Z-100 Series Computers

User's Manual

ZF-116-42

ZENITH | **data systems**

Regulatory and Registration Information

WARNING - This equipment has been certified to comply within the limits established for a Class B computing device, pursuant to Subpart J of Part 15 of the rules established by the FCC. Only peripherals (computer input/output devices, terminals, printers, etc.) certified to comply within these Class B limits may be attached to this computer. Operation with non-certified peripherals is likely to result in interference to radio and TV reception.

This equipment generates and uses radio frequency energy for its operation; and if not properly installed and used, that is, in strict accordance with the instructions in this manual, may cause interference to radio and television reception. It has been type-tested and found to be within the RF emission limits for a Class B computing device which is intended to provide reasonable protection against such interference in a residential environment. However, there is no guarantee that interference will not occur in any particular environment or location. If this equipment does cause interference to radio and television reception, which can be determined by turning this equipment on and off, try to correct the interference by one of more of the following measures.

- Move the computing device away from the equipment receiving the interference.
- Relocate the computing device with respect to the receiver.
- Reorient (turn) the antenna of the receiving equipment.
- Plug the computing device into a different AC outlet so that the computing device and receiver are on separate circuits from the fuse or circuit breaker box.
- Disconnect and remove any input/output cables that are not being used since *unterminated* input/output cables are a potential source of high RF emission levels.
- Unplug and remove any serial input/output circuit board cards that are not being used since *unterminated* cards can be a potential source of interference.
- Make sure that the computing devices are plugged into grounded outlet receptacles. Avoid using AC two- to three-wire cheater plugs. Lifting or removing the power cord ground may increase RF emission levels. Removing the ground circuit also may cause a lethal shock hazard to the user.

If you need additional help, consult your dealer or ask for assistance from the manufacturer. You may also find the following booklet helpful: *How to Identify and Resolve Radio-TV Interference Problems.* This booklet is available from the U.S. Government Printing Office, Washington, DC 20402, stock number 004-000-00345-4.

Registration
To receive the full benefits of your warranty, complete and mail the accompanying registration card. Also, record the series and serial numbers of your equipment below. Refer to these numbers in any correspondence you have with Zenith Data Systems regarding this equipment.

Model _____   Serial Number _____

Series _____   Date purchased _____

Place purchased   _____

Any attempt to alter or modify the design, or to use this device in a manner other than described in this manual, will void the warranty and release the manufacturer from any responsibility for its operation.

# Z-100 Series Computers

User's Manual

Welcome

Congratulations on your purchase of the Zenith Data Systems Z-100 Series Computer. The Z-100 microcomputer represents a truly state-ofthe-art design, capable of satisfying both your business and personal needs.

With the Z-1 00 Computer - the All-in-One model or the Low-Profile model - the future is here today. The Z-100 Computer can act as a simple tool or function as the heart of a powerful and expandable business automation package. Combined with Zenith Data Systems software, your new Z-100 Computer can easily provide the practical and affordable solutions to your business problems. It can easily satisfy a variety of business applications, such at data processing, telecommunications, networking, and financial analysis to aid you in making those all-important business decisions.

This User's Manual has been prepared for you, the new computer owner and user. Welcome to computing at its best and accept Zenith's assurance and commitment that the quality goes in before the name goes on.
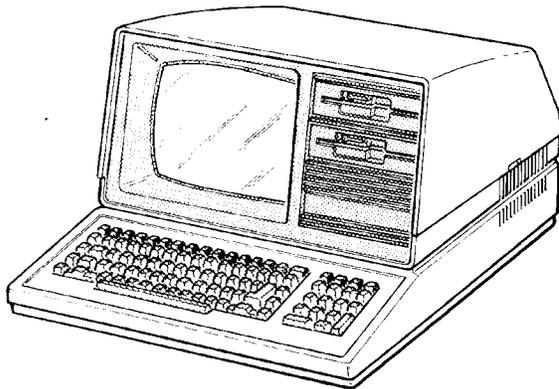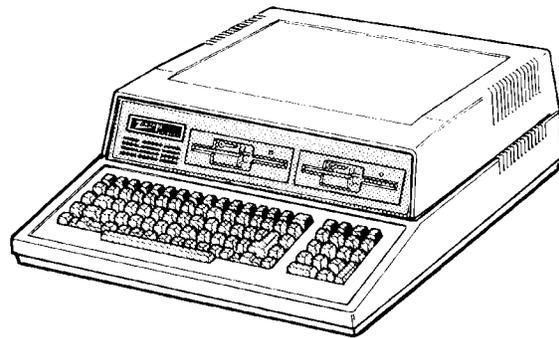
All-in-One Model   **Low-Profile Model**

Preface

This User's Manual is divided into four sections for easy use:

- Operation - The beginning section tells you how to set up your new Z-100 Computer. Then you will turn it on and be introduced to the keyboard and controls. You will learn about disks and how to use a special demonstration disk. And finally, there is a section on what to do if you have a problem with your computer.

- Disk Operating System - This chapter will help you understand and use your computer. In addition, it will show you how to make extra copies (called "backups") of the information stored by your computer.

- Computer Programming and BASIC - Here you will be briefly introduced to the world of programming and learn how to give instructions to your computer in BASIC, one of the most popular computer "languages."

- Appendices - This last section contains reference material that you may find informative. It also contains step-by-step disassembly and assembly information that replaces the equivalent instructions in the installation manual included with any accessories you may purchase for your computer.

You will want to become familiar with your computer's many features. This manual will help you get the most out of your new Zenith Data Systems Z-1 00 Computer.

Contents

Chapter 3 Computer   **Programming and BASIC**

Appendix H   **System Specifications**

Appendix I   **CP/M-85 Disk Operating System**

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Your Computer System

Your new Z-100 Computer is a tool, much like a typewriter or calculator. You can use it in a wide number of applications, such as general accounting, inventory management, payroll, communications, maintaining mailing lists, filing and retrieval of information, and word processing. It is also an excellent educational aide that can make the learning process fun and challenging for the student while providing management support for the teacher and school.

Your computer is an extremely reliable machine. When it is properly installed and receives proper care, it will last for years with little need for service.

A typical computer system will consist of at least two units: the computer and a peripheral (any piece of equipment that is attached to and controlled by the computer). It may be a video display, printer, telephone communications device (called a modem), or additional disk drives.

The heart of the system is the computer with its keyboard and storage devices. The All-in-One model, shown in Figure 1-1, also contains a built-in video display.
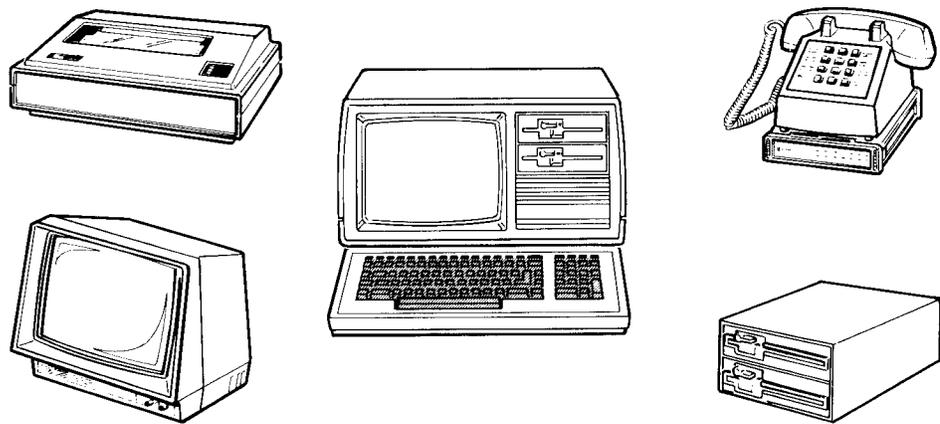
Figure 1-1:   Typical System Components

The video display (sometimes called the CRT, monitor, or screen) is like a television set. This is where you will see and work with the programs you use in your computer system. The Low-Profile model does not have a built-in video display; it uses a separate video monitor that is connected to the computer with a cable.

You will use the keyboard to enter information into your computer. It has all the keys contained on a standard typewriter keyboard plus additional special function keys. There is also a calculator-style "keypad" to the right of the main keyboard that will allow you to make faster numeric entries. (information can also be placed in the computer from disks, signals over telephones lines, and other special devices.)

The floppy disk capability that is built into your computer allows you to store large amounts of information on 5.25-inch plastic disks (see Disks later in this chapter). Each disk that your computer uses is capable of holding up to 180 pages of typewritten text. You can get even more storage by adding 8-inch floppy disk drives or a high-capacity Winchester disk drive.

You can greatly enhance the operation of your computer by adding a printer to your system. This makes it possible to produce copies of letters, accounting records, or any other material.

Finally, you may add computer-to-computer communications via telephone. This capability makes it possible for your computer to exchange information with other computers over the telephone, which makes available electronic mail service, news, shopping services, electronic banking and bill paying, stock market services, and so on.

You should select an area to set up your computer that:

- accommodates the computer and all of its peripherals.
- has a level work surface that is near a power source and a telephone.
- has an environmental range of 60 to 90 degrees Fahrenheit (15.6 to 32.2 degrees Celsius) and 10 to 80 percent relative humidity.

Setting Up

The following paragraphs will describe setting up each connector and control on your computer. While examining the back panel and the connectors, be sure that the computer is turned off and unplugged. Rotate the computer so you are looking at its back.

Back Panel

Refer to Figure 1-2 for the All-in-One model and to Figure 1-3 for the Low-Profile model.

- Fan – Used to provide ventilation to the power supply. Never block the fan openings or restrict air movement while you have your computer turned on.

The following control and connector(s) are located next to the fan openings on the upper back panel.

- J15 -- The brightness control. Used to adjust the brightness of the video display. Adjust the brightness to obtain the most suitable display. (All-in-One model only.)

- J15 – The composite video output connector. Provides the proper video signal for a separate black and white (monochrome) video monitor. The Low-Profile model requires a separate video monitor; you cannot use a standard television receiver for this purpose as it is not designed to display all of the information needed for word processing or accounting applications.

- J9 – The RGB video output connector. Provides the necessary signals for a high-resolution color monitor that uses RGB (Red, Green, Blue) color signals. Appendix G contains the necessary information that you need to configure this connector.

In addition to the above control and connectors, on the upper back panel there are a number of unfilled positions (J5-J8, J1-J13, J15, and J17). Any necessary controls and/or connectors needed for future expansion will be provided with the optional accessories.
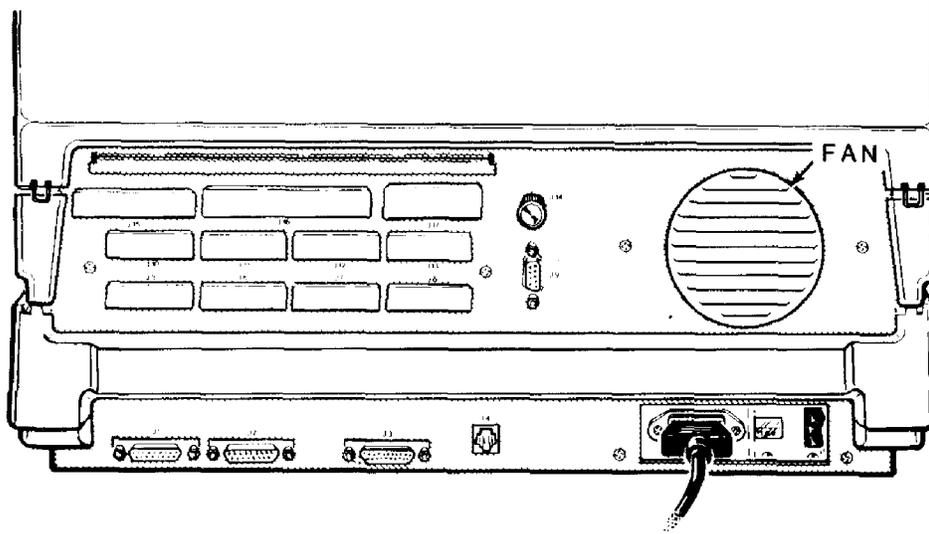
Figure 1-2:   All-in-One Model
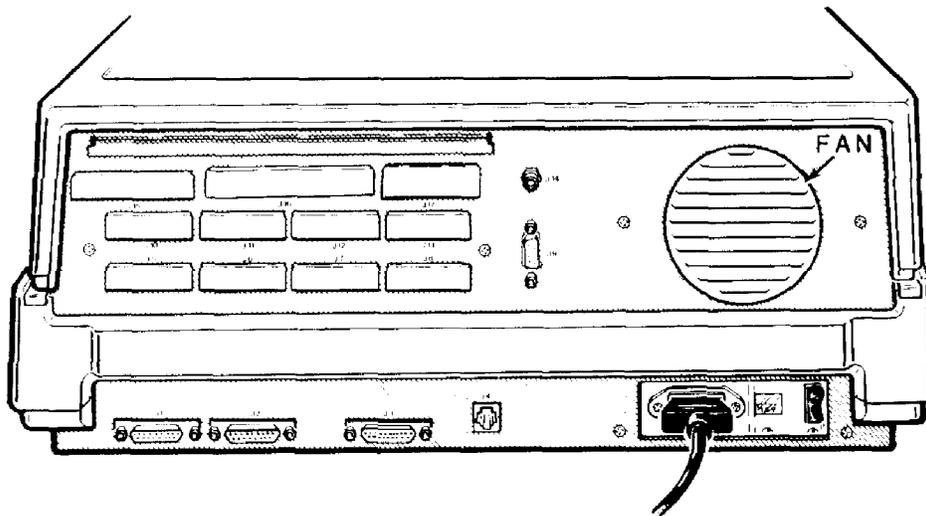
Figure 1-3:   Low-Profile Model

Refer to Figure 1-4. These connectors are on the lower-left portions of the back of your computer.

- J1 – A serial connector. Provides the necessary EIA-standard RS-232 DCE signals for connection to a serial printer.

- J2 – A serial connector. Provides the necessary EIA-standard RS-232 DTE signals for use with a telephone modem.

- J3 – The parallel printer connector. Provides the necessary Centronics-type parallel signals for connection to a parallel printer.

- J4 - The light pen connector. Provides the necessary signals for connection to a light pen for on-screen graphics work.
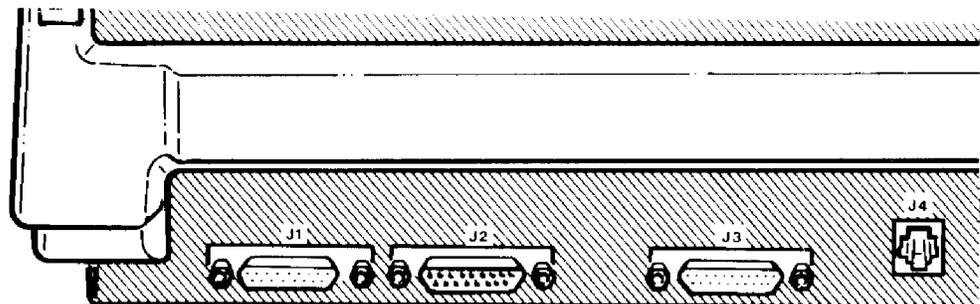
Figure 1-4: Peripheral Connectors

Refer to Figure 1-5. These features are located on the lower-right portion of the back panel.

- Power cord connector – Used with the AC power cord to supply power to the computer.

- Line select switch – Used to select between 115 volts AC and 230 volts AC. Normally, you will never use this switch unless (during initial setup) you are in an area serviced by a 230 volts AC power source. (Changing the setting on this switch should be done only be qualified individuals. When changing line voltage, i.e., 115 to 230, the line cord plug must be changed to the proper type and voltage rating. Check local electrical codes.)

- On/off power switch – The main power switch to your computer.

POWER
CONNECTION

LINE
SELECT
SWITCH
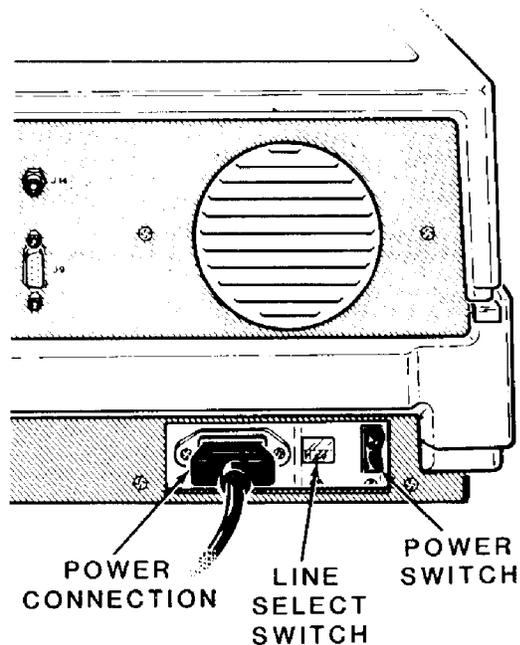
POWER
SWITCH

Figure 1-5: Power Connectors and Controls

Power Connection

☐ Locate the power connector, power switch, and openings for the fan in Figure 1-6 and on your computer. Never block the fan openings or restrict air flow.

☐ Make sure the power switch is in the OFF position.

☐ Plug the power cord into your computer.

☐ Be sure that the line select switch shows the proper voltage level for your power source. You may read the voltage setting through the plastic window located between the power cord receptacle and the power switch. If it is set incorrectly for your needs, contact your local Zenith Data Systems dealer for instructions.

☐ Rotate the computer so the keyboard faces you.

☐ Plug the other end of the power cord into an AC power outlet (common wall or floor plug).
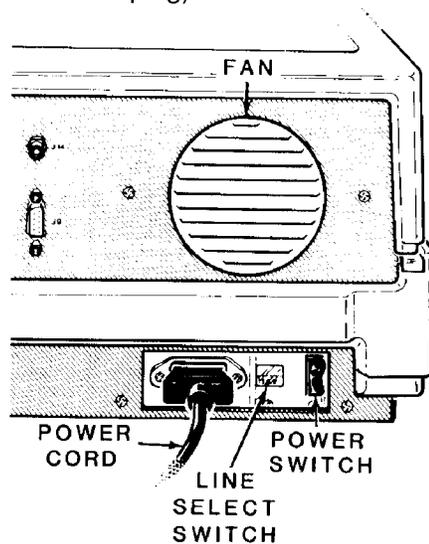
Figure 1-6:   Power Connections

Keyboard

The keyboard of your computer consists of 95 keys, which are discussed on the following pages in groups.

Whenever you hold any key except the SHIFT or CTRL keys down for more than a moment, it will automatically start repeating. The rate of repeated entry is equal to pressing the same key about eleven times a second.

Alphabetic Keys

Refer to Figure 1-7 for the following discussion.

- The computer has the standard 26 letters of the alphabet arranged as they are on a typewriter. These keys allow you to enter either loweror uppercase letters. You can hold either SHIFT key down or push the CAPS LOCK key to obtain uppercase letters.

- The CAPS LOCK key is a push-to-latch, push-to-release key, and affects only the alphabetic keys.
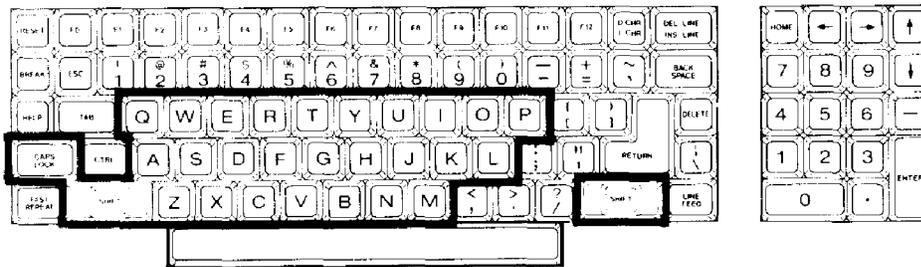
Figure 1-7: Alphabetic Keys

Nonalphabetic Keys

- The nonalphabetic keys are those with double markings, as shown in Figure 1-8. These include the numbers 0 through 9, punctuation marks, and special characters. The lower marking is generated when both of the SHIFT keys are released, while the upper marking is generated when either SHIFT key is held down. The CAPS LOCK key will not shift these keys.
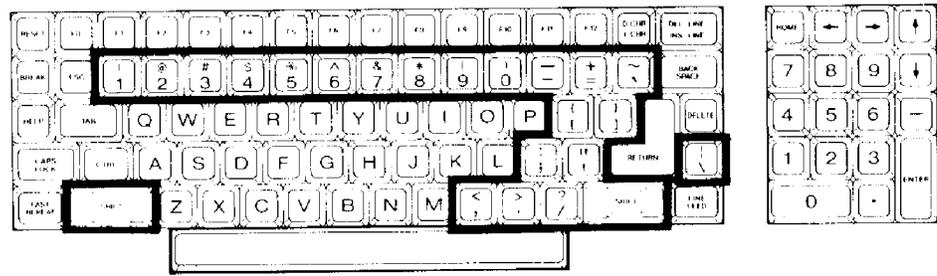
Figure 1-8: Nonalphabetic Keys

Other Keys

The following discussions describe the normal function for each key. However, software (a program) may direct any key to cause some other action to take place. Any key that performs a special function is usually described in the documentation that accompanies the program.

Refer to Figure 1-9 for the following discussion.

- SPACE BAR - Enters a blank character (space), just as it does on a typewriter.

- BACK SPACE - Moves the cursor' one space to the left, just as it does on a typewriter.

- TAB - Moves the cursor to the next tab column (set to every eighth column).

RETURN - Returns the cursor to the left side of the display (software will usually add a line feed as well). It also tells the computer that data or instructions have been entered and may be processed or executed.
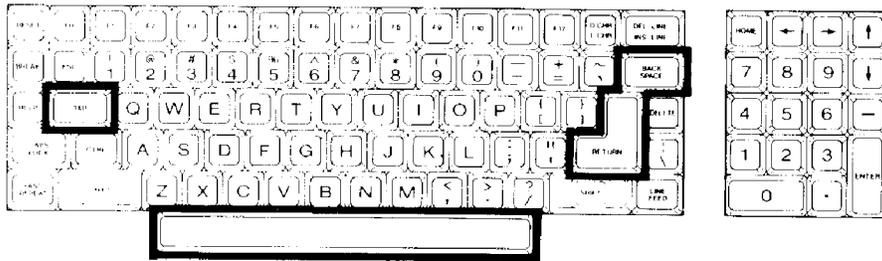
Figure 1-9: Other Keys

[1] A "cursor" is an indicator on the display that lets you know where the next key entry will appear. The indicator may be an underline or a solid block.

See Figure 1-10 for the next discussion.

The following keys are used for special purposes. Instructions that tell you how to use them will appear with the programs.

- Special function keys (FO through F12) - Used for special purposes by some programs.

- HOME, LINE FEED, and arrow keys - Used to control cursor movement and screen presentation by some programs.

