to the surface may cause a loss of stored data.

To help us to provide you with the best manuals possible, please make your comments and suggestions concerning this publication on the form below. Then detach, fold, tape closed and mail to us. All comments and suggestions become the property of Wang Laboratories, Inc. For a reply, be sure to include your name and address. Your cooperation is appreciated.

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