- D CHR/I CHR and DEL LINE/INS LINE keys - Used in applications that require special insertion and deletion operations.

- DELETE - Often duplicates the BACK SPACE key, but is sometimes used for other purposes.

- BREAK - Used to interrupt program execution (not always active).

- RESET - Used with the CTRL key (described later) to reset the computer to a power-on state. This key also has a power-on indicator in it which will be illuminated whenever the computer is turned on.
- HELP - Used by some programs to provide operator aid in the form of special "prompts," or "helps."
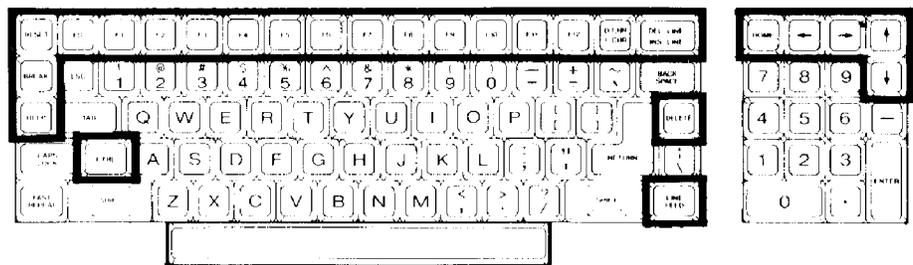
Figure 1-10:   Special Purpose Keys

The following keys are used in combination with other keys to perform a function. See Figure 1-11.

- ESC - The escape key. Performs special functions when you press Et and another key in sequence. For instance, if you want to enter ESC E, you would press the **ESC** key, release it, and then press the **E** key. If you want to enter ESC <, you would press the **ESC** key, release it, press and hold the SHIFT key, and then press the < key.

- CTRL - The control key. You can use it to perform special functions by pressing it and an alphabetic key at the same time. For instance, if you want to enter the CTRL-C combination, you would press and hold the **CTRL** key and then press the **C** key, or you may press both keys at the same time. If you want to enter the CTRL-S combination, you would press and hold the **CTRL** key and then press the S key, or you may press both keys at the same time.

The following keys are used to speed up the entry of data.

- Calculator-style keypad - This group of keys, located to the right of the main keyboard, is organized somewhat like a calculator and include: the numbers 0 through 9; a period for entry of decimal points; a dash for entry of negative numbers; and an **ENTER** key for signaling the computer that the entry has been completed.
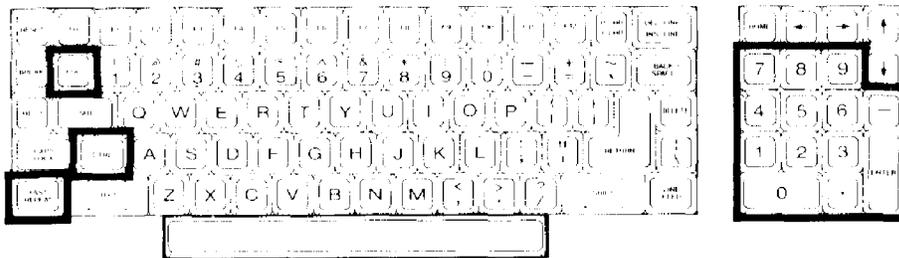
Figure 1-11:   Control Keys and Numeric Keypad

- FAST REPEAT - This key, when held down at the same time as another key, triples the rate of normal repeat entry and takes effect immediately. It is especially convenient when you want to enter the same key a large number of times. The CTRL and SHIFT keys are not affected by the use of this key.

Disk Drives

The disk drives are storage devices designed to transfer information into and out of your computer's memory. Refer to Figure 1-12 for the All-in-One model and Figure 1-13 for the Low-Profile model.

NOTE: The disk drives shown in this manual are typical of the type supplied in Zenith Data Systems computers. The drives in your unit may appear to be different; however, they function the same.

- Disk drive positions - One or two disk drives are included with your computer. For dual-drive systems on the All-in-One model, the top disk drive is referred to as drive A and the bottom as drive B. One the Low-Profile model, the left disk drive is drive A and the right one is drive B.

If your computer has only one disk drive, it will be known as drive A, regardless of its position in either the Low-Profile or All-in-One model.

The drive names, A and B, are arbitrary with the disk operating system (DOS). The systems supplied with your computer use these names. Other operating systems may refer to the drives by other means. Consult the documentation supplied with those systems for the names of the drives (drive A will be the lowest-named drive; drive B, the next).
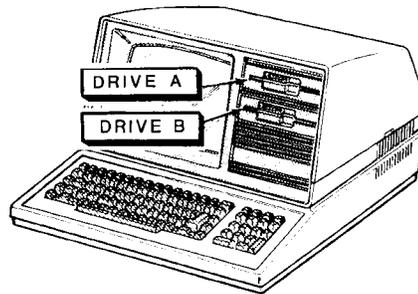
Figure 1-12:   All-in-One Model   **Figure 1-13:   Low-Profile Model**
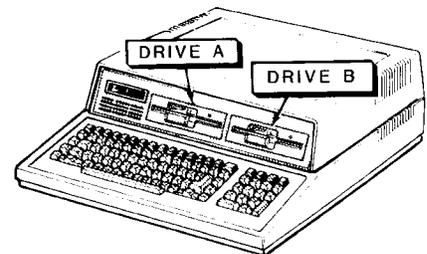
Refer to Figure 1-14 for the following discussion.

- Disk load slot - Insert 5.25-inch disks in this slot with the label up and toward you. If the disk is not oriented as shown in the figure, the computer will not operate properly and you may damage the disk and/or disk drive. If the disk meets resistance while you are inserting it into the drive, check to make sure that there is not a disk already in the drive. It should slide smoothly into the drive.

- Disk drive latch - Your floppy disk drive may have a latch, door, or handle as illustrated in the insets. It is used to secure the floppy disk in the proper position in the disk drive. Closing the latch engages the drive hub into the disk and brings the read/write heads into contact with the disk surface. If the latch closes with difficulty, remove the disk, inspect the edge of the center hole for damage, check for proper floppy disk orientation (see the previous discussion), and try again.

  NOTE: Several different disk drive types are equipped with a locking mechanism that prevents the latch from being closed if there is no disk inserted in the drive. This prevents possible damage to the read/write heads. Be sure there is a disk inserted in the disk drive before attempting to close the latch.

- LED Disk Access Indicator - This light, which may be in one of several different locations on the front of your disk drive, indicates that the computer is attempting to read from or write to the disk. The read/write operation will be successful only if the disk is inserted properly and the disk drive latch is closed.
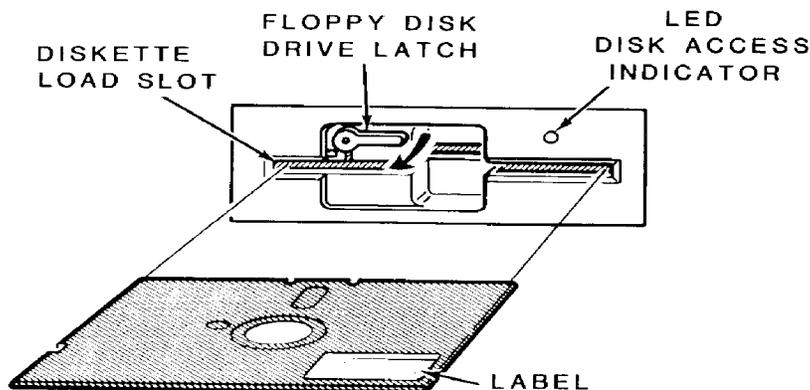
Figure 1-14:   Disk Drive Controls

NOTE: Winchester disk drives do not have removable disks. Instead, all you will see is the LED disk access indicator.

Disks

The floppy disk, or disk, sometimes called a diskette, is a precision storage medium which requires care and attention to insure a long, trouble-free life.

A disk is made up of three parts (see Figure 1-15): the plastic disk, the disk liner, and the disk jacket. A disk envelope is provided for additional protection when the disk is not being used in your computer.

The disk is made out of a very thin plastic material (usually Mylar®) that is flexible and coated with a magnetic oxide similar to that used in magnetic recording tape. It can be bent or marked easily, leaving distortions in its surface that will destroy its usefulness.
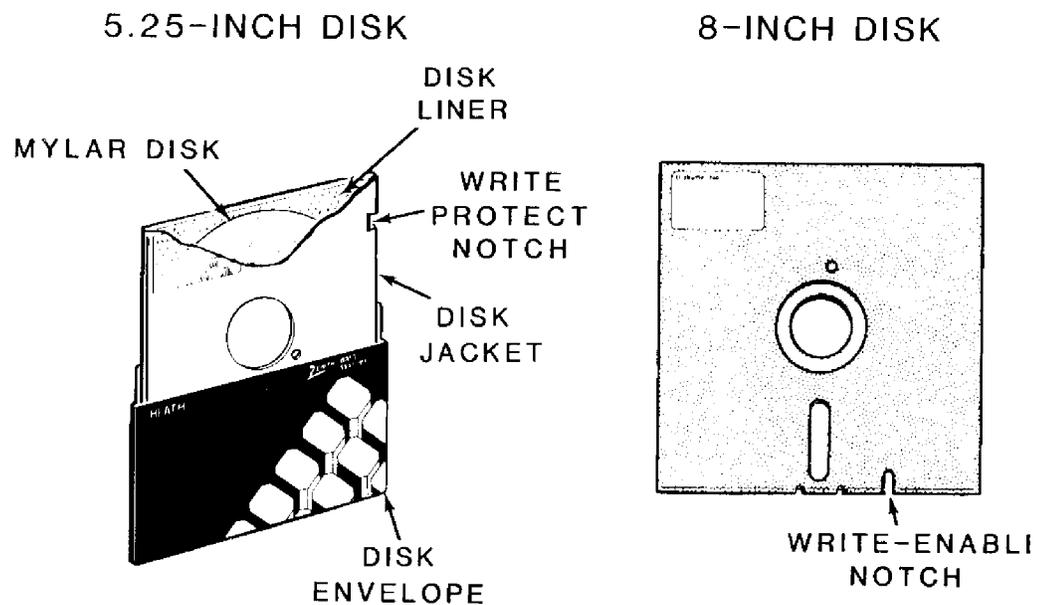
Figure 1-15: Disks

The disk is well protected against accidental damage. The protective liner, a sleeve of cloth-like material that cleans the disk and traps dust particles, is placed around the disk. The outer jacket (with a label on the upper left-hand corner) adds additional protection and makes the disk somewhat rigid. The protective envelope covers the exposed areas of the disk when it is not in use or is being stored.

The outer jacket has three openings and a notch along one side. The disk drive grips the disk through the large center opening. The small circu-lar hole to one side is used for timing purposes. The read/write head accesses the disk through the long slot.

The notch, on 5.25-inch disks, is called a "write-protect notch" and is located near the label. Whenever you have important information on a disk that you do not want to "write over," place an opaque tab over this notch. The computer will sense its presence and will not record on this disk. I .B⁻, 8-inch disks (used in 8-inch disk drives), the notch is located near the read/write head access slot and is a "write-enable" notch that must covered in order to record information on the disk.

The read/write head functions like the recording and playback head in a tape recorder. The disk comes in contact with the read/write head, which will either record (write to) or read magnetic impulses from the disk. If the disk is in any way deformed, this process is interrupted and valuable data can be lost. For instance, the oily residue left from a fingerprint will cause the disk to loose good contact with the head, interrupting the read/ write process.

You can compare a disk to a file cabinet that is fall of files. When the disk is new, it is like new, empty file drawers. You have to organize ("format") the disk so it can hold your "files" of information. This information may take the form of data, programs, or the disk operating system (DOS). The "Disk Operating System" chapter of this manual will tell you how to organize, or format, your disks.

Refer to Figure 1-16. A disk's surface is divided into tracks and sectors. A track is that portion of the disk that passes under the read/write head. It is divided into sectors by either timing holes placed in the disk itself, or by software. When timing holes determine the sectoring of a track, the disk is said to be a "hard-sector" disk. When software determines the sectoring, the disk is a "soft-sector" disk.

The amount of information each sector can hold determines the disk's density. (Disks are sold as single- or double-density types.) If a disk is capable of "double-density" usage, it can hold twice as much information as the standard "single-density" disk. A double-density disk can be formatted for single-density use, but a single-density disk should not be formatted for double-density use.
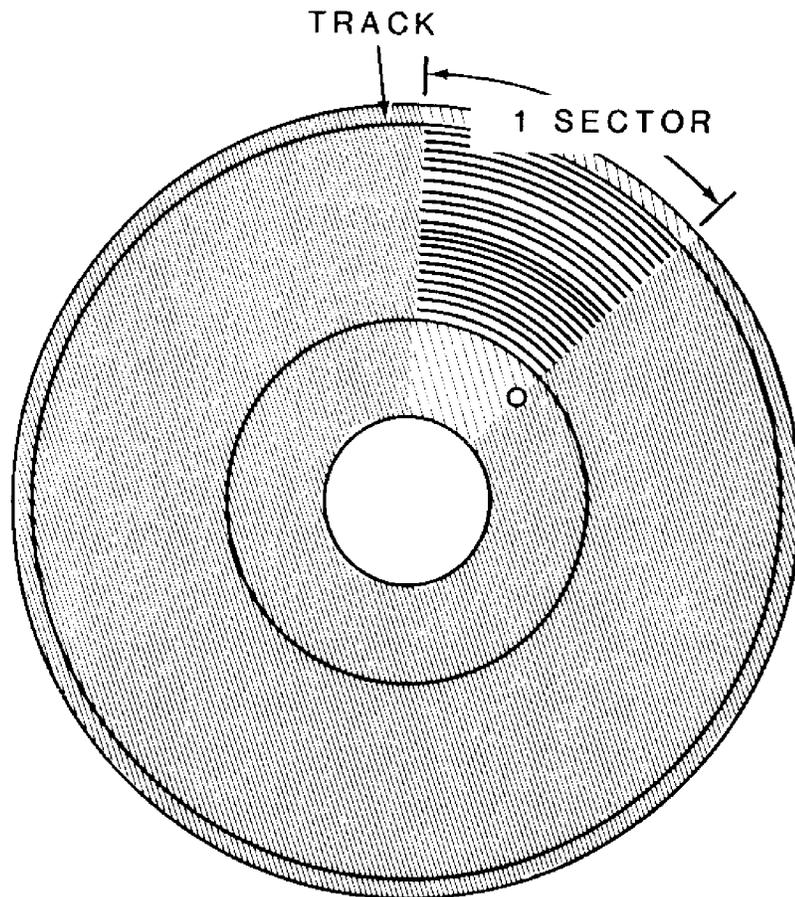
Figure 1-16:   Disk Surface

The number of tracks that a disk can hold is measured in tracks per inch (tpi). Two common specifications are 48 tpi and 96 tpi, although you may find these disks labeled 40 tracks and 80 tracks, respectively. Occasionally, you will find disks labeled for 35-track systems. Your computer uses 48 tpi, 40 track disks in its built-in drives. If 48 tpi disks are not available, you may safely use 96 tpi disks.

The other difference between disks is the number of sides. All disks are coated on both sides; however, double-sided disks have been tested for use with double-sided disk drives. Single-sided disks are for disk drives that only write on one side of the disk. Your computer has double-sided disk drives to provide full business applications usage.

When you purchase disks for use in the built-in drives of your computer, ask for 5.25-inch disks that are soft-sectored, double-sided, and doubledensity. You may use either 40 track, 48 tpi, or 80 track, 96 tpi disks.

For 8-inch disks, ask for double-sided, double-density 77 track, 48 tpi disks. You may also use single-sided, single-density disks, but will have to make special provisions when you format them.

Disk Care

Because the disks can be damaged when you handle them, keep the following precautions in mind.

When you prepare a label for a disk, write on it before you place it on the disk; or, if you must write on a label that is already on the disk, use a felt-tip pen. Ball point pens and pencils may exert enough force on the disk to crease the Mylar (thus destroying its usefulness) and should not be used to mark labels once they are on a disk.

Handle the disk much the same as you would an audio record. It should be stored in its protective envelope in an upright position and away from heat or direct sunlight when not in use. Don't bend it or use paper clips on it and do not touch the exposed areas of the disk.

Magnets and magnetized objects can erase some of the information stored on your disks. Also, X-rays may destroy the data on a disk. By keeping your disks away from these sources of trouble, you can help reduce problems with your computer.

Power Up

You are now ready to see your new computer in operation. The following directions will help you power up your computer and prepare it for the demonstration disk.

☐ Turn on the power switch. You should see the power-on indicator (in the RESET key) light and disk drive A's disk access indicator glow.

NOTE: The disk access indicator may not glow if certain features are not enabled on your computer. However, if you do not see the power-on indicator light up, turn the power off and refer to In Case of Difficulty in this chapter.

☐ After about 30 seconds, the following message should appear on the screen.

> Device Error

A small hand (called the "hand prompt"), pointing to a cursor, will appear in the upper left-hand corner of the screen. If the prompt does not appear, press both the **CTRL** and **RESET** keys at the same time. If the message, small hand, and cursor still do not appear after another 30 seconds, refer to In Case of Difficulty at the end of this chapter.

NOTE: If the disk access light does not glow when you turn on your computer, the hand prompt should appear very shortly. If it does not, press both the **CTRL** and **RESET** keys at the same time. If the hand prompt does not immediately appear, refer to the In Case of Difficulty section.

Also, you may override the 30-second wait by pressing the **DELETE** key while the disk access light is glowing. The screen will then display the following message and the hand prompt.

> Boot Abort

Z-100 Demonstration Disk

Introduction

The Z-100 Demonstration Disk will show you some of the power and versatility of your new computer. The demonstration disk contains three sections; the first two are automatic and will provide you with a good demonstration of the graphic capabilities of your computer. The third section is a useful program that will allow you to specify, design, and display your information using the graphic capabilities of either Z-BASIC or (3W-BASIC. The instructions for using the interactive portion of the disk are found in Appendix K.

If this is the first time that you are going to use your demonstration disk, be sure you have read the section on disks, found earlier in this chapter, before you start. You may also want to make a backup copy of it for safe keeping. You will need MS-DOS to do this. Refer to Appendix L of this manual for information about making backups.

To; use your demonstration disk, follow these procedures:

⌐
If you have not done so, turn on your computer. Otherwise, if the hand prompt is showing, press the B key. The word **Boot** will appear on the screen. Press the F1 key. The letters f1 will appear on the screen in reverse video (dark letters on a light background). Press the **RETURN** key.

NOTE: Look at your demonstration disk. If a tab is covering the write-protech notch, remove it.

⌐
Refer to the Disk Drive section earlier in this chapter and insert your demonstration disk into drive A (left drive on the Low-Profile model, top drive on the All-in-One model).

After a moment, a message similar to the following will appear on the screen. These are the sign-on messages of Z-DOS, an operating system used on your computer.

Z-DOS/MS-DOS BIOS release 1.00, version 1.00

Z-DOS/MS-DOS release 1.00, version 1.25
(C)Copyright 1982 Zenith Data Systems

Z-DOS/MS-DOS Command release 1.00, version 1.19

The demonstration program will then automatically start and you will see the following:

A: zbasic choice

There will be a brief pause while the next part of the program loads into your computer's memory. The screen will clear and then display the BASIC copyright notice (similar to the following):

Z-BASIC Rev. 1.0

[Z-DOS/MSDOS Version]
Copyright 1982 (C) by Microsoft
Created: 15-Jul-82
62168 Bytes free

Master Menu

The master menu will now load into memory, the screen will clear, and the following choices will be displayed:

> Z-100 / Z-BASIC Demonstration System
>   Version 1.0
>
> <:F1> Artwork.
>
> <F2> Interactive Business Graphics.
>
>   Enter your choice :

If you press the F1 function key, you will select an automatic display of several interesting graphic designs. If you press the F2 function key, you will select a program which will allow you to design and display different charts on your computer.

If you do not want either program, you may safely end the program. To do so, open the disk drive door and remove your disk. Then either press both the CTRL and **RESET** keys at the same time or turn off your computer.

Artwork

☐ Press the F1 function key to select the artwork display. The screen will clear and the following will be displayed.

> A:autoexe1
>
> A:zbasic f

After a moment, the screen will clear and the BASIC copyright notice will appear. Then the screen will again clear and the first display will be drawn. After it is completed, the screen will once again clear and a new display will be drawn. This process will continue through the entire series of displays.

⌐
─ If you want to "freeze" any picture, press both the CTRL and S keys at the same time and then release them. This action will stop the display and allow you more time to study the drawing.

⌐
─ To continue the display, press any other key.

After all the displays have been completed, the computer will return to the master menu where you may either reselect the artwork series or go on to the business graphics section.

Interactive Business Graphics

The interactive business graphics portion of your demonstration disk is actually a set of very powerful programs which you may use by themselves or incorporate into your own software. The interactive portion of the program is described in Appendix K at the back of this manual.

⌐
─ Press the F2 function key at the master menu. The screen will clear and the following will appear on your screen:

    A:autoexe1

    A:zbasic menu

Then the BASIC copyright notice will appear, the screen will clear, and the following menu illustrated in Figure 1-17 will be displayed.

```
                    Zenith Data Systems'
                          Z-100
                 Business Graphics Demonstration
                        Version 1.0
     Data Management                              Graphic Design
      -->Press <F1>                               -->Press <F2>
  ┌────────────────┐  Press Function Key Indicating  ┌──────────────────┐
  │Desc.  Value   %│         Your Choice              │                  │
  │                │                                  │TYPE OF GRAPH> Bar │
  │EUROPE  877.3 63.0│                                │DATA FILE> Data1   │
  │CANADA  514.9 37.0│  Demonstration -->Press <F4>   │TITLE> Sales Growth│
  │                │                                  │                  │
  │                │       Graphic Displays           │                  │
  │                │        -->Press <F3>             │                  │
  │Total  1392.2   │     ┌──────────────────┐         └──────────────────┘
  └────────────────┘     │        ▐▌         │
                         │      ▐▌▐▌▐▌        │
                         │     ▐▌▐▌▐▌▐▌▐▌     │
                         │     ▐▌▐▌▐▌▐▌▐▌     │
                         │     Sales Growth   │
                         └──────────────────┘
        Enter your choice (F1-F4) or <HOME> to END> _
```
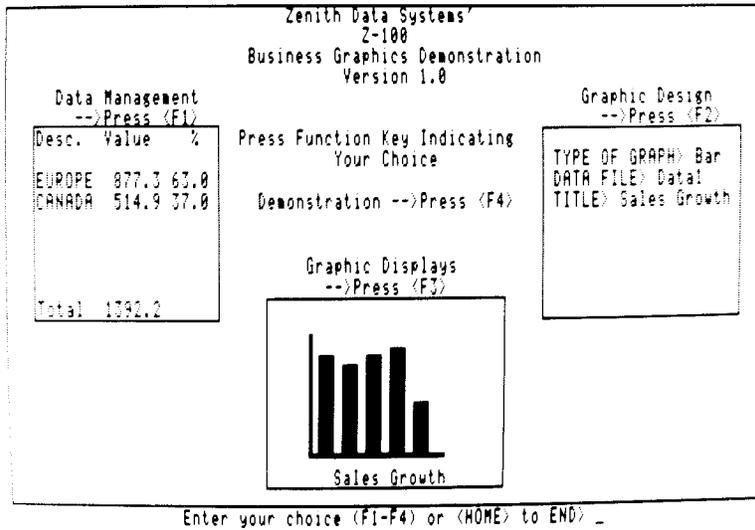
Figure 1-17:   Business Graphics Menu

In addition, the business graphics menu runs a continuing display of various types of charts in three "windows." The following types of charts are illustrated:

- Line charts
- Side bar charts (horizontal bars)
- Bar charts (vertical bars)
- 3-D charts (three-dimensional bars)
- Trend-line charts (data with least square fit analysis)
- Pie charts (single, full-screen pie)
- Multiple-pie charts (up to eight pies on one screen)

For now, select the continuous demonstrations to look at full-screen representations of the different types of charts. Later on, after you have become familiar with your new computer, you may turn to Appendix J and use the other three functions of this program to create your own charts with your own information.

□ Press the F4 function key to select a demonstration of screen-sized charts. Like the artwork demonstration, this program does not require any keyboard entries on your part.

The display is a series of designs created by Zenith Data Systems as examples of each of the seven types of charts. In some cases, you will see different examples that illustrate the versatility offered in the design phase of these routines. Two types of charts will not be illustrated on machines that do not contain the color option: multiple pie charts and three-dimensional bar graphs. A test is performed and an appropriate message will be displayed for the monochrome display machines.

Each chart will be displayed for about a minute (or 40 seconds on 8 MHz machines) before going on to the next.

□ If you wish to exit the continuous demonstration portion, press the **HOME** key when the following appears at the bottom-left of your screen:

        PRESS <HOME>

Otherwise, when the entire series has been displayed, the program will return to the business graphics menu.

□ To return to the master menu from the business graphics menu, press the **HOME** key. The screen will clear and the master menu will be displayed. At that point, you may remove your disk and reset your computer or turn it off.

In Case of Difficulty

ZDS computer hardware and software products are designed to work together as a complete system. Proper operation can be assumed only when your computer is used with ZDS-designed or approved accessories. ZDS does not assume the responsibility for improper operation resulting from custom interfacing, custom software, or the use of accessories not approved by Zenith Data Systems.

All the computer components have been wired and tested by ZDS. If you encounter any malfunction during the warranty period, call your Zenith Data Systems dealer or authorized Zenith Data Systems repair facility to arrange for service. **Do not** attempt to service this computer yourself during the warranty period; to do so may void the warranty.

You may have out-of-warranty products repaired by your Zenith Data Systems dealer of authorized Zenith Data Systems repair facility. You may wish to obtain a maintenance contract for your computer system, or you can purchase individual replacement parts to do your own service.

If you cannot locate a Zenith Data Systems dealer or repair facility, call 1-800-447-4700 (in Illinois, 1-800-322-4400) for the name and location of one nearest you.

The following information will provide you with information concerning possible solutions to common problems.

Condition: Nothing happens at power on, and the red light in the RESET key is not lit.

Possible causes:
1. The AC power cord may not be plugged in (check both ends). If you are using a multiple outlet box, check its plug.
2. The power may not be on at the AC power source (wall outlet). Check the power source with a different electric device.
3. The computer's (or the multiple outlet box's) power switch may not be on.
4. The line select switch may be set incorrectly for your power source.

Condition: No video (blank screen).

Possible causes:
1. The brightness control may be turned down (either in the All-in-One model or external monitor).
2. The external monitor (Low-Profile model) may not be plugged in and/or turned on.
3. The external monitor (Low-Profile model) may not be property connected to the computer.
4. The computer may not be transmitting a signal (screen may have been blanked or cleared by a program). Note that this will not be the case when you first turn your computer system on or if the computer is waiting for you to do something.
5. The computer may have failed during the initial self-tests.

Condition: Insufficient brightness on the screen.

Possible cause:
1. The brightness control is probably turned down (either in the All-in-One model or external monitor).

Condition: With the autoboot feature off, the disk won't boot from the hand prompt.

Possible causes:
1. You may not have pressed the B, F1, and RETURN keys. Press the CTRL and the **RESET** keys at the same time and try again. Don't forget to press the **RETURN** key after pressing the B and F1 keys.
2. You may have the wrong disk in the disk drive (you may be trying to boot from an unformatted disk or a data disk).
3. The disk may be inserted in the drive wrong or may be in the wrong disk drive.
4. The disk drive latch may not be closed.
5. You may have pressed the wrong key.
6. The disk may be damaged. Try another bootable disk.

Condition: With the autoboot feature on, the system won't boot automatically.

Possible causes:
1. You may have the wrong disk (you must use a system disk in the boot drive).
2. The disk may be inserted in the drive incorrectly or may be in the wrong disk drive.
3. The disk drive latch may not be closed.
4. The disk may be damaged. Try another bootable disk.

Condition: The system resets to the power-up point or the disk keeps rebooting.

Possible causes:
1. You may have a bad or loose power cord.
2. You may have a bad disk (part of the information on it may not be read correctly). This is not a common cause for this condition - it is more likely that the system would not boot properly from a damaged disk.

Service Information

In the extreme case where you are unable to resolve a problem with your computer system, you may want to contact your local Zenith Data Systems dealer or authorized Zenith Data Systems service center.

If you can isolate the problem to a particular symptom or hardware unit, such as the printer, you will save time and possible service expenses.

When You Call for Help

When you call for service, list the following information about your computer and its peripherals. It will help your ZDS representative diagnose and repair your unit.

1. The problem you are having. Supply any error messages that may have been displayed on the screen at the time your equipment failed.

2. The name, model number, and series or serial number of your computer and affected peripherals.

3. The way your system is configured; that is, the name and model numbers of the peripherals that are connected to your computer and how (or where) they are connected.

4. Any additional information that will help describe your system and the difficulty you are experiencing.
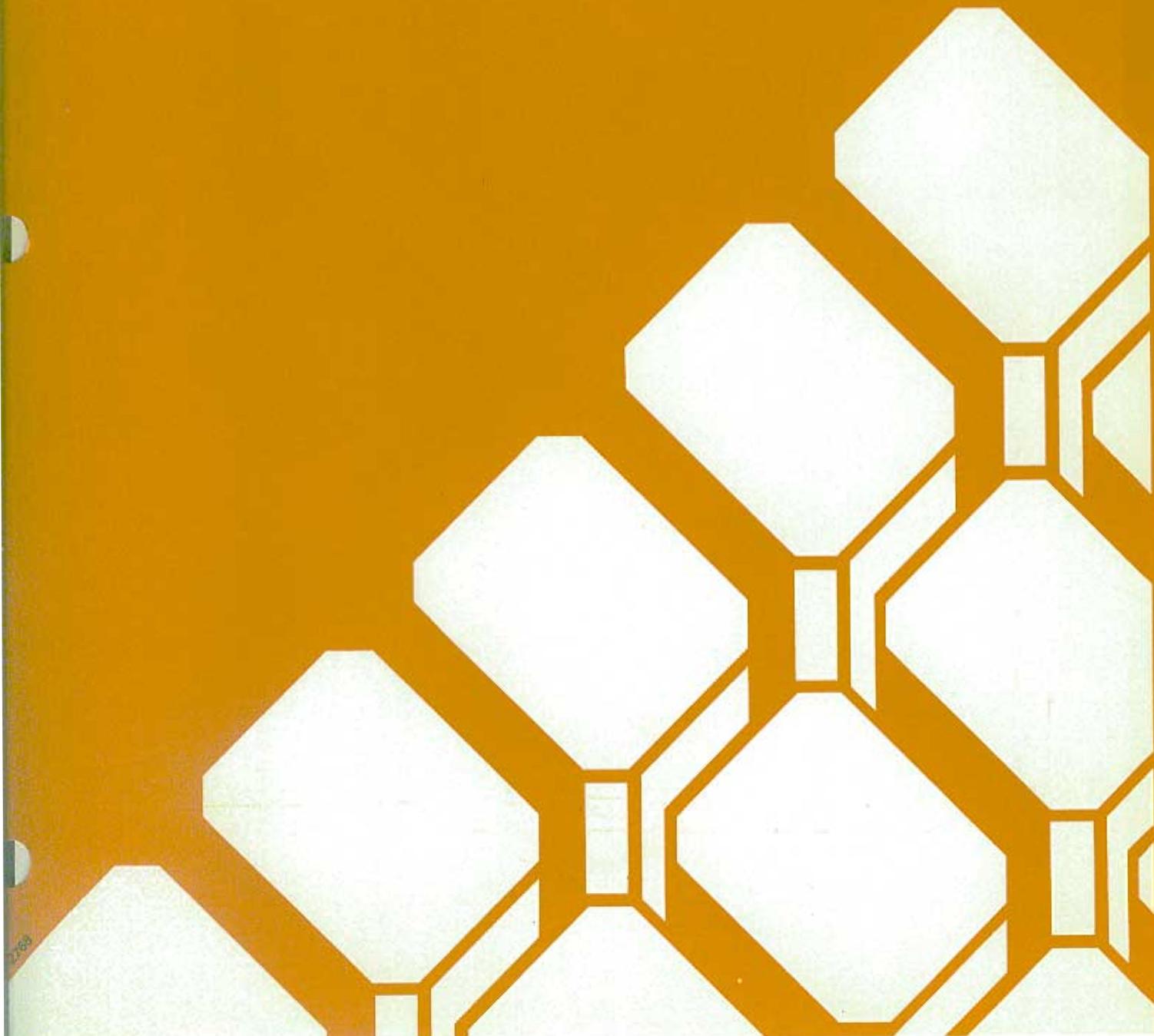
Introduction

A disk operating system, or DOS, is a program that lets you do certain tasks, such as organize the disk (with the FORMAT command), copy information from one disk to another (with the COPY command), enter the date and time (DATE and TIME commands), and load other programs.

NOTE: Two disk operating systems that work with your computer are MS-DOS and CP/M. There is also at least one version of BASIC for each operating system: BASIC-80 for use with CP/M-85 and existing 8-bit software, and Z-BASIC for use with MS-DOS and 16-bit software. GW-BASIC is also available for use with MS-DOS.

MS-DOS was prepared for Zenith Data Systems Z-100 Computers by Microsoft. It is compatible with the same MS-DOS that runs on the IBM Personal Computer. MS-DOS stands for Microsoft Disk Operating System. It is supplied on disk and must be loaded into your computer.

To load MS-DOS, you will use a program called a "monitor," which is built into your computer. The monitor program is always there, ready to help you get started, to check out certain features, and to serve as a system supervisor. You will learn how to load MS-DOS into your computer and how to use some of the features of MS-DOS to organize disks and duplicate them.

CP/M-85 is briefly compared to MS-DOS in Appendix I. Complete information concerning this operating system is contained in the CP/M-85 documentation.

If you are using your Z-100 computer for the first time, be sure you have read the "Operation" chapter of this manual; it contains important information for new users. Even if you have used other computers, you should read the discussion on controls before you attempt to use your computer.

NOTE: The following information assumes you have two floppy disk drives built into your computer. If your system has only one floppy disk drive, refer to Appendix D for proper use of one-drive commands.

The Monitor Program

Your computer contains a special program, called a monitor, that is designed to help you get started. One of its functions is to load (or "boot") the disk operating system from disk into memory. The Z-100 computer is set at the factory to automatically boot the DOS when it is turned on. By setting a switch (see Appendix G) you can disable this feature (called "autoboot").

Autoboot

If autoboot is disabled, after power up you will see a small hand pointing to a flashing underline in the upper left-hand corner of the screen. This "prompt" is the computer's way of telling you that it is ready and waiting for your command. To execute any monitor program command, the hand prompt must be present. It occurs automatically after the system is turned on and may be restored at any time. To do so, simultaneously press both the **CTRL** and **RESET** keys if you ever find that you need to start over. However, do not reset your computer unless you are sure that no important programs are being executed.

If autoboot is enabled (set as the computer comes from the factory), then there will be no display until a certain amount of time passes, or you press the **DELETE** key, or you insert a disk with the DOS on it into drive A:

If you press the **DELETE** key, the autoboot process will be interrupted and the screen will show:

Boot Abort

and the hand prompt. The system is now in a manual mode and you can use the commands described later in this chapter.

If you wait for the system and do not put a disk into drive A, the screen will show:

Device Error

and the hand prompt. This message will also appear if you put the disk into the disk drive incorrectly.

The system is now in a manual mode and you can use the commands described later in this chapter.

If you want to restart the computer at any time, press both the **CTRL** and **RESET** keys at the same time. The computer will attempt to boot in a DOS, as it did when you first turned it on. If you have a disk properly inserted in drive A, the DOS will be booted.

The Commands

The monitor program will execute twelve different commands, a summary of which is shown in Table 2-1. Only a few are explained here. The remainder are briefly described in Appendix C.

Table 2-1: Monitor Command Summary

COMMAND	NAME	DESCRIPTION
B	Boot	Loads the operating system from a disk.
C	Color Bar	Displays a color bar pattern on the screen. If the computer does not have color capability, a single white bar, will be displayed on the right half of the screen. Monochrome displays will display a pattern of gray-scale bars.
D	Dump	Displays the contents of a block or portion of memory in hexadecimal and ASCII.
E	Examine	Examines and/or changes the contents of a memory location.
F	Fill	Fills the specified range of memory locations with the data entered.
H	Help	Displays the list of monitor program commands.
HELP key	Help	See the H command.
I	Input	Returns the contents of the specified port.
O	Output	Sends a value to the specified port.
S	System	Displays the parameters (memory size, video RAM devices, video type: color or monochrome) of the computer.
T	Test	Displays the diagnostic test menu.
V	Version	Displays the version number of the ROM program.
X	Execute	Initiates machine language program execution at the specified memory address. Allows breakpoints.

Some of these commands are used by programmers for machine language Programming and debugging (see later discussion on programs in Chapter 3).

B – Boot

This is the monitor command you will use if your system is not set up to boot automatically, if a disk is not autobooted after power up, or if you want to manually boot the system. The boot process reads the operating system from the disk and loads it into the computer. To use this command

⌐ Make sure the computer is on and the hand prompt is showing.

⌐ Insert the MS-DOS disk (or any disk that contains a Z-100 disk operating system) into drive A (see the discussion on disk drives in Chapter 1).

⌐ Close the disk drive door or latch.

⌐ Press the B key and then the F1 function key. The computer will display:

   Boot f1

⌐ Press the **RETURN** key.

The computer will now execute the boot routine and load the operating system from the disk in drive A into the computer's memory.

There are several variations of the boot command available to you. Three of the function keys, F1, F2, and F3, tell the computer what kind of disk drive to use: F1 is for the built-in floppy disk drives, F2 is for the optional 8-inch floppy disk drives, and F3 is for the optional Winchester disk system.

In addition to being able to specify which disk drive type, you may also specify which disk drive by using the number keys: 0 for the first drive (drive A, if you are booting from the built-in floppy disk drives) and 1 for the second disk drive.

Therefore, if you want to boot from the second 8-inch floppy disk drive, you would (1) turn on your computer and the 8-inch disk system, (2) insert an 8-inch floppy disk into the bottom 8-inch disk drive (it must contain a Z-100 operating system), (3) close the drive, and (4) press the B key, the **F2** key, the 1 key, and the **RETURN** key, in that order. The computer will display:

Boot f2 1

and load the operating system from the second 8-inch disk drive.

NOTE: For a complete discussion on the optional 8-inch disk drives or Winchester disk system, refer to the documentation that accompanies these products and also your operating system documentation.

C - Color Bar

If your computer is equipped with color video memory, it has the capability to display a color bar pattern on the screen so you may adjust your color monitor for the most pleasing display. To use this command:

⌐   Make sure your computer is properly attached to your color monitor.

⌐   Make sure the monitor is on.

⌐   Make sure the computer is on and the hand prompt is showing.

⌐   Press the C key. You will see one of two possible patterns, depending upon the capabilities of your system.

- If your computer is equipped with color video memory, you will see a pattern of color bars across the top half of the screen. Each color bar will be identified with the name of the color that is being represented. On a monochrome monitor, the pattern will be shaded from the most dark to the most light, left-to-right.

- If your computer is not equipped with color video memory, you will see a single block of light in the upper right-hand quarter of your display.

⌐ Use this pattern to adjust the controls for your monitor to provide the most pleasing display.

H -- Help

This command will display the commands available for the monitor program. The HELP key, located on the left side of the keyboard will also provide the same display when it is pressed. To use this command:

⌐ Make sure the computer is on and the hand prompt is showing.

⌐ Press <u>either</u> the H key or the **HELP** key. The computer will display:

```
Boot
Color Bar
Dump
Examine
Fill
Help
<HELP Key>
Input
Output
System
Test
Version
Xecute
```

A complete description of each command is found in Appendix C.

S - System

This command will provide you will a brief summary of the features of your computer. If provides you with the amount of system memory installed in your computer, the amount of video memory installed in your computer, and the type of video (color or monochrome) supported by your system. To use this command:

⌐ Make sure the computer is on and the hand prompt is showing.

⌐ Press the S key. The computer will show you a display similar to:

```
256Kb of contiguous RAM
64Kb Video memory
Color
```

This particular display tells you that your system has 256 kilobytes of random access memory (RAM) and 64 kilobytes of color video memory. Other variations that will commonly be seen are 128 or 192 kilobytes of random access memory and 32 or 64 kilobytes of color or monochrome video memory.

V - Version

NOTE: Professional software is released in versions. Updates and enhancements to these programs are made as they are developed. Each time a revision of this type occurs, it is called a new "version" and given a number (Version 1.0, Version 1.1, Version 2.0, etc.).

You can use the Version command whenever you want to find out what version of the monitor program you have in your computer. To use this command:

⌐ Make sure the computer is on and the hand prompt is showing.

⌐ Press the V key. The computer will display:

    Version 2.5

and return to the hand prompt.

The display tells you that the monitor version (in this example) is 2.5. There is no relationship between the monitor version number and the operating system version number shown later in this chapter.

Loading MS-DOS

With the MS-DOS manual, you will receive two MS-DOS disks: disk #1 and disk #2. The following steps will show you how to "load" the disk operating system the first time and then create "backups," or "working copies," of the distribution disks.

To load MS-DOS:

⌐ Turn on the computer or press the CTRL and **RESET** keys at the same time if the computer is already on.

⌐ Insert the MS-DOS distribution disk #1 into drive A.

⌐ Close the disk drive door or latch.

⌐ If you are booting the computer manually, press the B key and then the **F1** key. The computer will display the following.

    Boot f1

⌐ Press the **RETURN** key.

The floppy disk drive's disk access indicator will come on, indicating that the disk is being "read" by the computer. You may hear a faint whirring noise, which is the normal sound of the disk drive motors.
As MS-DOS is read into the computer, your display will show a message similar to:

                MS-DOS Version 2.20
       Copyright(C) 1984, Zenith Data Systems Corporation

    A>date

    Current date is Mon 11-12-1984
    Enter new date:

The date actually shown on your computer will probably differ from this sample. The format for entering the date is M/D/Y or M-D-Y where M is the month (1 to 12), D is the day (1 to 31), and Y is the year (80 to 99). Four digits may be used for year if you are entering a year from 2000 from 2099. Any other response will cause the computer to display:

    Invalid date
    Enter new date:

Some examples of how valid dates are entered and stored are:

Your entry:	Will be stored as:
6-9-82	Wed 6-09-1982
12-31-2084	Sun 12-31-2084
8/12/91	Mon 8-12-1991
2-5-85	Tue 2-05-1985

Enter the current date and press the **RETURN** key. The computer will display:

    A>time
    Current time is 12:02:17.16
    Enter new time:

The time actually shown on your computer will probably differ from this sample. You will use the format H:M:S.C to enter the time, where H is hours (0 to 23), M is minutes (0 to 59), S is second (0 to 59), and C is tenths of a second (0 to 9). Minutes, seconds, and tenths of a second are optional and may be omitted. The separators, colon and period, must be used exactly as shown or else the following error message will be displayed.

    Invalid time

    Enter new time:

Some examples of valid entries and how they are stored in your computer follow:

Your entry:	Will be stored as:
9:15	9:15:00.00
9:15:30	9:15:30.00
9:15:30.5	9:15:30.50
14:2:3	14:02:03.00

Enter the current time and press the **RETURN** key. The display will now show:

    'Path- \bin

You have now successfully loaded MS-DOS into your computer. The computer has performed one other function: to allow you to access all the programs on the default disk without having to worry about "directory paths." Directory paths will be explained later in this chapter.

The MS-DOS Prompt

Normally, after you load MS-DOS, you will see:

A>

You can see by this example that the small hand has been replaced by the A>, which is MS-DOS's prompt. The A> also tells you which drive is currently being used by the system. This is called the "default drive." Later on, you'll find out how to change the drive being used. But first, you need to create a copy, or backup, of MS-DOS and store the original in a safe place.

Making A Backup

Backups

A backup might easily be considered to be an "insurance copy." It is a duplicate of important data. During the course of normal operation, accidents do happen and a disk can be accidentally ruined. By having a backup, you have "insured" yourself against the loss of information that may be vital to the successful operation of your business or computer.

By making backups at regular intervals, you can minimize the amount of work that would be necessary to bring your computer records up to date if information is lost through mishandling of a disk or by some other cause.

Backups also provide a convenient method of rotating your disks so that one is not in constant use. The backup procedure gives you a way of verifying that the disk you are using is a good one, and not one which may cause a problem.

Since you computer has now loaded MS-DOS and is waiting for your instructions, the following will take your through the step-by-step process. Appendix L illustrates another method you can use to make a backup of important disks while using MS-DOS.

Backing Up Your Disks the First Time

The DISKCOPY utility has been designed to allow you to create an exact duplicate, or backup, of a disk. You will use it now to duplicate the two 5.25-inch MS-DOS distribution disks.

The working master disks are those that you will create during this backup procedure. Because there is more than one disk, you will be asked to repeat the process twice. The disk that is now in drive A should be labeled disk #1. You will be given an opportunity to make sure that it is the correct disk in a moment.

You will be copying the information from the distribution, or "source," disks onto "destination" disks.

To start the backup procedure, make sure that the A> MS-DOS prompt is showing on the screen. If it is not, reboot your system (see the procedure earlier in this chapter).

⌐ Enter the following into your keyboard. The characters you type will be shown on the screen.

    BACKUP/V

⌐ Press the **RETURN** key. The light in drive A will come on and your screen will show a display similar to the following.

          DISKCOPY version 2.20
      Copyright(C) 1984 Zenith Data Systems Corporation

      Source drive name? (A-H) _:

⌐ You will notice that the cursor is to the left of the colon. It is prompting you to enter the name of the disk drive in which the source disk is located. Now you can check to make sure that you have the distribution disk, disk #1, in drive A. To do so, open the drive door or latch and remove the disk. After you have checked the label on the disk and made sure it is disk #1, put it back in drive A and close the door or latch.

⌐ Press the A key. The computer will now show:

> Destination drive name (A-H) _:

NOTE: This backup procedure does not check to see if your destination disk has data on it. Any information previously recorded on the disk will be erased and blank (empty) tracks will be placed on the disk, making it ready to receive new data. Be sure you are using a blank disk (or one that you wish to erase).

⌐ Insert a blank disk in drive B and close the door or latch.

⌐ Press the B key. The computer will display:

> Place the source disk in A and the destination disk in B.
> Press RETURN when ready.

You now have one last chance to check that you have the correct disks in the proper drives. The source disk, MS-DOS distribution disk #1, should be in drive A. The destination disk, a blank disk, should be in drive B. If you are not sure that they are correct, check them now.

You also may stop the duplication process now if you wish. To stop (or abort) the backup procedure, you would press both the CTRL and C keys at the same time. The computer would end the program and display ↑C on the screen, followed by the MS-DOS prompt. However, you need to make working copies of your distribution disks, so continue with the following procedure.

⌐ With MS-DOS distribution disk #1 in drive A and a blank disk in drive B, press the **RETURN** key. The light in drive A will come on momentarily and then the light in drive B will come on. You will see the following on the screen.

> Formatting destination...

When the light came on for drive A, the computer was checking the type of disk in drive A and the way the tracks were organized on the source disk. Next, it checked the type of disk in drive B. When it was satisfied that the disks were of an identical

type (both soft-sectored, in this case), it displayed the message and began formatting, or organizing, the tracks and sectors so they matched those of the disk in drive A. After the destination has been formatted, the display will show:

Copying...

Now you will see the disk access indicators in drive A and drive B alternately come on. While the indicator in drive A is on, the computer is reading information from the disk into memory. Then while the indicator in drive B is on, the computer is writing that same information onto the tracks and sectors in drive B. When this process has been completed, the computer will show:

Verifying...

Again, the disk access indicators in drive A and drive B will alternately come on. This time, the computer reads the information from each respective disk and then compares the data to make sure it matches. This process verifies that the destination disk is an exact copy of the source disk. When this process has been completed, the computer will show:

Do you wish to copy another disk (Y/N)? <N>

⌐ Remove MS-DOS distribution disk #1 from drive A and place it in its protective envelope.

⌐ Remove the disk in drive B and prepare a label for it. Whenever a new disk has been used for a backup, you will want to prepare a label for it.

Labeling Disks

There are many different methods of labeling and keeping track of disks. One method is to keep a log containing the date the disk was first formatted and the material that you expect to place on the disk (a summary or title only). An example would be:

Formatted 7-15-85   PAYROLL DATA

Most people assign each disk a unique number or code. This allows them to track the location of the disk easily and use a permanent storage area or container for the disk.

For your new copy of the MS-DOS distribution disk #1, assign it number 1, label it with the format date (the current date), and call it "MS-DOS disk 1 - working copy 1." It is called a working copy because it is one you will use on a continuing basis. Place the label in the upper right-hand corner of the disk, making sure you do not cover the write-protect notch.

The message on the computer is asking you if you want to duplicate, or back up, another disk. You need to make a backup of the second distribution disk, so press the Y key and then the **RETURN** key. The computer will show:

Source drive name? (A-H) _:

Press the A key. The computer will show:

Destination drive name? (A-H) _:

Press the B key. The computer will show:

Place the source disk in A and the destination disk in B.
Press RETURN when ready.

Insert the second distribution disk, disk #2, into drive A and close the door or latch.

Insert a blank disk into drive B and close the door or latch.

Press the **RETURN** key. The computer will repeat the backup process as described earlier in this chapter. When the destination disk has been formatted and the information copied from the disk in drive A and verified, the computer will display:

Do you wish to copy another disk (Y/N)? <N>

The letter N inside the angle brackets is the default answer that will be accepted by the computer if you press only the RETURN key.

⌐ Since you have no more disks to copy at this time, press the **RETURN** key. The computer will display the MS-DOS prompt.

⌐ Remove the distribution disk from drive A and place it in its protective envelope.

⌐ Remove the disk from drive B and place it in its protective envelope.

⌐ Prepare a label for the destination disk which includes the number (number 2), the format (current) date, and "MS-DOS disk #2 - working copy 1." Place the label in the upper right-hand corner of the disk, making sure you do not cover the write-protect notch with the label.

You have now completed the first backup of the distribution disks. When convenient, you will want to make at least one more working copy of these disks. The easiest way to do it is to follow these same instructions. However, label your disks as copy 2 (or 3) instead of copy 1.

It is possible that, after reading the remainder of this chapter, you will want to make a custom working copy of MS-DOS. The procedure in Appendix L explains how to do this.

MS-DOS Control Key Functions

The following keys and key combinations are those that function while you are operating under MS-DOS. (If you have trouble locating any of these keys, you will find them highlighted in the Keyboard section of Chapter 1.)

These are the only keys, other than commands and special function keys, that MS-DOS will recognize. The special function keys are explained in the MS-DOS documentation.

Three single keystrokes are recognized by MS-DOS:

- RETURN - When you press this key, the computer will accept what you have entered through the keyboard. If you typed the information correctly, the computer will follow your instructions.

- BACK SPACE - If you accidentally press the wrong key or keys, you can use the BACK SPACE key to back over and erase those characters. Then you can enter the correct information.

- LINE FEED - You will not need to use this key unless you have a large amount of information to enter on one line. MS-DOS won't automatically go to the next line when you come to the end of the physical line on the screen and have more information to enter. To go to the next line, press the **LINE FEED** key. It will put the cursor (underline) at the beginning of the next physical line and then, when the command is executed, the computer will use information from both lines.

NOTE: There is a danger in using the BACK SPACE key after using the LINE FEED key. The BACK SPACE key will function normally, "backing out" each character and erasing it from the screen until it reaches the beginning of the line. Then, if you continue to press the BACK SPACE key, it will continue to back out each character typed in the previous line, but it will not affect the display. Without seeing the action of the BACK SPACE key, it is difficult to know what has been backed out unless you are very careful. The CTRL-X combination, described later, provides the easiest solution: it cancels the current command and gives you the opportunity to start over.

MS-DOS will also recognize the following five combinations of keys. One key is always the control key (labeled CTRL). In this manual, whenever you see the word "control" or "CTRL" followed by a dash and some letter, you are to press and hold the CTRL key and then press the other key.

- CTRL-X - If you have entered a line of instructions and want to start over, you have two choices. You may either use the BACK SPACE key and back out all of the instructions, or you may use the CTRL-X combination. This will put a back slash (\) on the screen and start a new line. The information you had previously entered will be ignored by the computer.

- CTRL-S - Some of the commands you will give the computer will cause more information to be displayed than the screen vertically can hold at one time. In order to stop the information from moving off the display, you can press the CTRL-S combination, which will tell the computer to stop what it is doing. Then, when you press any key, the computer will continue. By alternately pressing the CTRL-S and another key, you can control the way information is displayed on the screen.

- CTRL-C - There will be times when you wish to interrupt an operation and you don't want it to finish. You can cancel most operations by pressing the CTRL-C combination. This tells the computer to stop what it is doing, return to the MS-DOS prompt, and wait for your next instruction. Remember, you have canceled the operation, so you cannot start where you have left off - the CTRL-S allows for that. A ^ C will be displayed on the screen where you entered the command.

- CTRL-P - There will be times when you want to send information normally shown on the display to a printer (if you have one connected to your computer). By pressing the CTRL-P combination, you tell the computer to send information to both the computer screen and the printer. Whenever the computer does this, most operations are slowed, because a printer is slower than the screen.

NOTE: If you do **not** have a printer connected, or if it is not turned on, or if it is off line, out of paper, or something is not right, then the computer can "hang up" until the problem is corrected. If there is no printer, or if there is some other problem that cannot be easily corrected (for instance, MS-DOS may not be configured for your printer), the computer will have to be reset.

Since all printers are not alike, MS-DOS must be configured to the needs of your printer. The MS-DOS command, CONFIGUR, and how to configure MS-DOS for the needs of your printer are explained in Appendix F.

- CTRL-N - This combination will cancel the CTRL-P operation and return the computer to normal operation.

NOTE: If the printer should hang up your computer for some reason, CTRL-N will **not** operate. The computer must be reset or the fault corrected.

Try the functions described in this section. The more you use them, the easier they will be to remember.

MS-DOS Commands

An MS-DOS command is an instruction to your computer that you type on the keyboard. Some of the commands, called "internal commands," are an integral part of the operating system. Other commands, referred to as "external commands," are actually separate programs on the disk, and must be loaded into the computer before the functions are performed.

The DISKCOPY command, for example, is external; that is, it is a separate program. The COPY command is internal and, as such, is always a part of MS-DOS. In order to use an external command, the command "file" must exist on the disk. If it is not present, the command will not work.

Changing MS-DOS Prompts

The prompt is a signal to you that your computer is ready to accept a command. While using MS-DOS, you will see the prompt displayed as the letter representing the drive being used by MS-DOS (the default drive). It is followed by some symbol, usually the greater-than sign (>), and the cursor.

If you selected drive A (and this is the normal default drive on power up), the MS-DOS prompt would look like this:

    A>

If you selected drive B, then the MS-DOS prompt would appear as:

     B>

The greater-than sign may be replaced by another symbol, if desired. For more information on changing the prompt symbol, consult your MS-DOS documentation.

You can change the prompt (and the default drive) by typing the new drive name, a colon, and pressing the RETURN key. (You will be instructed to use the RETURN key only in the next two examples. However, you should always use it whenever you finish entering an MS-DOS command.)

If drive A is currently the default drive and you want to change the default drive to drive B, type:

     B:

and press the **RETURN** key.

If drive B is the current default drive and you want to change the default drive to drive A, type:

     A:

and press the **RETURN** key.

You will notice that the current default drive (in the form of the prompt) is displayed each time you finish an MS-DOS command.

Error Messages

Your computer will display an error message when something is wrong. The message itself often will tell you what is wrong so you will be able to correct the problem. An example of this would be:

     Invalid drive specification

This message implies that, in your command, you specified a drive that is not connected to your computer. You would then re-enter the command, specifying the correct drive.

For a complete list of MS-DOS error messages and their meanings, refer to the MS-DOS documentation.

Files, Programs, and File Names

A file may contain either data or a program. Some "programs" may actually consist of several different files. MS-DOS is a good example; there are three programs (files) critical to the operation of MS-DOS: IO.SYS, MSDOS.SYS, and COMMAND.COM (the first two are "hidden" files - files that are physically present on the disk, but do not display as part of the disk directory). On the disk, these are separate files.

Each file is identified by a file "specification." It has three parts: an optional drive name, a file name, and an extension.

- Drive name - The drive name is a letter from A to H and must be followed by a colon. The use of these letters is limited to the configuration of your computer system. For instance, if your computer system does not have more than two drives and you try to use any drive name beyond B, an error message may be displayed.

- File name - The file name is from one to eight characters in length. These characters can be any letter from A to Z, any number from 0 to 9, or certain punctuation characters. Examples of legal file names are MYFILE, AI PROG, and 333-1.

- The extension is from one to three characters in length. The allowed characters are the same as those that you can use for the file name. A period (.) must be used to separate the extension from the file name. Examples are: BAS, SYS, and COM. Some extensions, like SYS, are reserved for certain file types.   Consult your MS-DOS documentation for more information.

Examples of valid and invalid file names are as follows.

Valid file names:	Invalid file names:
MYPROG.BAS	WE,3.BAS (comma)
COMMAND.COM	B:MYP:2.BAS (second colon)
MS-DOS.SYS	MS.OS.SYS (first period)

Internal Commands
The commands that are internal to MS-DOS are listed in Table 2-2.

Table 2-2: Internal MS-DOS Commands

THE COMMAND:	TELLS THE COMPUTER TO:
filename.BAT	Execute a file with a.BAT extension.
BREAK [ON|OFF]	Enable or disable detection of CTRL-C.
CD	Display or change the current directory (same as CHDIR).
CHDIR	Display or change the current directory (same as CD).
CLS	Clear the display.
COPY	Copy files.
CTTY	Change the device from which commands are received.
DATE	Display the current system date and prompt for a new entry.
DEL	Delete a file or files from the disk (same as ERASE).
DIR	List directory entries.
ECHO [ON|OFF]	Enable or disable the echo feature or display a message.
ERASE	Delete a file or files from the disk (same as DEL).
EXIT	Exit current command and return to lower command level.
FOR	Extend batch (or interactive) command.
GOTO	Branch to another command.
IF	Allow conditional execution.
MD	Create a new directory (same as MKDIR).
MKDIR	Create a new directory (same as MD).
PATH	Search directories specified for commands/files.
PAUSE	Temporarily halt batch execution.
PROMPT	Use a new system prompt.
RD	Remove a directory (same as RMDIR).
REM.	Insert a comment in a batch file.
REN	Rename a file (same as RENAME).
RENAME	Rename a file (same as REN).
RMDIR	Remove a directory (same as RD).
SET	Set one string value to be equivalent to another value.
SHIFT	Make it possible to use over 10 batch parameters.
TIME	Display the current system time and prompt for a new entry.
TYPE	Display the contents of a file.
VER	Display the current version of MSDOS.SYS and IO.SYS.
VERIFY	Enable or disable verification of data after it is written to the disk.
VOL	Display the label of the disk in the default drive.

The batch processing commands, (.BAT), ECHO, FOR, GOTO, IF, PAUSE, REM, SET, and SHIFT, will not be discussed in this manual. Likewise, BREAK, CTTY, EXIT, PATH, and PROMPT will not be discussed. For more information on batch files and these commands, refer to the MS-DOS documentation.

COPY

The COPY command allows you to produce a "copy" of any file or program. The general form of the command is:

COPY (from) file specification (to) file specification

Remember that the file specification is made up of the drive name, the file name, and the extension. If the default drive is being used, you may omit the drive name.

Here are some examples of the COPY command:

      (1)   COPY OLDFILE.EXT=NEWFILE.EXT

      (2)   COPY A: OLDFILE.EXT=NEWFILE.EXT

      (3)   COPY B: OLDFILE.EXT=A: NEWFILE.EXT

      (4)   COPY A: OLDFILE.EXT=B: NEWFILE.EXT

In each case, the file OLDFILE.EXT was duplicated under the name of NEWFILE.EXT. The drive names allow you to: (1) use the default drive for both files; (2) use drive A as the source drive and the default drive for the destination; (3) use drive B as the source drive and drive A as the destination; and (4) use drive A as the source drive and drive B as the destination. You will note that, in examples (3) and (4), the default drive was not important.

Wild cards (see the discussion under the DIR command) give you flexibility and allow you to back up a disk without having to know the names of each file. The backup copy procedure in Appendix L uses asterisks in :his manner.

There are several options and limitations in the format of the COPY command. These are fully explained in the MS-DOS documentation. However, me very important restriction (for your protection against accidental file destruction) is that you may not copy a file onto itself. If you try it, the following error message will be displayed.

     File cannot be copied onto itself
         0 File(s) copied

DATE

The DATE command allows you to change the date that is currently stored in your computer. The command will be executed when you enter DATE and press the **RETURN** key. The computer will display the current date and prompt you for a new entry. If you press the **RETURN** key without entering a new date, the computer will not make any change to the current date.

The format for entering the date is M/D/Y or M-D-Y where M is the month (1 to 12), D is the day (1 to 31), and Y is the year (80 to 99). Four digits may be used for year if you are entering a year from 2000 from 2099. Any other response will cause the computer to display:

> Invalid date
> Enter new date:

Some examples of how valid dates are entered and stored are:

Your entry:	Will be stored as:
6-9-82	Wed 6-09-1982
12-31-2084	Sun 12-31-2084
8/12/91	Mon 8-12-1991
2-5-85	Tue 2-05-1985

Each disk, when it has been formatted, is organized to accept files. The names of these files are stored on the disk in areas called directories. The DIR command allows you to look at the directories that are on the disk in the default drive. For the following examples, place one of your copies of MS-DOS disk #1 in drive A.

To display, or "get" the directory, type:

> DIR

(Don't forget to press the **RETURN** key.) You will see a listing similar to the following on your display.

```
Volume in drive A is 890-434-09
Directory of A:\

COMMAND  COM  16421   11-12-84   11:03a
ALTCHAR  SYS    432   4-04-84    3:18p
AUTOEXEC BAT     23   4-04-84    2:36p
CONFIG   SYS     12   9-06-84    2:36p
BIN          <DIR>    11-12-84   12:02p
     5 File(s)              34816 bytes free
```

The five columns of information represent, in order, the name of each file, the extension name, the number of bytes used to store the file (a byte is a measure of memory which can be equated to one keystroke of a printable character on the keyboard), and the date and time that file was created, last edited, or changed.

The last entry in the listing tells you that there is another directory, indicated by <DIR>, on this disk. You will be told how to change directories later in this chapter.

The last line on the screen shows you the number of files displayed and the number of unused bytes on the disk.

You can list the directory of a drive other than the default drive by adding the drive name. Place one of your copies of MS-DOS disk #2 in drive B and then enter:

DIR B:

The computer will display on following on the screen.

```
Volume in drive B is 890-435-02

Directory of B:\

DEVEL  <DIR>    8-20-84    10:14a
PSC    <DIR>    8-20-84    10:14a
DEV    <DIR>    8-20-84    10:14a
CHR    <DIR>    8-20-84    10:14a
       4 File(s)     214016 bytes free
```

In this case, there are four additional directories on the disk in drive B.

If you want to look for a specific file, you may use the name of the file, as in the following examples:

     DIR ALTCHAR.SYS

or

     DIR B: FORMAT.COM

Note that you must use the entire file name, although the extension is optional. The inclusion of the drive name tells the computer to look on the disk in that disk drive.

If you attempted to use these examples, you will note that the second example, DIR B: FORMAT.COM resulted in a display similar to the following.

     Volume in drive B is 890-435-02

     Directory of B:\

     File not found

This display tells you that the directory is either empty or does not contain the file(s) for which you are searching.

Wild Cards

There are two additional characters that you may use with a file's name. They are called "wild cards," which mean "anything," and are represented by the question mark (?) and the asterisk (*). Wild cards allow you to have the computer look for a number of files that have similar names.

You can use the question mark as a wild card to take the place of any fetter in a file name. For instance, if you enter the following command, the computer will display any files (which appear in the directory of the disk in the default drive) with five letter names that begin with AB, end with DE, and have the extension of EXT.

     DIR AB?DE.EXT

The other wild card is the asterisk (*). This character is used in place of multiple question marks, and it can take the place of more than one character in a file name. For instance, if you entered the following command, the computer will display any files with names that begin with AB and have the extension of EXT.

DIR AB*.EXT

Likewise, the following command will cause the computer to list all files starting with the letter F, regardless of the rest of the filename or extension.

F*.*

With MS-DOS disk #1 in drive A, enter the following command.

DIR C*.*

The computer will display a directory similar to the following:

Volume in drive A is 890-434-09 Directory of A:\

```
COMMAND  COM   16421     11-12-84   11:03a
CONFIG      SYS      12      9-16-84    2:36p
     2 File(s)           34816 bytes  free
```

Multiple Directories

MS-DOS version 2 can support directory roots and branches. While this feature is not overly important on 5.25-inch floppy disks, it is a benefit to the operation and organization of higher-capacity mass storage devices, such as 8-inch floppy disks and Winchester disk systems. The following discussion briefly describes this capability. For complete information on all of the directory commands (CD, CHDIR, DIR, MD, MKDIR, PATH, RD, and RMDIR), refer to the MS-DOS documentation.

The concept of directories in MS-DOS version 2 is based on the concept of a tree, where the *root* of the tree is the foundation that supports the trunk and *branches* of that

tree. Likewise, the basic directory is referred to as the *root* directory that supports *branch* directories. These branch directories are treated as files which in turn support other branch directories and/or the actual data and program files on the disk. In other words, any directory, whether it is *a root* or *branch* directory, can support branch directories, data files, and programs.

In the case of your two distribution disks, disk #1 contains one additional directory file, identified in the directory as BIN, while disk #2 supports four additional directory files, identified as DEVEL, PSC, DEV, and CHR. In addition, the root directory of disk #1 supports four files, COMMAND.COM, ALTCHAR.SYS, AUTOEXEC.BAT, and CONFIG.SYS.

At this point in the discussion, you should have your computer turned on. Place your working copies of the two MS-DOS disks in drive A (disk #1) and B (disk #2). The default disk drive should be drive A.

Get the directory of drive A by entering the following.

DIR

Note that because the default drive is drive A, you did not have to specify the drive name in the command line you just entered. The computer should display something similar to the following.

```
Volume in drive A is 890-434-09
Directory of A:\

COMMAND   COM   16421    11-12-84    11:03a
ALTCHAR   SYS     432    4-04-84     3:18p
AUTOEXEC  BAT      23    4-04-84     2:36p
CONFIG    SYS      12    9-06-84     2:36p
BIN       <DIR>            11-12-84   12:02p
     5 File(s)         34816 bytes free
```

The command to change directories is CD or CHDIR, followed by the directory name (in this case, BIN). Enter the following command, which will change the directory in drive A.

```
CD BIN
```

Now get the directory of drive A by entering the following.

    DIR

Note that you did not use any special commands in the directory command line.   You had changed directories with the CD command.   The computer will display a directory similar to the following.

```
Volume in drive A is 890-434-09
Directory of A: \bin
```

		<DIR>	11-12-84	12:02p
		<DIR>	11-12-84	12:02p
EDLIN	COM	8080	4-04-84	1:48p
CHKDSK	COM	6468	4-04-84	1:47p
SYS	COM	922	4-04-84	1:49p
FORMAT	COM	13674	11-12-84	11:42a
CONFIGUR	COM	12031	11-12-84	11:47a
DISKCOPY	COM	15738	11-12-84	11:35a
DISKCOMP	COM	1917	11-12-84	11:39a
PRINT	COM	6288	10-31-84	12:52p
ASSIGN	COM	5214	11-12-84	11:37a
RECOVER	COM	2295	4-04-84	1:49p
SEARCH	COM	4338	11-12-84	11:43a
APPLY	COM	1945	10-31-84	1:17p
MORE	COM	4364	4-04-84	1:49p
CIPHER	COM	153	4-04-84	1:22p
FC	EXE	2585	4-04-84	1:50p
SORT	EXE	1632	4-04-84	1:46p
FIND	EXE	10624	11-03-83	1:47p
FONT	EXE	31396	11-12-84	11:31a
BACKUP	EXE	55354	11-12-84	11:22a
RESTORE	EXE	24840	11-12-84	11:27a
RDCPM	COM	3818	11-12-84	11:33a
ZDIR	COM	3372	6-01-84	2:58p
MAP	COM	3743	10-26-84	1:23p

```
         25 File(s)34816 bytes free
```

As you look over this directory listing, you will notice two additional directories. However, these are represented by periods and are called "dot" and "dot-dot." These are not actually files or directories, but are names that are held in this directory's first two locations. The dot-dot entry is a synonym for the parent of this directory (the root directory, in this case), while the dot entry refers to the directory itself, the current working directory.

Returning to the analogy of the tree, dot-dot refers to the branch or root of the tree from which the current directory grows. If you were climbing in an actual tree, moving to the branch named dot-dot would mean moving closer to the root of the tree.

You may change the directory to move closer to the root directory by entering the following command. In this case, since the BIN directory is the first branch away from the root, you will move back to the root directory.

CD ...

Now if you get the directory of drive A, you will see the original root directory.

In order to work with the files in any particular directory, you must move to that directory. However, certain commands, such as copy, allow you to work with one directory from another directory. Whenever you do this, you must know the directory path name to use. A complete description of how to use directory path names is provided in the MS-DOS documentation.

In the following paragraphs, you will be instructed to enter commands that affect the disk in drive B. However, you will be working from the disk in drive A (the default drive). Occasionally, you may forget to add the disk name to the command line and end up with results that are not represented in this discussion. If that happens to you, attempt to correct the problem by issuing the correct command sequence again.   If you still encounter difficulties, reset your computer and reboot your system with your working copies of MS-DOS disk #1 in drive A and MS-DOS disk 2 in drive B. Then return to this point in the discussion. (Don't forget to press the **RETURN** key at the end of each command line.)

Get the directory of drive B by entering the following command.

DIR B:

The computer will display something similar to the following:

```
Volume in drive B is 890-435-02
Directory of B:\

DEVEL   <DIR>            8-20-84      10:14a
PSC     <DIR>            8-20-84      10:14a
DEV     <DIR>            8-20-84      10:14a
CHR     <DIR>            8-20-84      10:14a
     4 File(s)          214016 bytes free
```

To change the directory on drive B to the DEVEL directory, enter the following command line.

CD B:DEVEL

Now you may get the directory of drive B by entering the following command line.

DIR B:

The computer will display the following.

```
Volume in drive B is 890-435-02 Directory of B: \devel

            <DIR>            8-20-84      10:14a
            <DIR>            8-20-84      10:14a
LINK     EXE     39952    4-13-84       9:07a
LIB      EXE     23168    5-23-84       9:08a
DEBUG    COM     12484    4-04-84       9:20a
EXE2BIN  EXE      1649    4-04-84       9:19a
     6 File(s)          214016 bytes free
```

Likewise, to return to the root directory, you would enter the following command line.

CD B:..

As you can see, to change to any directory, you must be at the root directory of the disk. Then enter the change directory command, followed by the name of the target directory (the directory you wish to access). If you are working with a disk in a drive other than the default disk drive, then you must precede the name of the directory with the disk drive name.

To get a feel of how to use the CD and DIR commands, place one or more of your disks in the computer and experiment with these commands. Refer to the MS-DOS documentation for a complete discussion on directory features.

ERASE (DEL)

There will be times when you have a file that you want to delete from a disk. If your MS-DOS disk had a file by the name of BADFILE.EXT, you would enter the following command line to delete it.

ERASE BADFILE.EXT

or:

ERASE B: BADFILE.EXT

You must use the drive name if the file you want to remove is not on the default drive. Likewise, if the file you want to remove is not on the root directory, you must change the directory to the proper one.

The command DEL may be used in place of the ERASE command. You would enter the following command line to delete BADFILE.EXT.

DEL BADFILE.EXT

or:

DEL B:BADFILE.EXT

RENAME (REN)

Occasionally, you will want to rename a file for one reason or another. To do this, you would enter a command line similar to the following.

RENAME NAMEOLD.EXT NAMENEW.EXT

or:

RENAME B: NAMEOLD.EXT=NAMENEW.EXT

These files do not exist on your MS-DOS disks, but if they did, the computer would take the file named NAMEOLD.EXT and rename it to NAMENEW.EXT. Note the use of the drive name. If the file you want to rename is on a drive other than the default drive, then the drive name must be used. Likewise, you must use the correct directory (see the discussion on multiple directories).

You may use either a space or the equals sign (=) between the two names.

An alternative command to RENAME is REN. It does the same thing and may be used interchangeably with the longer command.

TIME

The TIME command allows you to display and/or change the time that is currently stored in your computer. The command will be executed when you enter TIME and press the **RETURN** key. The computer will display the current time and prompt you for a new entry. If you press the **RETURN** key without making any entry, the computer will not make any change to the current time.

You will use the format H:M:S.C to enter the time, where H is hours (0 to 23), M is minutes (0 to 59), S is second (0 to 59), and C is tenths of a second (0 to 9). Minutes, seconds, and tenths of a second are optional and may be omitted. The separators, colon and period, must be used exactly as shown or else the following error message will be displayed.

Invalid time
Enter new time:

Some examples of valid entries and how they are stored in your computer follow:

Your entry:	Will be stored as:
9:15	9:15:00.00
9:15:30	9:15:30.00
9:15:30.5	9:15:30.50
14-2-3	14:02:03.00

TYPE

You can use the TYPE command to display the contents of a file on the screen. By using the CTRL-P function, described earlier, you may also make a permanent hard copy on your printer.

If you want to look at the file TEXTFILE.TXT, you would enter the following command line.

TYPE TEXTFILE.TXT

The computer would then display the contents of the file on the screen. if you would want to temporarily stop the display, you could use the CTRLS function, described earlier.

VER

The VER command allows you to see the version numbers of the two hidden MS-DOS system files. Occasionally, some versions of application software will require that you know what version of MS-DOS is being used. To use this command, enter the following command line.

VER

The computer will display a message similar to the following.

IO.SYS Version 2.20
MS-DOS Version 2.11

VERIFY

The VERIFY command will force your computer to automatically verify that any information that it has written to the disk is correct. This process, often called "read after write," will cause the computer to read the information it has just written to the disk and compare it against the material it had written. That way, if a defective or damaged disk is being used in the disk drive, you will know it because the computer will generate and display an error message, describing the problem.

To enable this feature, you would enter the following command line.

VERIFY ON

To disable this feature, you would enter the following command line.

VERIFY OFF

VOL

Under MS-DOS version 2, you may uniquely identify each disk when you format it. This procedure is explained later, when the FORMAT command is discussed in this chapter. A disk is identified as a "volume" and when you give it a name during the format procedure, explained later when the FORMAT command is discussed in this chapter, that name becomes the volume name.

The VOL command will cause the computer to display the volume name)f the disk in the specified or default disk drive. For instance, if you wanted to identify the disk in the default drive (drive A), you would enter the follow-ing command line.

VOL

The computer would then display the following.

Volume in drive A is 890-434-09

Likewise, if you wanted to identify the disk in a drive other than the default drive, you would enter a command similar to the following. In this example, the command line is requesting the volume name from the disk in drive B:

     VOL B:

The computer will respond with the following.

     Volume in drive B is 890-435-02

Remember that these examples are representative of MS-DOS disk #1 (in drive A) and MS-DOS disk #2 (in drive B). The actual volume name may not exactly match that which is on your disks.

Other Internal Commands

You will find more complete instructions and how to use the options of the internal MS-DOS commands in the MS-DOS documentation.

External Commands

External MS-DOS commands are actually separate programs. They are called commands because you execute them from MS-DOS in the same manner as an internal command. Because they are separate programs, you can (selectively) remove them from your disk with the ERASE command. Or, if you prefer, you can selectively copy them (with the COPY command) to a new bootable disk as described in Appendix L.

All external commands will appear on the directory listings of a disk. These programs are known as "utilities;" they are used for some common task, such as the FORMAT command, which is explained later in this chapter and illustrated in Appendix L.

The external commands included with MS-DOS are summarized in Table 2-3.

Table 2-3: External MS-DOS Commands (Utilities)

THE COMMAND: TELLS THE COMPUTER TO:

APPLY	Execute another command with a substitution.
ASSIGN	Assign a logical drive name to a Winchester partition.
BACKUP	Back up, or archive, one or more files.
CHKDSK	Check the directories of a disk and report the status.
CIPHER	Encrypt or decrypt a file using a keyword.
COMMAND	Make executive calls on resident commands.
CONFIGUR	Configure the system according to specific parameters.
DEBUG	Load and execute the system debugger.
DISKCOMP	Compare the contents of two disks to see if they are identical.
DISKCOPY	Duplicate the contents of one disk onto another.
EDLIN	Load and execute a line editor.
EXE2BIN	Convert an executable file (EXE) to a binary file (COM).
FC	Compare the contents of two files and list the differences.
FIND	Search for a specific string of text.
FONT	Load and execute the font editor or load an alternate character set.
FORMAT	Format a disk.
LIB	Load and execute the library utility.
LINK	Combine several object modules into one relocatable load module or run file.
MAP	Temporarily reassign disk drive names to other disk drives.
MORE	Display output one screen at a time.
PRINT	Print the contents of one or more files on the printer.
PSC	Print the contents of the screen on a printer.
RDCPM disk.	Copy the contents of a CP/M disk or file to an MS-DOS
RECOVER	Recovers specified file(s) that had previously been erased or deleted from a directory.
RESTORE	Restore one or more files from the files created with the BACKUP command.
SEARCH	Locate file(s) with the directory structure.
SORT	Sort a data file.
SYS	Transfer the current system files (IO.SYS and MSDOS.SYS) to the specified drive.

Only the most commonly-used commands are discussed in this manual. Those commands discussed here and the other external commands not discussed in this manual are explained in the MS-DOS documentation.

For the following discussions, place your MS-DOS disk #1 in drive A and boot the system (if it is not already booted) from this disk.

CHKDSK

This command lets you check your disks to make sure they are still usable and do not contain any bad areas. Also areas of the disk that have been "garbaged" (made unusable) by software can be recovered with this command.

You should use the command occasionally on all of your disks to verify that they have not been damaged. A number of error messages may be displayed, depending upon the condition of the disk. These are discussed in the MS-DOS documentation.

After the error messages are displayed (if any), the CHKDSK command will display a status report on the disk. To execute the CHKDSK command, you would enter the following command line.

CHKDSK

This will result in a display similar to the following.

Volume 890-434-09 created Nov 12, 1984 12:02p

```
322560   bytes total disk space
 32768   bytes in 3 hidden files
  1024   bytes in 1 directories
253952   bytes in 27 user files
 34816   bytes available on disk

262144   bytes total memory
220768   bytes free
```

In this report, you will see the volume name and creation date and time. Following that is an analysis of disk usage, which includes total disk space, disk space occupied by hidden files, disk space occupied by branch directories, disk space occupied by bad sectors (none are illustrated in this example since this disk contains no bad areas), disk space occupied by visible files (called user files), and the amount of remaining disk space. The system characteristics contain the total amount of memory in the system (this example is equivalent to a system with 256 kilobytes of memory) and the amount of free memory that is not used by MS-DOS.

The system reports three hidden files. Earlier in this chapter, you were told there were two hidden files on the disk: IO.SYS and MSDOS.SYS. The third file is a directory entry that is occupied by the name of the volume. Since this directory entry is not displayed as a visible file, it is considered by CHKDSK to be a hidden file.

If run CHKDSK on a formatted, but unnamed system disk, you would see the following report:

.   322560   bytes total disk space
.   32768   bytes in 2 hidden files
.   17408   bytes in 1 user files
.   272384   bytes available on disk

.   262144   bytes total memory
.   220768   bytes free

As you can see from this report, there are only two hidden files. Also missing is the volume name and creation date and time. Next, when you read about the FORMAT command, you will want to make a practice of naming each disk you create.

FORMAT

The FORMAT command is used in the backup procedure explained in Appendix L. As is explained in that text, FORMAT organizes your disks so they can receive files of data and programs. No check is made to see if the disk to be formatted contains data, so be sure that you know that the disk does not contain vital information.

This command also puts information in the area of the disk which normally holds the operation system. If you try to boot your computer with a disk that has only been formatted and does not contain an operating system, the following message will appear.

        No system

If you get this message, you will have to press both the CTRL and RESET keys at the same time to reset your computer. Then you can place a system disk in drive A and properly boot the system. Incidentally, the term "system disk" refers to any disk with the operating system on it.

When you use the FORMAT command to prepare system disks, you place the operating system on the new disk with a /S. The slash and letter are identified as a "switch," a term which is used to identify any combination of symbols and letters that modify a command. The switches for the FORMAT command are summarized in Table 2-4.

Table 2-4: FORMAT Switches

USE:	TO CAUSE FORMAT TO:
/A	Format 8-inch disks as single-sided, single-density
/C	Clear the directory only. Do not reformat the disk.
/M	Format only one side of the disk.
/N	Suppress all prompts. If you use this switch, you must place the disk in the disk drive before you execute the command.
/S	Record the operating system on the disk.
/V	Verify that each track and sector is usable and lock out any tracks and/or sectors that are not usable.
/9	Format the disk with nine sectors per track, increasing the disk capacity to approximately 360 kilobytes. The normal density is 8 sectors per track which results in disk capacities of about 320 kilobytes.

The switches which you will be using the most often are: /S to record the system files on the disk, /V to verify that the disk is good and to lock out any bad tracks or sectors, and /9 to increase the density of the disk to 9 sectors per track.

In this section, you will be shown two examples of how to use the FORMAT command. In the first example, the command line will cause the computer to format a data disk, one which contains no operation system. In the second example, you will format and produce a bootable system disk.

To format a data disk in drive B, enter the following command line.

FORMAT B:/V

To format a bootable system disk in drive B, enter the following command line.

FORMAT B:/V/S

In both cases, the computer will display a message similar to the following.

FORMAT version 2.20

Copyright(C) 1984, Zenith Data Systems Corporation

Insert new disk in drive B
and press RETURN when ready.

When a disk has been formatted that will have the operating system on it, you will see the following message on the screen.

System transferred

After the system has been recorded on the disk or, for a data disk, after it has been formatted, you will see the following prompt on your screen.

Enter desired volume label (11 characters, RETURN for none)?

This is the only place that you can assign a volume name to your disk. Remember that the volume name is displayed by the CHKDSK and VOL commands.

You may enter up to 11 characters, consisting of letters, numbers, spaces, underlines, and/or hyphens. All other characters are illegal and if you try to use one of them in your label, the computer will display the following error message.

Invalid characters in volume id
Enter desired volume label (11 characters, RETURN for none)?

It is a good idea to enter a volume name (label) that is similar to the label you prepare for the disk. However, be aware that 11 characters are a very limited number of characters that you can use for the name, so carefully plan what you want to enter.

Once a disk has had a name entered onto it, the only way the name can be changed is to reformat the disk.

After you have entered the volume name, the computer will then display a report on the amount of disk space used and available. For a system disk formatted with 8 sectors per track, the computer will display the following.

```
322560 bytes total disk space
50176 bytes used by system
272384 bytes available on disk
```

For a data disk formatted with 9 sectors per track, the computer will display the following.

```
362496 bytes total disk space
362496 bytes available on disk
```

Finally, the computer will prompt you with the following message. It is asking you if you want to format additional disks, using the same parameters (specifications) that you specified in the original command line.

Do you wish to format another disk (Y/N)?

Press the Y key if you wish to format another disk using the same disk drive and parameters that you specified in the command line. Otherwise, press the N key if you do not want to format another disk using the same drive or parameters. The computer will either prompt you to insert a new disk in the specified drive or return you to the MS-DOS prompt. Note that you do not have to press the RETURN key for this prompt.

SYS

From time to time, improvements and/or enhancements are made to the operating system. When this happens, you can use the SYS command to copy the new system onto your existing disks. Refer to your MS-DOS documentation when you need to use the SYS command.

DISKCOPY

The DISKCOPY utility is a program that, once loaded into your computer, will allow you to easily duplicate disks. It contains its own formatting routines, so the destination disks to not have to be previously formatted. However, no check is made to see if the destination disk contains data, so be sure that you know that the destination disk does not contain vital information.

The DISKCOPY program may be used with one switch, the /V. This switch adds a verification cycle to the disk duplication process, making sure that the destination disk matches the source disk.

To use the DISKCOPY program, enter the following command line.

> **DISKCOPY/V**

The computer will display a message similar to the following.

> DISKCOPY version 2.20
> Copyright(C) 1984 Zenith Data Systems Corporation
>
> Source drive name? (A-H) _.

Press the key that corresponds to the drive which will contain your source disk. The next prompt will be similar to the following.

> Destination drive name? (A-H) _.

Press the key that corresponds to the drive which will contain your destination disk. The computer will then display a message similar to the following,

indicating the source drive name and the destination drive name. For instance, if you pressed the A key for the source drive and the B key for the destination, the display would be similar to the following.

> Place the source disk in A and the destination disk in B.
>
> Press RETURN when ready.

NOTE: The DISKCOPY utility will not copy one disk size and type to another. It will only copy disks with identical specifications. In other words, you cannot use DISKCOPY to copy a 5.25-inch disk to an 8-inch disk or v ice versa. The same is true of the Winchester; you cannot copy to or from a Winchester partition using DISKCOPY.

Place your source and destination disks in their respective drives and press the **RETURN** key. The display will show the following messages as the destination disk is formatted, the source disk information copied to the destination disk, and the two verified.

> Formatting Destination...
> Copying...
> Verifying...

When this procedure is complete, you will be prompted with a message similar to the following.

> Do you wish to copy another disk (Y/N) ? <N>

If "you have another disk to duplicate, press the Y key and then the **RETURN** key. You will again be prompted to enter the names of the drives that you want to use.

If you do not have any other disks to duplicate, press the **RETURN** key. The computer will return to the MS-DOS prompt.

You may use the following command line as an alternative way to use DISKCOPY.

> DISKCOPY/V A: B:

In this command line, you are supplying the responses to the prompts as *parameters.* The source disk will be in drive A and the destination disk will be in drive B. The /V switch tells the computer to include the verify cycle in the procedure. You will see a message similar to the following in response to the command line.

DISKCOPY version 2.20
Copyright(C) 1984 Zenith Data Systems Corporation

Place the source disk in A and the destination disk in B. Press RETURN when ready.

When you have placed the appropriate disks in their respective drives, press the **RETURN** key to start the process. The computer will format, duplicate, and verify the disk as before. After the duplication process is completed, the computer will return to the MS-DOS prompt. The following represent the messages you will see during the process and at the end.

Formatting destination...
Copying...
Verifying... A>

DISKCOMP

Should you forget to use the /v switch in the DISKCOPY command line, DISKCOMP can be used to verify that the two disks are identical. Likewise, if you have two disks that you suspect might be identical, DISKCOMP provides a quick method to check them out.

To use DISKCOMP, enter the following command line.

DISKCOMP

The computer will display a message similar to the following.

> DISKCOMP version 2.20
> Copyright(C) 1984 Zenith Data Systems Corporation
>
> Source1 drive name? (A-H) _.

⌐ Press the letter that corresponds to the drive that you will use for one of the disks. The computer will display the following.

> Source2 drive name? (A-H) _.

⌐ Press the letter that corresponds to the drive that you will use for the other disk. If you used drive A for the Source1 drive and drive B for the other, the computer will display a message similar to the following.

> Place source1 disk in A and source2 disk in B Press RETURN when ready.

After you insert the disks into their respective drives and press the RETURN key, the computer will start comparing the two disks and display:

> Verifying...

If the two disks are not identical, the computer will display a message similar to the following.

> Disk verify failure
>
> Compare another? (Y/N) <N>

If the two disks are identical, the computer will prompt:

> Compare another? (Y/N) <N>

If you have more disks to compare, press the Y key. If you do not, press the **RETURN** key.

Other External MS-DOS Commands

You will use the CONFIGUR utility to set up your system for a printer, modem, or other input/output devices. The complete instructions are provided in Appendix F of this manual. They are also provided in the MS-DOS documentation.

MAP is used to route disk input/output according to drive name from one drive to another. Certain application packages require the use of the MAP command on Winchester systems.

CREF, DEBUG, EXE2BIN, EDLIN, LIB, and LINK are related to program development procedures. ASSIGN, BACKUP, and RESTORE are used with the Winchester disk system. APPLY, CIPHER, FC, FIND, FONT, MORE, PRINT, PSC, RDCPM, RECOVER, SEARCH, and SORT are used for the various purposes described in Table 2-3. Since these commands are usually not used on a day-to-day basis or for setting up a computer system, they are not discussed in this manual. You will find a complete discussion on these commands and the non-command files on your MSDOS disks in the MS-DOS documentation.

Computer Programming and BASIC

This chapter of the manual introduces you to program languages, programming, and BASIC. If you are familiar with these concepts, you may want to skip this chapter.

Programs

In everything we do, whether it is building a kit or driving a car, we use instructions. Computers also need instructions to operate. A program is a set of instructions that the computer can follow. Without instructions, a computer will only consume electricity, and will not calculate, display, or print information.

The following pages will introduce you to the concepts of writing computer programs. You will learn what a computer program is, what the different types of programs are, how to conceptualize and define a computer programming task, and how to translate that task into computer instructions in the BASIC programming language.

Program Types

There are many different types of programs. You have already used several: when you turned on the computer, when you loaded MS-DOS, and when you used the demonstration disk.

The first type of program you used is called a monitor, an elementary program used to get the computer started when it is first turned on. The computer's monitor program loaded the disk operating system from a disk. Then the monitor program turned control of the computer over to the operating system that was just loaded.

In the Z-100 computer, the operating system is oriented toward disk operation and manages the tasks of loading and storing application programs, utilities, and data files and provides for file maintenance. It has numerous built-in commands, such as COPY, RENAME, DIR, and TYPE. These were explained in the "Disk Operating System" chapter of this manual.

Some of the external commands you gave to MS-DOS (such as FORMAT) were actually separate programs, called utilities, that perform practical, often-needed jobs.   Many utilities exist in computing; most are associated with operating systems, such as those used and supplied with MS-DOS.

Programmers

A programmer conceives, plans, designs, writes, tests, and corrects programs. A basic programming skill is the ability to logically "think through" a problem in order to accomplish a given task. If you enjoy problem solving and have a natural ability for it, then you may enjoy programming. You can effectively use the tools of programming if you have the desire to learn.

Programming Languages

Just as individuals are capable of speaking different languages (such as English, Spanish, French, and so on), your computer is capable of using different programming languages. Some of these may be built around a particular computer and are referred to as being machine dependent. Other languages, such as BASIC, are more general and can be used on a large number of different computers.

Syntax

All languages, whether they are used by humans or computers, have rules of usage, called syntax.   In order to use a language to communicate effectively. you must understand and use these rules. Therefore, the syntax of a computer language must be followed very carefully; otherwise, the computer will not understand what you are trying to tell it. These rules sometimes vary slightly from one type of computer to another. While the basic elements of the language will remain the same, you will find slight variations in the way some parts are used.

Language Types

Refer to Figure 3-1 for the following discussion.

There are five different types of computer languages: machine languages, assembly languages, compilers, interpreters, and pseudo-compilers. The last three are usually referred to as high-level languages.

- Machine language - The only language a computer understands is called machine language. Machine language instructions are very detailed and are written in a numeric form so the computer can act upon them directly. All other language types must be translated (by special programs) into the machine language code in order for the computer to carry out your instructions.

- Assembly language - Assembly language is similar to machine language, except it is written using symbols, called mnemonics, that look like abbreviations of common English words. For example, you could use LD for load, AD for add, and so on. Since mnemonics cannot be used directly by a computer, they must be translated (or assembled) into machine language code by a program called an assembler.

- High-level languages - High-level languages are people-oriented. For example, you can direct your computer to do many things with *very* few instructions. Instead of detailing every step in machine language or assembly language, you may simply tell the computer to (for example) make D equal to 2 plus 3. The language you use will tell the computer how to do it and where to store the results.

While machine language and assembly languages are generally not known by a unique name, most high-level languages are. The names of the most common languages are BASIC, COBOL, and FORTRAN. These names (and those of most high-level languages) are formed from the first letter or letters of a series of words that describe the language. Examples of how the names of these common high-level languages are formed are shown in Table 3-1.

Table 3-1: Sources of Some High-Level Language Names

LANGUAGE NAME	SOURCE OF NAME (MEANING)
BASIC	Beginner's All-purpose Symbolic Instruction Code
COBOL	COmmon Business Oriented Language
FORTRAN	FORmula TRANslator

Other languages, such as Pascal, are named after people associated with the computer industry. Still others, such as Forth, have no such roots, but come from a term applied during the creation of the language.

High-level languages must also be converted into machine language code. This can be done by using one of the three processes shown in Figure 3-1: compile, interpret, or both compile and interpret (pseudo-compile).

- Compiler - A compiler will take your instructions and compile them into machine language instructions. This may produce a certain amount of duplication in the machine language code to handle common functions. The result is a machine language program that will usually be executed more slowly than a machine language or assembly language program that does the same thing. FORTRAN and COBOL are two examples of languages that are usually compiled.

- Interpreter - An interpreter works somewhat differently. Unlike the compiler, no translation takes place. Instead, the interpreter (which is a program itself) analyzes your instructions one by one and then it (the interpreter) completes the operation. Interpreters are usually much slower than compilers for two main reasons: the interpreter analyzes each instruction each time it is executed and the analysis itself usually takes longer than the execution. However, because there is no compilation step (as in the case of compilers), programs may be written and tested much easier. Several versions of BASIC for the Z-100 are interpreters. (A version of BASIC is also available as a compiler.)

- Pseudo-compiler - A pseudo-compiler does not compile your instructions into machine code, but into a compact intermediate object code. This code is then interpreted by a run-time program that will provide the necessary machine instructions to complete the operation. The run-time program executes the intermediate code in a manner similar to that of an interpreter and, as a result, runs slower than a true compiler.

The two advantages are mainly size (the intermediate code is compact when compared to the resulting machine code of a true compiler) and transportability (the intermediate code is machine independent and highly transportable). The UCSD Pascal P-code compiler and CBASIC are two examples of pseudo-compilers.

HIGH-LEVEL LANGUAGES

MACHINE LANGUAGE	ASSEMBLY LANGUAGE	COMPILERS	INTERPRETERS	PSEUDO-COMPILERS
		ENGLISH CODE	ENGLISH CODE	ENGLISH CODE
		COMPILER		COMPILER
	MNEMONICS			INTERMEDIATE CODE
			INTERPRETER	
	ASSEMBLER			RUN-TIME PROGRAM
		MACHINE CODE		
MACHINE CODE	MACHINE CODE			
			MACHINE INSTRUCTIONS	MACHINE INSTRUCTIONS
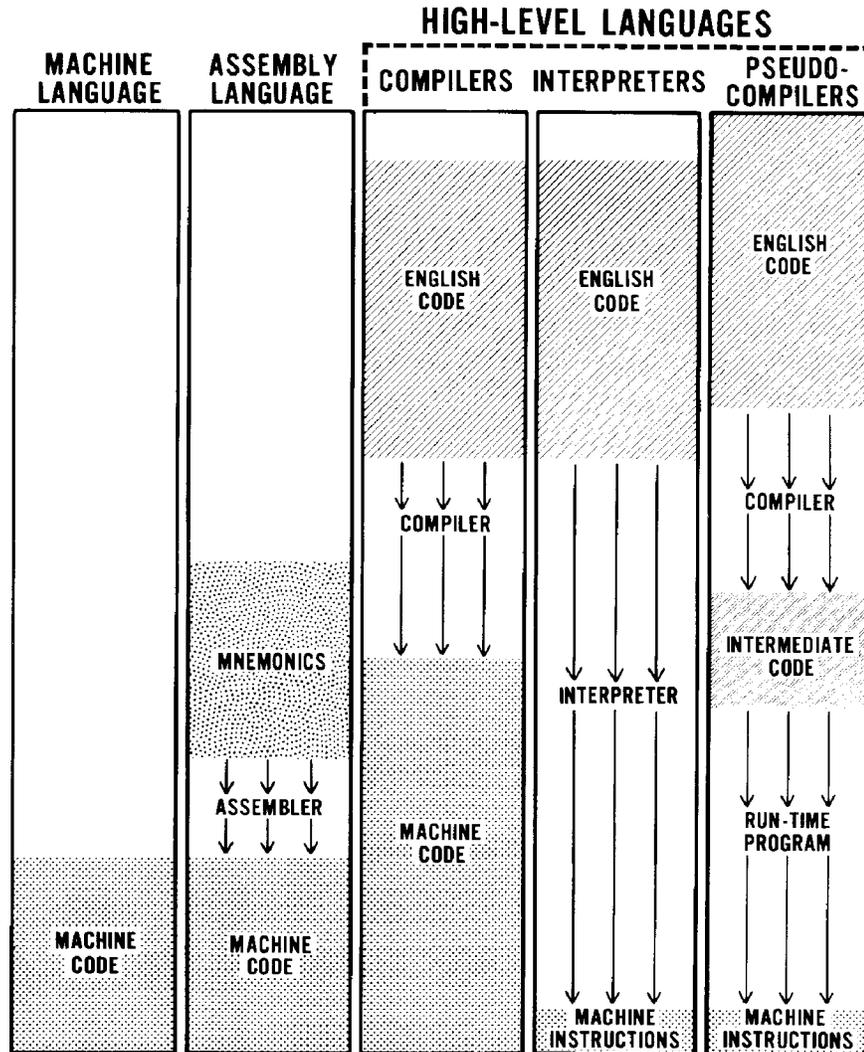
Figure 3-1:   A Comparison of Language Types

Understanding BASIC

BASIC is a high-level computer programming language specifically designed for people with no previous programming experience. The elements of the language were carefully chosen to make them easy to learn, use, and remember. Program commands use ordinary English words - PRINT, and GOTO (the words "go" and "to" are combined) - while numerical calc-ulations are written in a form much like that of simple algebra.

The original BASIC, developed in the 1960's at Dartmouth College, quickly grew to become one of the most popular of all computer languages because it is so easy to learn. Only COBOL, because of the established number of users, including financial and government institutions, is more widely used. BASIC is available as an interpreter, compiler, and pseudocompiler. Three versions (BASIC-80, Z-BASIC, and GW-BASIC) for the Z-100 computer are interpreters. In the following discussion, either ZBASIC or GW-BASIC may be used with MS-DOS. BASIC-80 must be used with CP/M-85, which is not covered in this manual.

Getting Started with BASIC

While you can run BASIC directly from your distribution disk, we recommend that you prepare a working disk and use it instead. The instructions in Appendix L will tell you how to build an elementary working MS-DOS disk. Take one of the disks that you developed using the procedure there and copy your version of BASIC to your new disk. This process needs only to be done once since you can then duplicate the working disk as many times as you wish with the DISKCOPY command of MS-DOS.

To create a working disk with Z-BASIC or GW-BASIC on it, follow these steps:

⌐ Create an MS-DOS working disk as outlined in Appendix L.

⌐ Label this disk as "working BASIC disk #1."

⌐ Place working BASIC disk #1 in drive A.

⌐ Place your BASIC (either Z-BASIC or GW-BASIC) distribution disk in drive B.

⌐ Enter the following command line.

    COPY B:*.* A:

Don't forget to press the **RETURN** key. The computer will display each file as it is transferred and give you a total count of all files moved to your BASIC disk.

⌐ When the MS-DOS prompt is displayed on your screen, remove the distribution disk from drive B and put it in a safe place.

⌐ If you want to make extra copies of your working disk, do so now by using the DISKCOPY command as shown in the "Disk Operating System" chapter of this manual.

Loading BASIC

Because you may have either Z-BASIC or GW-BASIC, you need to be aware that these versions of BASIC load differently.

⌐ With a working copy of BASIC in drive A, follow the instructions in step 1 for Z-BASIC or the instructions in step 2 for GW-BASIC.

Step 1 - To load Z-BASIC, enter the following command line into your computer.

    BASIC

Step 2 - To load GW-BASIC, enter the following command line into your computer.

    BASICA

Press the **RETURN** key. The screen will clear and a message similar to one of the two following will appear.

Z-BASIC Rev. 1.0

[Z-D0S/MSDOS Version]
Copyright 1982 (C) by Microsoft
Created: 01-Oct-82
xxxxx Bytes free
Ok

GW-BASIC 2.00
(C) Copyright Microsoft 1983,1984
Zenith Version 2.00
(C) Copyright Zenith Data Systems 1984
xxxxx Bytes free
OK

The xxxxx in the message will be replaced by a number which tells you how many bytes are available for your BASIC programs. The Ok on the last line is the BASIC prompt. It has replaced the A> prompt of MS-DOS.

BASIC Modes of Operation

BASIC has two modes of operation: the direct mode and the indirect mode. Whenever BASIC is waiting to go into one of the two modes, or waiting to run a program, the screen will display the Ok prompt.

- In the direct mode, you may enter instructions without line numbers. Then, when you press the RETURN key, the instruction is interpreted and executed immediately. While the results of arithmetic and logical operations may be displayed and/or stored for later use, the instructions themselves are gone and will not be executed again unless you re-enter them.

- In the indirect mode, you enter instructions with line numbers. The instructions are not executed when you press the RETURN key, but are stored as a program (or part of a program) so that you may use them as often as you need them.

Statements

The BASIC language contains a large number of instructions, called statements. Each statement is an English word, abbreviation, or contraction (without punctuation), that tells the computer to do something. In this manual you will learn how to use several of these statements in the direct mode, and then you will be taught how to use these same instructions in a short, practical loan payback (amortization) program.

NOTE: Whenever you are instructed to enter a line of BASIC into your computer, press the **RETURN** key to complete the line.

Direct Mode Operation

With BASIC (either version) loaded into your computer, you are now ready to learn to use several BASIC statements. For each statement, you will see several examples. Try them and any others you may think of. You cannot harm your computer by making mistakes at the keyboard. If you do make a mistake, the computer simply will stop and display an error message, such as the following.

```
Syntax error
```

This tells you that you either entered your instruction(s) incorrectly or did something else wrong. Go back and try an example or two from this manual that is similar to your attempt. Carefully check to see how your attempt differs from those shown in this chapter. You should be able to locate the difference in syntax that is causing you the difficulty.

There is the remote possibility that some other error message will appear. If it does, refer to your BASIC documentation for more information.

Whenever you want to put information on the display of your computer, you will use some form of the PRINT statement. Enter the following BASIC line into your computer.

```
PRINT "HELLO, I AM YOUR Z-100 COMPUTER."
```

When you pressed the RETURN key, you computer displayed (or printed) the message between the quotation marks on the screen. You will use the PRINT statement whenever you want to display a message or answer on the video screen. It has two common forms:

    PRINT
    PRINT data

A PRINT statement without data will cause your computer to space one line. Otherwise, the data will be printed.

The data could be (try the following):

1.   A message enclosed by quote marks.

    PRINT "HELLO, WHAT IS YOUR NAME?"

2.   The result of a calculation.

    PRINT 2*3+6

3.   Information previously stored in memory.

    A=4/7 PRINT A

4.   Or, a combination of 1, 2, and 3.

    PRINT "2 times 3 plus 6 is equal to "; 2*3+6 PRINT "While 4 divided by 7 is ";A;"."

NOTE: If the result of the last print statement is 0, then type the following and then try the print statement again:

    A= 4/7

Variables

The previous statement assigns the result of the calculation to a memory location represented by the letter A (called a variable). Data contained within quotation marks are called constants because they are never changed by the computer. Variables are called such because the value contained in a variable can be varied by a computer program or command.

A variable is a symbol, usually represented by one or two letters or a letter and a number, although BASIC can recognize variable names up to 40 letters and numbers long (as long as the first character is a letter). This symbol is used to represent a memory storage location in your computer. The BASIC language will take care of placing variable values in memory and will keep track of where they are located.

Variable Types

BASIC will recognize four types of variables: integer numbers, single-precision (up to seven significant digits) numbers, double-precision (up to sixteen significant digits) numbers, and string variables (a string variable will store alphabetic and numeric information).

In addition, each is represented by its own symbol. String variables (or "strings" for short) are represented by the dollar sign ($), as in A$, A1$, BH$, and so on. Numeric variables use the percent sign (%) for integers, the exclamation point (!) for single-precision, and the number sign (#) for double-precision. Any variable without a declaration symbol (%, !, or #) will automatically be assigned as a single-precision variable.

Try the following combinations of assignment statements and PRINT statements.

```
PRINT "HELLO, WHAT IS YOUR NAME?"
B$=" (put your name here instead of this message)"
PRINT "HELLO, ";B$;". HOW ARE YOU?"
```

Programming in BASIC

As you know, a program in BASIC is a series of instructions. Up until flow, you have been giving your computer instructions directly. Now you are ready to program your computer and learn some more BASIC statements.

A good place to start is to program your computer to accept and store your name in memory. You will use the same BASIC statements as you cud earlier, but will make some changes so you can enter the information from the keyboard.

In order for the computer to keep track of its place in the program, BASIC requires line numbers to be used. This way, you also tell your computer the sequence that you want it to use when it executes your instructions (program).

Using the Indirect Mode of BASIC

When you enter the following BASIC lines, you will notice that your computer will not execute the instructions when your press the RETURN key. This is because you are now in the indirect mode of BASIC. The lines are stored in memory and will be used as a program when you tell your computer to execute or run it.

Enter the following lines.

```
10 PRINT "HELLO, WHAT IS YOUR NAME"
20 INPUT A$
30 PRINT "HELLO, ";A$;". HOW ARE YOU";
40 INPUT B$
50 PRINT "I FEEL THAT WAY, TOO." 0 END
```

As you entered these lines, you may have noticed the INPUT statement. This statement allows you to enter information from the keyboard and tells your computer to store it in the variable (A$ or B$). When you run this program, you won't have to use quote marks, because you told your computer that you will enter a string of alpha and/or numeric characters by using the $ declaration symbol with the variable name).

The END statement tells your computer that it has come to the end of the program. It is an optional statement that may also be used (as needed) in the middle of a program.

Now try your program by entering the following direct command.

      RUN

The RUN command tells your computer to execute the program that is stored in memory. The questions that are displayed (or "printed") on the screen are your creation. Any time you see a question of this nature, it is called an operator prompt. By generously using operator prompts, your program can become very "user friendly." In addition, important data will not be overlooked or get put in the wrong spot. Later in this chapter, you will use operator prompts to obtain entries for your amortization program.

Answer the questions as they are displayed (or printed) on your computer's video screen.

If you want to look at your program so far, enter the following command.

      LIST

The LIST statement tells your computer to display the program on your video screen. If you want to look at a particular line, such as line 20, you would enter the following command.

      LIST 20

If you want to look at a range of lines, such as line 20 to line 40, you would enter the following command.

      LIST 20-40

Be sure to place a space between the statement and the line number, or a syntax error will occur. The reason for the syntax error is that many BASIC statements and commands must not be run together, or the interpreter would not understand them.

Saving and Loading Programs

When you turn your computer off, it will "forget" your program. However, you can save the program for later use. Then you won't have to re-enter it into the computer each time you want to use it.

The general form of the SAVE statement is: SAVE "filename"

For your program, call it "MYPROG" and save it by entering the following command.

        SAVE "MYPROG"

The SAVE command will record ("write") your program on the disk in the default drive. BASIC will also record the name of the program on the directory. To find out if the program is really recorded on the disk, enter the following command.

        FILES

This command will read the directory of the disk in the default drive and list the name of each file on the screen.

Later, when you want to use your program, you can load it from disk into your computer's memory with the LOAD command. The general form

        LOAD "filename"

To load your program, enter the following command.

        LOAD "MYPROG"

The computer will respond by checking the directory for your program. When it finds it, BASIC will load your program into memory and display the following prompt.

        Ok

However, if your program is not found in the directory (because it is not on the disk), your computer will respond with the following message.

File not found

This tells you that your program is not on that disk, or that your program was saved under a different name. You can either use the FILES statement to get a listing of the directory or go back to MS-DOS by entering the following command.

SYSTEM

This will return you to MS-DOS (and display the MS-DOS prompt). Now you can get a listing of your disk's directory and find your program. You will notice that a . BAS extension has been added to the program name and that the date and time you saved your program has been recorded with the directory information.

To go back to BASIC, enter the appropriate command: ZBASIC to load Z-BASIC, or BASICA to load GW-BASIC.

Again, as explained earlier in this chapter, the screen will clear and the opening BASIC information presented as before. BASIC is now ready to accept a program from the keyboard or from disk. Try loading your BASIC program, "MYPROG" and running it with the following command.

RUN "MYPROG"

The RUN command not only will run the current program in memory, but if a program name is placed behind it, it will clear out any previous program, load the one from disk, and execute it. The results are the same as if you had entered the following two commands.

LOAD "MYPROG" RUN

Designing a Program

Now that you have entered a program into your computer and run it, you are ready to design a program from scratch.

Designing a program takes quite a bit of forethought and consideration. The example that you will try on the next few pages will demonstrate the steps needed to design and successfully write a program. The five steps of program design are:

1. Program purpose - State the purpose of your program and define any unknown terms.

2. Breakdown - Break the purposes down into more detail and define any additional unknown terms.

3. Detailed steps - Isolate and state each step necessary to accomplish each stated purpose.

4. Conversion - Convert each step into one or more BASIC program lines. These lines may be entered into your computer as they are converted or written down on paper for entering later.

5. Testing - Using a set of known values, compute the results with a calculator or on paper and test your program. If your program produces the same results as you got with a calculator or on paper, then you know your program will work under those same conditions.

As an assignment, design an amortization (loan payment) table program. The following describes how you would perform each previously outlined

Program Purpose

For this step, you would state: "Compute and display a mortgage (loan) amortization table. An amortization table shows each payment, the amount .icing to interest, the amount paid on the principal, and the new balance. It is (usually) based on an even number of payments per year."

Notice that an amortization table was defined and its contents listed in this step.

Breakdown

For the second step, you would state: "Given the yearly rate of interest, beginning balance, and amount of each payment, produce an amortization schedule for monthly payments. An amortization schedule is a table as explained in step 1."

Detailed Steps

Now list each step needed to accomplish the task. This is where you must think through each logical step. Notice in the following list, you actually are thinking of what must be done with the computer.

- Enter the beginning amount.

- Enter the monthly payment.

- Enter the annual interest rate.

- Test the annual interest rate. If it is greater than or equal to one, divide by one hundred to convert it to a decimal form. If it is less than one, then assume it is already in the proper decimal form.

- Compute the monthly interest rate (divide the annual interest rate by 12).

- Test the monthly payment. Calculate the first interest payment. If the monthly payment is less than the first interest payment, then print an error message and start over. (If the monthly payment is greater than the first interest payment, then the payments will eventually pay off the principal. No error will occur and the program may continue.)

- Print the headings: Payment #, Payment, Interest, Principal, and Balance.

- Make the payment counter (number) equal to one.

- Start the payment loop.

Calculate the interest (monthly interest rate times principal).

- Calculate the principal payment (payment minus interest).

- Calculate the new balance (principal minus principal payment).

- Test the new balance. If the new balance is negative or equal to zero (if this is true, the principal has been paid), then go to the steps at the end of the program. Otherwise, continue the program.

- Print the amounts: Payment #, Payment, Interest, Principal Payment, and New Balance.

- Add one to the payment counter.

- Go back to the beginning of the "start payment" loop.

- The end-of-program steps start here.

- Subtract the overpayment (if any) from the payment. (At this point, the new balance will reflect the amount of overpayment as a negative number. This can be added to the payment, effectively subtracting the overpayment.)

- Subtract the overpayment from the principal payment. (Again, the new balance will reflect the overpayment as a negative amount and therefore can be added to the principal payment.)

- Make the new balance equal to zero.

- Print the amounts: Payment #, Payment, Interest, Principal Payment, and New Balance.

- End of the program.

Conversion

Before you start entering the program, you want to make sure your computer's memory is clear of any previous program (like the program you named "MYPROG"). To clear the memory of your computer, and prepare it for a new program enter the following command.

        NEW

This statement is executed in the direct mode and clears out any previously stored program or data that was in memory. It does not affect any files or programs that may be stored on the disk. Your computer is now ready for your new program.

 It is nice for the operator to see a message explaining what data you want entered into your program. Therefore, operator prompts have been added to your program in the appropriate steps.

- Enter the beginning amount.

        10 PRINT "ENTER THE BEGINNING PRINCIPAL";

        20 INPUT BP

- Enter the monthly payment.

        30 PRINT "ENTER THE MONTHLY PAYMENT";

        40 INPUT MP

- Enter the annual interest rate.

        50 PRINT "ENTER THE ANNUAL INTEREST RATE";

        60 INPUT AIR

- Test the annual interest rate. If it is greater than or equal to one, divide by one hundred to convert it to a decimal form. If it is less than one, then assume it is already in the proper decimal form.

        70 IF AIR>=1 THEN AIR=AIR/100

- Compute the monthly interest rate (divide the annual interest rate by 12)

      80 MIR=AIR/12

- Test the monthly payment. Calculate the first interest payment. If the monthly payment is less than the first interest payment, then print an error message and start over. (If the monthly payment is greater than the first interest payment, then the payments will eventually pay off the principal. No error will occur and the program may continue.)

      90 FIP=BP*MIR
      100 IF MP<FIP THEN PRINT "PAYMENT IS TOO LOW" : GOTO 10

- Print the headings: Payment #, Payment, Interest, Principal, and Balance.

      110 PRINT "PAYMENT # PAYMENT INTEREST PRINCIPAL
      BALANCE"

- Make the payment counter (number) equal to one.

      120 PC=1

- Start the payment loop.

- Calculate the interest (monthly interest rate times principal).

      130 I=MIR*BP
      140 I=INT(I*100+. 5) /100

- Calculate the principal payment (payment minus interest).

      150 PP=MP-1

- Calculate the new balance (principal minus principal payment).

      160 NB-BP-PP
      170 BP=NB

- Test the new balance. If the new balance is negative or equal to zero (if this is true, the principal has been paid), then go to the steps at the end of the program. Otherwise, continue the program.

      180 IF NB=<0 THEN GOTO 220

- Print the amounts: Payment #, Payment, Interest, Principal Payment, and New Balance.

      190 PRINT PC,MP,I,PP,NB

- Add one to the payment counter.

      200 PC=PC+1

- Go back to the beginning of the "start payment" loop.

      210 GOTO 130

- The end-of-program steps start here.

- Subtract the overpayment (if any) from the payment. (At this point, the new balance will reflect the amount of overpayment as a negative number. This can be added to the payment, effectively subtracting the overpayment.)

      220 MP=MP+NB

- Subtract the overpayment from the principal payment. (Again, the new balance will reflect the overpayment as a negative amount and therefore can be added to the principal payment.)

      230 PP=PP+NB

- Make the new balance equal to zero.

      240 NB=0

- Print the amounts: Payment #, Payment, Interest, Principal Payment, and New Balance.

  25O PRINT PC, MP, I, **PP, NB**

End of the program.

  260 END

Here are a number of explanations for various statements you find in the program.

- Line 70 - This is the first of several similar statements in your program. It is an IF ... THEN statement; it allows your computer to make a decision based on a comparison. In this case, the variable AIR contains the annual interest rate, which needs to be expressed as a decimal number for your program to function properly. If the number is greater than or equal to one, then the number is not a decimal number and needs to be divided by 100 to come up with the proper amount (i.e., 12%=.12).

- Line 100 - This is the next IF ... THEN statement. The test is relatively simple: If the monthly payment (MP) is less than the first interest payment (FIP), then the interest will not be paid and the loan will never be paid off. Since this condition needs to be conveyed to the operator as a message, the PRINT statement is executed. However, you also need to return to the beginning of the program for new entries. Two ways are open to you:

    1. Stop the program with an END statement. Force the operator to start over by entering the RUN command in direct mode.
    2. Return program control to the beginning of the program with a GOTH statement.

The second method is preferred, but the problem with either is how to execute more than one statement on a program line. The answer is the colon (:), which is used to separate BASIC statements. In the case of line 100, the message will be displayed and then the GOTO statement executed.

The GOTO statement tells the computer to transfer execution to the line specified rather than continue with the next sequentially numbered line.

- Line 140 - This line represents a standard used to round off to the nearest penny. The amount (represented here by the variable I) is first multiplied by 100 (to move the decimal point right two places) and then .5 is added to the result (to round off the next digit). Then the greatest integer is taken (by using the BASIC math function, INT), which will truncate (or eliminate) the fractional part of the number. The result is then divided by 100 to return the answer to two places.

- Line 180 - This is the third and last IF ... THEN test. In this line, instead of executing some kind of statement, as in line 70, a GOTO statement sends execution of the program to line 220. Incidentally, the GOTO statement may be omitted and BASIC will automatically assume that you want control transferred to the specified line. The line without the GOTO statement looks like this:

```
180 IF NB= <0 THEN 220
```

- Lines 190 and 250 - Here the comma is used between the variable names as both separators and to space the answers. Whenever a comma is used, the cursor position goes to the next tab position (every eighth column).

- Lines 220 and 230 - These two lines may be slightly confusing as both add a negative number to accomplish a subtraction. This is a form of elementary algebra which your computer uses in its math.

When you run this program, you will find that some of the numbers don't end up expressed as cents as they should. The information in Table 3-2 will give you an idea of some of the answers you could expect to see printed on your screen.

Table 3-2: Sample Output from BASIC

YOUR ANSWER:	WILL PRINT AS:
15.00	15
6.50	6.5
75.12	75.12
.10	.1

The solution to this problem is found in the form of a special PRINT statement. It is very complex, far beyond the scope of this discussion. So that you can see that it can be solved, enter the following three lines exactly as they appear.

```
5 A$="  ###    $#,###.##   $#,###.## $#,###.## $#,###.##"
190 PRINT USING A$;PC;MP;I;PP;NB
250 PRINT USING A$;PC;MP;I;PP;NB
```

Now run the program. If you get an error message, go back and carefully examine each of the three lines. Refer to your BASIC documentation for full details concerning the use of PRINT USING.

When you are satisfied with the operation of your program, save it on disk for use whenever you want to generate an amortization, or payment, table.

Here is a complete listing of the program that you finished entering. It does not contain any of the comments and should be identical to the display you see when you enter LIST and press the **RETURN** key.

```
5 A$=" ###     $#, ###. ## $#, ###. ## $#, ###. ## $#,###.##"
10 PRINT "ENTER THE BEGINNING PRINCIPAL";
20 INPUT BP
30 PRINT "ENTER THE MONTHLY PAYMENT";
40 INPUT MP
50 PRINT "ENTER THE ANNUAL INTEREST RATE"; 60 INPUT AIR
70 IF AIR>=1 THEN AIR=AIR/100
80 MIR=AIR/12
90 FIP=BP*MIR
100 IF MP<FIP THEN PRINT "PAYMENT IS TOO LOW" : GOTO 10
110 PRINT "PAYMENT # PAYMENT INTEREST PRINCIPAL BALANCE"
120 PC=1
130 I=MIR*BP
140 I=INT(1*100+.5) /100 150 PP=MP-1 160 NB-BP-PP
170 BP=NB
180 IF NB=<0 THEN GOTO 220
190 PRINT USING A$;PC;MP;I;PP;NB 200 PC=PC+I
210 GOTO 130 220 MP=MP+NB 230 PP=PP+NB 240 NB=0
250 PRINT USING A$;PC;MP;I;PP;NB 260 END
```

Summary

This chapter of computer programming and BASIC has told you about:

- Program types: the monitor program, the operating system, and utilities.
- What a programmer does.
- Programming languages and syntax.
- Creating a working BASIC disk.
- Loading BASIC.
- The two modes of BASIC and how to use them.
- Entering, listing, saving, loading, and running your own BASIC program.
- Designing your own BASIC program from scratch.

As you start running BASIC programs and continue to learn more about programming, use your BASIC documentation. In there you will find more information and alternate methods to those shown in this manual.

We hope this chapter has helped you learn a little about programming. Your demonstration disk was written in Z-BASIC and has some very powerful "routines" that you can use directly or in your programs. More information about some of the special features of Z-BASIC, GW-BASIC, and the demonstration programs will be found in Appendix K.

Good programming!

A Glossary of Commonly-Used Computer Terms

This appendix is a short glossary of the commonly-used computer terms that you may encounter while working with the Z-1 00 Computer.

Acoustic coupler (Modem) – One of the two types of modems: a device you can connect between a standard telephone handset and a computer to communicate with other computers. A modem will translate the normal digital signals of the computer into tones that are transmitted over standard telephone lines and will translate the received tones back into digital signals. By using an acoustic coupler modem, you can use any telephone with a standard handset on a temporary basis and avoid a permanent connection to the telephone lines. *See* Modem; and Direct-Connect Modem.

Acronym – A word formed from letters found in a name, term, or phrase. For example, FORTRAN is formed from the words FORmula TRANslator,

Address -- The label, name, or number identifying a register, location or unit where data is stored. In most cases, address refers to a location in computer memory.

Algorithm – A defined set of instructions that will lead to the logical conclusion of a task.

Alpha – The letters of the English alphabet.

Alphanumeric -- Letters, numbers, punctuation, and symbols used to represent information or data.

ALU – Arithmetic Logic Unit. This section of the computer performs the arithmetic, logical, and comparative functions of an operation.

ANSI -- American National Standards Institute. This organization publishes standards used by many industries, including the computer industry. Most noted are those standards established for computer languages such as FORTRAN and COBOL.

Application --- A system, problem or 'ask to which a computer has been assigned.

Application program – A program or set of programs designed to accomplish a specific task such as word processing.

Argument – A term used to describe a value in a variable, statement, command, or element of an array or matrix table.

Array – A series of items arranged in a pattern. In computing, this term is used to describe a table with one or more dimensions.

Artificial intelligence – A term used to describe the capability of a machine that can perform functions normally associated with human intelligence: reasoning, creativity, and self-improvement.

ASCII – American Standard Code for Information Interchange. A code used by most computers, including those sold by Zenith Data Systems. €t is the industry standard used to transmit information to printers, other computers, and other peripheral devices. The most notable exception is some IBM equipment which uses EBCDIC code. *See* EBCDIC.

Assemble – A term that means to prepare a machine-usable code from a symbolic code.

Assembler – A computer program used to assemble machine code from symbolic code.

Assembly language – A computer programming language that is machine-oriented and makes use of mnemonics for instructions, operands, and pseudo-operations.

Asynchronous – A mode of operation where the next command is started and stopped by special signals. In communication, the signals are referred to as start and stop bits. *See* Synchronous.

Backup – A disk copy of data and/or programs that is retained in case the original is damaged or destroyed.

BASIC – Beginner's All-purpose Symbolic Instruction Code. An easilylearned programming language consisting largely of English words and terms.

Batch processing – An operation where large amounts of data is processed by a computer with little or no operator supervision. *See* Interactive processing.

Baud rate – The rate at which information is transmitted serially from a computer. The baud rate is expressed in bits per second.

BCD – Binary Coded Decimal. The method of encoding four bits of computer memory into a binary representation of one decimal digit (number).

Binary – A numbering system with a base of two rather than ten (decimal). *See* bit.

Bit – 1. A single binary element or digit. 2. The smallest element in computer memory.

Bit density – A measure of the number of bits recorded in a given area.

Block diagram – 1. A graphic representation of the logical flow of operations in a computer program, usually more general than a flowchart. 2. A graphic representation of the electronic configuration of computer hardware and/or peripherals.

Board – A printed circuit board assembly that mounts onto the physical chassis of a computer, peripheral, or other device. Other cards (assemblies) may or may not be "plugged" into this board. *See* Card.

Boolean algebra – A symbolic system (algebra) named after its developer, George Boole. It is concerned with computer and binary processes and includes logical operators.

Boot – The process of initializing (or loading) a computer operating system. Also referred to as "booting up."

Bootstrap – A program used by a computer to initialize (or load) the operating system of the computer.

Branch – To depart from the sequential flow of an operation as the result of a decision.

Break – The process of interrupting and (usually halting temporarily) a sequence of operations, as in a computer program.

Buffer – An auxiliary storage area for data. Many peripherals have buffers which are used to temporarily store data that the peripheral will use as time permits.

Bug – A term that is widely used to describe the cause of a computer misoperation. The "bug" may be either in the hardware design or in the software (programs) used by the computer.

Bus – A circuit or line used to carry data or power between two or more locations. The S-100 bus, used in the Z-100 Computer, is composed of one hundred separate bus lines.

Byte – A term used to describe a number of consecutive bits. In microcomputers, a byte usually refers to eight bits and is used to represent one ASCII or EBCDIC character.

Cable – An assembly of one or more conductors used to transmit power or data from a source to a destination and, in some cases, vice versa.

Card – A printed circuit board assembly that "plugs" into another card or board and is (usually) held in place by an assembly called a "card cage." *See* Board.

Centronics-type interface – A parallel printer interface which has become accepted as "quasi-standard" through common usage by a number of manufacturers. *See* Parallel; Printer; and Interface.

Character – A letter, number, punctuation, operation symbol, or any other single symbol that a computer may read, store, or process.

Checksum – A method of checking the accuracy of characters transmitted, manipulated, or stored. The checksum is the result of the summation of all the digits involved.

Chip – The term applied to an integrated circuit that contains many electronic circuits. A chip is sometimes called an IC or an IC chip. The name occasionally applied to the entire integrated circuit package.

Circuit – A system of electronic elements and connections through which current flows.

Class A – One of two classes established for computers by the Federal Communications Commission regulating the allowable amount of radio frequency interference (RFI) radiation. At one time class A type computers referred to personal computers installed in commercial environments. *See* Class B.

Class B – One of two classes established for computers by the Federal Communications Commission regulating the allowable amount of radio frequency interference (RFI) radiation. At one time class B type computers referred to personal computers designed for home or residential use. Now all personal computers must meet class B requirements. *See* Class A.

COBOL – COmmon Business Oriented Language. This common highlevel language is used in a wide number of applications, most notably those dealing with financial transactions.

Code – A method of representing data in some form, as in an ASCII or EBCDIC form.

Command – A code that represents an instruction for the computer.

Communication – The process of transferring information from one point to another.

Compile – The process of producing machine code or pseudo-operational code from a higher level code or language, such as COBOL or FORTRAN.

Compiler – The program that compiles machine code from a higher level code. *See* Compile.

Composite video – A signal which contains all the elements needed by a video monitor to produce a display. It may be either a color or monochrome signal. *See* Video; Monitor; RGB video; and CRT.

Computer – A machine capable of accepting information, processing it by following a set of instructions, and supplying the results of this process.

CP/M – Control Program for Microcomputers. This is a disk-based operating system commonly used by many microcomputers. CP/M is a registered trademark of Digital Research, Inc.

CPS – Characters Per Second. This term is sometimes used in relating transmission speed, and is more commonly used in rating a printer's in, stantaneous printing speed.

CPU – Central Processing Unit. The circuitry that actually processes the information and controls the storage, movement, and manipulation of data. The CPU contains the ALU and a number of registers for this purpose.

Crash – A term that refers to a computer or peripheral failure.

CAT – Cathode-Ray Tube. This term is used interchangeably with display, screen, and video monitor. It refers to the television-like screen in _ computer, terminal, or monitor.

Cursor – A character (usually an underline) that is used to indicate a pos ition on the screen.

Cylinder – A term used to describe the tracks in disk systems with multiple read-write heads which can be accessed without mechanical movement of the heads.

Daisy wheel printer – A "hard copy" device that produces images on Caper when a "hammer" strikes an arm or projection of the print wheel.

Data – The general term used to describe information that can be processed by a computer. Although the term is plural, it is commonly used in .-re singular form to denote a group of datum.

Data base – A large file of information that is produced, updated, and manipulated by one or more programs.

Data processing – The action taken by a computer to receive, manipulate, store, and/or print information.

DCE – Data Communications Equipment. The DCE connector is a serial connector designed to be used with communications equipment, generally a modem. *See* Modem.

Debug – The process of locating and removing any bugs in a computer system; usually as it applies to software.

Decimal – A numbering system with a base of ten consisting of the digits 0 through 9.

Delete – A term that means to remove or eliminate.

Density – A term that refers to the amount of information that can be stored in a given area.

Descenders – That portion of a character which descends below the base line of printed material. Most notably, the lower case g, j, p, q, and y have descenders.

Device – A mechanical or electronic unit, such as a printer, disk drive, terminal, and so on.

Digit – A single element or sign used to convey the idea of quantity, either by itself or with other numbers of its series.

Digital computer – A computer in which numbers are used to express data and instructions.

Direct-connect modem – One of the two types of modems; a device you can connect between a telephone line and a computer to communicate with other computers. A modem will translate the normal digital signals of the computer into tones that are transmitted over standard telephone lines and will translate the received tones back into digital signals. By using a direct-connect modem, you avoid problems associated with high levels of noise and make a more permanent connection to the telephone lines. *See* Modem; and Acoustic coupler.

Directory – A disk file, listing all of the other files on the disk and pertinent information about each file.

Disk – A thin flexible plastic platter, coated with magnetic material and enclosed in a plastic jacket. It is used to store data and comes in two standard sizes: 5.25-inch and 8-inch in diameter. It is also called a "floppy disk," "flexible disk," or "diskette."

Disk drive – A device used to read data from and write data onto disks. *Diskette* – *See* Disk.

Disk operating system – *See* DOS.

Display – The television-like screen used by the computer to present information to the operator.

DOS – Disk Operating System. A program or programs that provide basic utility operations and control of a disk-based computer system.

Dot-matrix printer – A "hard copy" printer that works by forming the printed character through the selection of wires which strike the paper.

Double-density – This term is most often applied to the storage characteristics of disks, and generally refers to the density of the storage of bits on the disk surface on each track. It also refers to the density of the disk tracks, though this is not the common usage.

DTE – Data Terminal Equipment. The DTE connector is a serial connector resigned to be used with a terminal device, which also includes printers. Terminal; and Printer.

EBCDIC – Expanded Binary Coded Decimal Interchange Code. This code, used primarily in IBM equipment, is used to transmit information to peripheral equipment and other computers. It is similar to ASCII code which is the computer industry's standard and is similar. *See* ASCII.

Edit – A term that means to change data, a program, or a program

EEPROM – Electrically Erasable Programmable Read-Only Memory. Similar to EPROM, and PROM, except that this memory may be selectively red by electronic means and reprogrammed. It is similar in nature to RAM except that special voltages are needed for erasing and programming the memory. An EEPROM is Nonvolatile. *See* Volatile; RAM; ROM; OM; and EPROM.

EPROM – Erasable Programmable Read-Only Memory. It is similar to PROM, except that this memory is erased by exposing it to a high-intensity ultraviolet light after which it may be reprogrammed. An EPROM is nonvolatile. *See* Volatile; RAM; ROM; PROM; and EEPROM.

Execute – A term that means to perform a command.

Field – A set of related characters that make up a piece of data such as a field of characters that spell a person's first name.

File – A collection of related records that are treated as a unit. A file may contain data or represent a computer program. *See* Field and Record.

Firmware – A computer program that is part of the physical makeup of the computer. *See* Software; and Hardware.

Flowchart – A symbolic representation of the logical flow of operations. It is usually very detailed when it represents a computer program.

Formatting – The process of organizing the surface of a disk to accept files of data and programs.

FORTRAN – FORmula TRANslator. A popular high-level programming language used primarily in scientific applications.

Graphics – This term generally refers to special characters which may be displayed or printed. In other uses, it indicates that the specified device may be able to reproduce any type of display, from photographs to line and bar charts. Often, graphics capabilities are expressed in pixels, points, or dots.

Hard copy – Typewritten or printed characters on paper, produced by a peripheral, such as a printer or plotter.

Hard-sectored – This term applies to disks which have multiple timing holes that mark sector boundaries, as well as the beginning of a track.

Hardware – The physical computer and all of its component parts as well as any peripherals and interconnecting cables. *See* Firmware; Peripheral; and Software.

Hexadecimal – A numbering system with a base of sixteen, consisting of the digits 0 through 9 and A (10) through F (15). A single byte of data may be represented by two hexadecimal digits.

Hidden file – A file that may be accessed (read) but will not appear on a disk directory. *See* Disk; Directory; and File.

High-level language – A programming language which uses symbol and command statements that an operator can read. Each statement represents a series of computer machine language instructions. Examples of high-level languages are BASIC, COBOL, and FORTRAN.

Home – This term usually refers to the upper left-hand corner of the display screen, and specifically to the first displayable character location.

I/O – Input/Output. This term refers to the devices which enter and/or store data, and/or the paths through which such data passes. *See* Port.

IC – Integrated Circuit. *See* Chip.

Ink jet printer – A "hard copy" device that works by forming printed characters from tightly controlled jets of ink. These printers are often capable of producing multicolored copy and screen images.

Input – 1. Information or data transferred into the computer. 2. The route through which such information passes. 3. The devices which supply a source of input data, such as the keyboard or disk drive.

Instruction – A code that tells a computer to perform a particular operation.

Integer – A whole number.

Interactive processing – An operation where data is processed by a computer under the supervision of an operator, often requiring many keyboard entries. *See* Batch processing.

Interface – A device that serves as a common boundary between two other devices, such as two computer systems or a computer and peripheral. *See* RS-232 interface.

Interpreter – A special program that interprets the code in a high-level language for use by the computer. It performs an interpretation each time an instruction is executed; usually this results in slower operation as compared to a compiled computer language. However, the process of testing and debugging an interpreted computer program is much easier and faster. BASIC is an example of an interpreter. However, it is not always found in this form.

Interrupt – A temporary suspension of processing by the computer (and possible override by a high priority routine) caused by input from another part of the computer or a peripheral.

Jump – A departure from the normal sequential line-by-line flow of a program. A jump may be either conditional, based upon the outcome of a test, or unconditional (i.e., absolute).

Justify – To adjust exactly; the perfect alignment of a margin. Text is normally left justified; that is, the left margin is always aligned. A feature of many word processors is right justification; extra spaces between words or increments in spaces between letters are added to perfectly align the right margin.

K – Abbreviation for kilo. 1. A mathematical symbol used to represent 1000. 2. A unit of measurement of capacity in computers that represents the power of 2 closest to 1000 (2^{10} or 1024 = *1K*). *See* Binary; Kilo; and Kilobyte.

Keyboard – A device used to enter information into a computer. It is made up of two or more keys, often arranged like those of a typewriter and/or calculator.

Keyword – One or two words in a high-level language that define the primary type of operation to be performed.

Kilo – A prefix meaning: (1) 1000 when used in a mathematical expression; or (2) 1024 when used as a unit of measurement in computers. *See* K; and Kilobyte.

Kilobit – A unit of measurement in computers that equals 1,024 bits. *See* K; Kilo; and Bit.

Kilobyte – A unit of measurement in computers that equals 1,024 bytes. *See* K; Kilo; and Byte.

Language – A defined set of characters which, when used alone or in combinations, form a meaningful set of words and symbols. In a computer language, it refers to a set of words and operators and the rules governing their usage. Examples of computer languages are machine language, assembler language, BASIC, COBOL, and FORTRAN.

Load – The process of entering information (data or a program) into a computer, from a keyboard, disk, or other source.

Logical line – Continuous text, instructions, commands, or other material from its beginning to its end, regardless of any breaks imposed upon it by line length limitations of display or printing devices. Logical lines are terminated by the ASCII character CR, which is generated when you press the RETURN key. *See* Physical line.

M – An abbreviation for mega. 1. A mathematical symbol used to represent 1,000,000. 2. A unit of measurement of capacity in computers that equals 1000K or 1,024,000. *See K;* Mega; and Megabyte.

Machine language – A programming language consisting only of numbers or symbols that the computer can understand without translation. *See* Machine Glossary.

Mainframe – 1. The actual central hardware of a computer, containing the Central Processing Unit (CPU). 2. The largest type of computer, usually associated with financial and government institutions and having the ability process very large amounts of data in a batch processing mode.

Maintenance – The process of maintaining hardware and software. With hardware, in addition to corrective repair, this also includes preventive maintenance, or cleaning and adjustment. With software, maintenance refers to updating critical tables and routines (such as the updating of tax tables for income and social security tax deductions in a payroll program).

Matrix – 1. A rectangular array of data usually numeric, subject to mathematical operations or manipulation; any table is a matrix. 2. A rectangular array of elements that form symbols and/or characters in a dot-matrix printer or video display.

Mega – A prefix meaning: (1) 1,000,000 when used in a mathematical expression; or (2) 1,024,000 when used as a unit of measurement in computers. *See M;* and Megabyte.

Megabyte – A unit of measurement in computers that equals 1,024,000 bytes. *See* M; Mega; and Byte.

Memory – That part of a computer that is used to electronically store information (either data or programs). The amount of memory in a microcomputer is often used to imply the size or capability of that computer. *See* RAM; ROM; PROM; EPROM; and EEPROM.

Microcomputer – A term that (usually) applies to smaller, desktop and personal computer systems. *See* Minicomputer; and Mainframe.

Minicomputer – A term that applies to medium-sized computer systems. *See* Microcomputer; and Mainframe.

Mnemonic – A term applying to an abbreviation or acronym that is easy to remember.

Mode – Method of operation. For instance, BASIC has two modes of operation: direct mode and indirect mode.

Modem – MOdulator DEModulator. A device that converts the digital signals from a computer into a form compatible with transmission facilities and vice versa. Most commonly used with telephone communications.

Modulus – The result of modular arithmetic which deals with whole numbers, where the numbers are replaced by their remainders after division by an integer.

Monitor – 1. A control program in a computer. 2. A separate peripheral used to display information; such as a monochrome or color video display.

Monochrome display – A single-color (black and white, black and green, or black and amber) display.

Mouse – A peripheral device with one or two switches that is connected to a computer or terminal and used as an input device. It can serve as a graphics entry device or as a control for (relative) cursor positioning on the screen. *See* Graphics and Cursor.

Multiprocessing – A term that means doing two or more processes at the same time. This usually applies to computers with more than one CPU.

Multitasking – The ability to do two or more tasks at the same time. This term is often used synonymously with multiprocessing. In computers that have only one active CPU, multitasking is accomplished by "timesharing" the CPU between the tasks. *See* Timeshare; Multiprocessing; and Multiuser.

Multiuser – The ability to accommodate two or more operators on one computer system at the same time, usually through two or more terminals. *See* Multi-processing; Multitasking; and Network.

Network – 1. The interconnection of a number of stations by means of a common interface or communications facility, such as a telephone. 2. Two or more computer systems, physically linked together through a common data channel, that are serviced by one or more of the computer systems in that network.

Numeric – Denoting a number or a system of numbers.

OS – Operating System. A program or programs that provide basic utility operations and control of a computer system.

Operation – 1. A defined action. 2. The action specified by a single computer instruction.

Operator – 1. The person who actually manipulates the computer controls, places the disk into the disk drive, removes printer output, etc. 2. A symbol that designates a mathematical operation such as plus (+), minus (-), and so on. 3. A symbol or keyword that designates a logical comparison or operation such as greater than (>), less than (<), NOT, and so on.

Output – The results of computer operations. This may be in the form of displayed or printed information, data stored on (for example) a disk, or data transmitted to another computer.

Parallel – In computers, this refers to information sent as a group, rather than serially. For example, eight bits (or a byte) are transmitted simultaneously over eight channels or wires. *See* Serial.

Parameter – A specification or value used in an operation or statement.

Parity – Refers to a method used to check the validity of data that is stored, transmitted, or manipulated. The value of a parity bit (which is added to the number of bits which make up one character) will be determined by the desired outcome of the sum of the bits for that character (i.e., to be either an odd or even number).

Peripheral – A device that is connected to the computer for the purpose of supplying input and/or output capability to that computer. A peripheral may or may not be under direct control of the computer; it may be capable of some independent operation (self-test, etc.).

Physical line – Text, instructions, commands, or other material that resides on one line. If the material is broken into two or more lines by line length limitations of a display or printing device, then each line is considered to be one physical line. *See* Logical line.

Port – The path through which data is transferred into and/or out of the computer or CPU.

Precision – The degree of exactness, usually based on the number of significant digits in a value.

Printer – A device used to produce computer output in the form of written, typed, or printed characters and symbols on paper. The output of a printer is called "hard copy," or a "computer printout."

Problem – A situation where an unknown exists among a given set of knowns. The objective of a program or task in a computer might be the finding of an unknown.

Process – The act of completing or executing an instruction or set of instructions. It may include the capability to compute, assemble, compile, interpret, generate, and so on.

Processor – A computer or its *CPU. See CPU.*

Program – A set of computer instructions which, when followed, will result in the solution to a problem or the completion of a task.

Program language – Any one of a number of languages created for a computer. Examples include BASIC, COBOL, FORTRAN, and assembly language.

Programmer – A person who prepares and writes a computer program.

PROM – Programmable Read-Only Memory. Memory which is similar to ROM but which can be programmed (data written to it) by special methods. A PROM is nonvolatile. *See* Volatile; ROM; EPROM; and EEPROM.

Prompt – A symbol, character, or other sign that indicates that the computer is waiting for some form of operator input. The prompt may request specific data and be made up of text. In other instances, the prompt may simply mean that the computer is finished executing the latest command and is waiting for new instructions in the form of a command.

Pseudo – A prefix meaning imitative.

Queue – A waiting line or list. For example, a list of files waiting to be printed.

RAM – Random Access Memory. Volatile read-write memory in which data may be written to (stored) or read from (retrieved) directly. *See* Random access; and Volatile.

Random access – The ability to access locations without regard to sequential position; access may be accomplished by going directly to the location. On occasion, this is called "direct access."

Read – The process of obtaining data from some source, such as a disk.

Read/write head – A magnetic recording/playback head similar to those used by tape recorders. The function of the head is to read (playback) and write (record) information on magnetic material such as a disk surface.

Real time clock – A part of the computer that maintains the actual time of day which may be used in a computer program. In many small computers, this is a function of software rather than hardware, and may be subject to timing interrupts caused by certain operations.

Reset – The process of restoring the equipment to its initial state; the state it was in when power was applied and the system turned on.

RGB video – A high-resolution color monitor which utilizes separate red, green, and blue signals rather than a combination, or "composite," of the same. *See* Monitor; Composite video; CRT; and Display.

ROM – Read-Only Memory. Memory which is similar to RAM, except that data cannot be written to it. Data can be read from it directly, as in the case of RAM, but ROM is nonvolatile; that is, it will retain the information stored in it whether power is applied or not. It is most often used for special programs such as the monitor program in your computer. *See* Volatile; RAM; PROM; EPROM; and EEPROM.

Routine – A sequence of instructions that carry out a well-defined function. A program may be called a routine, although programs usually contain many routines. If a routine is separated from the main body of the program, it is referred to as a "subroutine."

RS-232 interface – A standardized interface adopted by the Electronic Industries Association (EIA) to ensure uniformity of interfacing signals between computers and peripherals. This capability is built into most computer devices. *See* Interface.

Search – The systematic examination of data to locate a specific item. Searches are characterized by several different methods including sequential (items are examined in a specific sequence) and binary (ordered data containing the desired item is repeatedly halved until the desired stem is found).

Sector – A portion of a disk track. The location of a particular sector on the track is a matter of timing. In a disk, timing is handled by timing holes. Disks containing only one timing hole are said to be soft-sectored because the timing is handled by software. Disks containing many timing holes are said to be hard-sectored because the timing is handled by hardware. *See* Track.

Sequential – The order in which things follow one after the other.

Serial – A term that usually refers to the treatment and handling of information. That is, the data is broken down into its component parts, which could be either characters (bytes) or bits. The resulting bytes or bits are then handled (processed, transmitted, or received) in a sequential manner. The term "serial device" refers to the method in which data is passed through or to that device.

Sign – A symbol that indicates whether the value is greater than zero or less than zero. The dash or hyphen sign (-) is used to indicate a negative (less than zero) value. The absence of the dash or a plus sign (+) indicates a value greater than zero (positive).

Single-density – This term is most often applied to the storage characteristics of disks, and generally refers to the density of the storage of bits on the disk surface on each track. It also refers to the density of the disk tracks, though this is not the common usage.

Soft-sectored – This term applies to disks which have a single timing hole that marks the beginning of a track. Sectoring of the track is controlled by software. *See* Track; and Sector.

Software – A general term that applies to any program (set of instructions) that can be loaded into a computer from any source. *See* Firmware; and Hardware.

Sort – To arrange (or place in order) data according to a predefined set of rules.

Synchronous – To be controlled by and synchronized (timed) with equally spaced timing signals. *See* Asynchronous.

Syntax -The rules governing the use of a language.

System – An assembly of components into a whole. A computer system is made up of the computer plus one or more peripherals.

Table – A collection of related data which is in a form suitable for easy reference. *See* Matrix.

Task – A job, usually performed by following a specific set of instructions to solve a problem.

Telecommunications – The transmission and/or reception of signals by wire, radio, light beam, telephone, or any other electronic means.

Terminal – An input/output device, usually consisting of a keyboard and a display screen. A terminal also may consist of a printer and a keyboard; this is referred to as a "printing terminal." Either type may include a modem (either the acoustic-coupled type or the direct-connect type) for remote operation.

Thermal printer – A "hardcopy" device that works: (1) by forming printed characters by heating tiny elements near or on heat-sensitive paper; or (2) by etching or "burning" printed characters on paper by the use of a low-power laser.

Time share – The process of accomplishing two or more tasks at (apparently) the same time. The computer will process one task at a time, but only a small portion, before switching to the next. Because a computer can process a great amount of data in a very short time, the switching between tasks is usually transparent to human observation except when many tasks are executed at the same time.

Track – The portion of a disk that one read/write head passes over while in a stationary position. Track density is measured in tpi (tracks per inch).

Utility – A program that accomplishes a specific purpose, usually quite commonly needed by a wide range of applications. Most utilities are furnished with a computer system while some, like sort routines, may be sold separately.

Variable – This term applies to a symbol or name that represents an assigned memory location where a value is stored by a program. The maintenance of the variable and its location is handled by the program.

Verify – To examine and substantiate the results of a computer operation.

Volatile – A characteristic of becoming lost or erased when operating power is removed from the hardware. *See* RAM.

Winchester – A term applied to most forms of high-density, nonremovable rigid disk storage devices.

Word processing – An application, widely used in microcomputers for entering, manipulating, correcting, deleting, formatting, and printing various types of text: correspondence, reports, legal documents, articles, manu-scripts, and books. These application programs often include a spelling checker and other aids to the writer: punctuation checker, thesaurus, and indexer.

Write – The process of recording data on some object, such as a display, disk, or paper.

Symbols and Codes

This appendix contains a number of tables: a decimal/octal/hexadecimal ASCII conversion table; three key code tables; and five control code tables.

Table B-1 describes the entire ASCII character set as implemented in the Z-100. The Z-19 graphics characters and foreign characters are not illustrated in the table.

If you want to see the graphics or foreign characters, use the FONT utility of MS-DOS to load the appropriate CHR file from MS-DOS distribution disk #2. The font utility provides you with the means to view and the characters to suit your own needs. Refer to the MS-DOS documentation for complete instructions.

Tables B-2 through B-4 contain the hexadecimal or ASCII codes sent by the keyboard for each key you press (and release) under different conditions. The conditions in Table B-2 are represented by the following: (1) normal or default keyboard operation with no extra keys pressed, (2) either SHIFT key pressed, (3) the CTRL key pressed, (4) both the CTRL and either SHIFT key pressed, (5) the CAPS LOCK key locked down, (6) the keyboard in the event-driven mode when a key is pressed, and (7) the keyboard in the event-driven mode when a key is released.

Tables B-5 through B-9 contain the description of each control code combination that the computer recognizes and the function performed.

Table B-1: The ASCII Character Set

DECIMAL	OCTAL	HEXADECIMAL	ASCII CHARACTER	KEY	CTRL	DESCRIPTION
0	000	00	NUL	...	@	Null, tape feed.
1	001	01	SOH	...	A	Start of heading.
2	002	02	STX	...	B	Start of text.
3	003	03	ETX	...	C	End of text.
4	004	04	EOT	...	D	End of transmission.
5	005	05	ENQ	...	E	[Enquiry] Inquiry.
6	006	06	ACK	...	F	Acknowledge.
7	007	07	BEL	...	G	Rings bell (sounds tone).
8	010	08	BS	BACKSPACE	H	Back space.
9	011	09	HT	TAB	I	Horizontal tab.
10	012	0A	LF	LINE FEED	J	Line feed - advance cursor to next line.
11	013	0B	VT	...	K	Vertical tab (VTAB).
12	014	0C	FF	...	L	Form feed to top of next page.
13	015	0D	CR	RETURN	M	Carriage return to beginning of line.
14	016	0E	SO	...	N	Shift out.
15	017	0F	SI	...	0	Shift in.
16	020	10	DLE	...	P	Data link escape.
17	021	11	DC1	...	Q	Device control 1 - turns transmitter on (XON).
18	022	12	DC2	...	R	Device control 2.
19	023	13	DC3	...	S	Device control 3 - turns transmitter off (XOFF).
20	024	14	DC4	...	T	Device control 4.
21	025	15	NAK	...	U	Negative acknowledge or ERR (error).
22	026	16	SYN	...	V	Synchronous idle (SYNC).
23	027	17	ETB	...	W	End of transmission block.
24	030	18	CAN	...	X	Cancel (CANCL) - cancels current escape sequence.
25	031	19	EM	...	Y	End of medium.
26	032	1A	SUB	...	Z	Substitute.
27	033	1B	ESC	ESC	[	Escape.
28	034	1C	FS	...	\	File separator.
29	035	1D	GS	...	]	Group separator.
30	036	1E	RS	...	^	Record separator.
31	037	1F	US	...	-	- Unit separator.
32	040	20	SP	space bar	...	Space (space bar).
33	041	21	!	!	...	Exclamation mark.
34	042	22	"	"	...	Quotation (ditto) mark.

Table B-1 (continued): The ASCII Character Set

DECIMAL	OCTAL	HEXADECIMAL	ASCII CHARACTER	KEY	CTRL	DESCRIPTION
35	043	23	#	#	...	Number sign.
36	044	24	$	$	...	Dollar sign.
37	045	25	%	%	...	Percent sign.
38	046	26	&	&	...	Ampersand.
39	047	27	'	'	...	Acute accent or apostrophe.
40	050	28	(	(	...	Open parenthesis.
41	051	29	)	)	...	Close parenthesis.
42	052	2A	*	*	...	Asterisk.
43	053	2B	+	+	...	Plus sign.
44	054	2C		...	Comma.	
45	055	2D	-	-	...	Hyphen or minus sign.
46	056	2E		...	Period.	
47	057	2F	/	/	...	Slash.
48	060	30	0	0	...	Number 0.
49	061	31	1	1	...	Number 1.
50	062	32	2	2	...	Number 2.
51	063	33	3	3	...	Number 3.
52	064	34	4	4	...	Number 4.
53	065	35	5	5	...	Number 5.
54	066	36	6	6	...	Number 6.
55	067	37	7	7	...	Number 7.
56	070	38	8	8	...	Number 8.
57	071	39	9	9	...	Number 9.
58	072	3A	:	:	...	Colon.
59	073	3B	;	;	...	Semicolon.
60	074	3C	<	<	...	Less than sign.
61	075	3D	=	...	Equal sign.	
62	076	3E	>	>	...	Greater than sign.
63	077	3F	?	?	...	Question mark.
64	100	40	@	@	...	At sign.
65	101	41	A	A	...	Capital letter A.
66	102	42	B	B	...	Capital letter B.
67	103	43	C	C	...	Capital letter C.
68	104	44	D	D	...	Capital letter D.
69	105	45	E	E	...	Capital letter E.
70	106	46	F	F	...	Capital letter F.
71	107	47	G	G	...	Capital letter G.
72	110	48	H	H	...	Capital letter H.
73	111	49	I	I	...	Capital letter I.
74	112	4A	J	J	...	Capital letter J.
75	113	4B	K	K	...	Capital letter K.

Table B-1 (continued): The ASCII Character Set

DECIMAL	OCTAL	HEXADECIMAL	ASCII CHARACTER	KEY	CTRL	DESCRIPTION
76	114	4C	L	L	...	Capital letter L.
77	115	4D	M	M	...	Capital letter M.
78	116	4E	N	N	...	Capital letter N.
79	117	4F	0	0	...	Capital letter O.
80	120	50	P	P	...	Capital letter P.
81	121	51	Q	Q	...	Capital letter Q.
82	122	52	R	R	...	Capital letter R.
83	123	53	S	S	...	Capital letter S.
84	124	54	T	T	...	Capital letter T.
85	125	55	U	U	...	Capital letter U.
86	126	56	V	V	...	Capital letter V.
87	127	57	W	W	...	Capital letter W.
88	130	58	X	X	...	Capital letter X.
89	131	59	Y	Y	...	Capital letter Y.
90	132	5A	Z	Z	...	Capital letter Z.
91	133	5B	[	[	...	Open brackets.
92	134	5C	\	\	...	Reverse slash.
93	135	5D	]	]	...	Close brackets.
94	136	5E	...	^	...	Caret.
95	137	5F	_	_	...	Underscore.
96	140	60	`	`	...	Grave accent.
97	141	61	a	a	...	Small letter a.
98	142	62	b	b	...	Small letter b.
99	143	63	c	c	...	Small letter c.
100	144	64	d	d	...	Small letter d.
101	145	65	e	e	...	Small letter e.
102	146	66	f	f	...	Small letter f.
103	147	67	g	g	...	Small letter g.
104	150	68	h	h	...	Small letter h.
105	151	69	i	i	...	Small letter i.
106	152	6A	j	j	...	Small letter j.
107	153	6B	k	k	...	Small letter k.
108	154	6C	I	I	...	Small letter l.
109	155	6D	m	m	...	Small letter m.
110	156	6E	n	n	...	Small letter n.
111	157	6F	o	o	...	Small letter o.
112	160	70	p	p	...	Small letter p.
113	161	71	q	q	...	Small letter q.
114	162	72	r	r	...	Small letter r.
115	163	73	s	s	...	Small letter s.
116	164	74	t	t	...	Small letter t.

Table B-1 (continued): The ASCII Character Set

DECIMAL	OCTAL	HEXADECIMAL	ASCII CHARACTER	KEY	CTRL	DESCRIPTION
117	165	75	u	u	...	Small letter u.
118	166	76	v	v	...	Small letter v.
119	167	77	w	w	...	Small letter w.
120	170	78	x	x	...	Small letter x.
121	171	79	y	y	...	Small letter y.
122	172	7A	z	z	...	Small letter z.
123	173	7B	{	{	...	Left brace.
124	174	7C	|	|	...	Vertical bar (broken).
125	175	7D	}	}	...	Right brace.
126	176	7E	...	~	...	Tilde.
127	177	7F	DEL	DELETE	...	Delete (rubout).
128-255	200-377	80-FF	...	...	...	unassigned.

Table B-2: Hexadecimal Key Codes

KEY	NOT SHIFTED	SHIFTED	CONTROL	CONTROL SHIFT	CAPS LOCK	DOWN CODE	UP CODE
) or 0	30	29	x	x	x	5B	DB
! or 1	31	21	x	x	x	57	D7
@ or 2	32	40	32	00	x	56	D6
# or 3	33	23	x	x	x	55	D5
$ or 4	34	24	x	x	x	54	D4
% or 5	35	25	x	x	x	53	D3
^ or 6	36	5E	36	1 E	x	52	D2
& or 7	37	26	x	x	x	51	D1
* or 8	38	2A	x	x	x	50	D0
(or 9	39	28	x	x	x	5A	DA

Table B-2 (continued): Hexadecimal Key Codes

KEY	NOT SHIFTED	SHIFTED	CONTROL	CONTROL SHIFT	CAPS LOCK	DOWN CODE	UP CODE
A	61	41	01	01	41	07	87
B	62	42	02	02	42	13	93
C	63	43	03	03	43	15	95
D	64	44	04	04	44	05	85
E	65	45	05	05	45	0D	8D
F	66	46	06	06	46	04	84
G	67	47	07	07	47	03	83
H	68	48	08	08	48	02	82
I	69	49	09	09	49	08	88
J	6A	4A	0A	0A	4A	01	81
K	6B	4B	0B	0B	4B	00	80
L	6C	4C	0C	0C	4C	10	90
M	6D	4D	0D	0D	4D	11	91
N	6E	4E	0E	0E	4E	12	92
O	6F	4F	0F	0F	4F	19	99
P	70	50	10	10	50	1A	9A
Q	71	51	11	11	51	0F	8F
R	72	52	12	12	52	0C	8C
S	73	53	13	13	53	06	86
T	74	54	14	14	54	0B	8B
U	75	55	15	15	55	09	89
V	76	56	16	16	56	14	94
W	77	57	17	17	57	0E	8E
X	78	58	18	18	58	16	96
Y	79	59	19	19	59	0A	8A
Z	7A	5A	1A	1A	5A	17	97
BACK SPACE	08	x	x	x	x	5F	DF
TAB	09	x	x	x	x	4E	CE
LINE FEED	0A	x	x	x	x	44	C4
RETURN	0D	x	x	x	x	4C	CC
ESC	1B	x	x	x	x	4F	CF

Table B-2 (continued): Hexadecimal Key Codes

KEY	NOT SHIFTED	SHIFTED	CONTROL	CONTROL SHIFT	CAPS LOCK	DOWN CODE	UP CODE
space	20	x	x	x	x	45	C5
" '	27	22	x	x	x	48	C8
< , (comma)	2C	3C	x	x	x	4D	CD
_ (under score) - (hyphen)	2D	5F	2D	1F	X	5C	DC
> . (period)	2E	3E	x	x	x	4A	CA
? /	2F	3F	x	x	x	4B	CB
: (colon) ; (simi-colon)	3B	3A	x	x	x	49	C9
+ =	3D	2B	x	x	x	5D	DD
{ [	5B	7B	1B	7B	x	59	D9
| (vert. bar) \	5C	7C	1C	7C	x	43	C3
}]	5D	7D	1D	7D	x	58	D8
~ `	60	7E	x	x	x	5E	DE
DELETE	7F	x	x	x	x	42	C2
ENTER	8D	CD	x	x	x	38	B8
HELP	95	D5	x	x	x	46	C6
F0	96	D6	x	x	x	27	A7
F1	97	D7	x	x	x	26	A6
F2	98	D8	x	x	x	25	A5
F3	99	D9	x	x	x	24	A4
F4	9A	DA	x	x	x	23	A3
F5	9B	DB	x	x	x	22	A2
F6	9C	DC	x	x	x	21	A1
F7	9D	DD	x	x	x	20	A0
F8	9E	DE	x	x	x	29	A9
F9	9F	DF	x	x	x	2A	AA
F10	A0	E0	x	x	x	2B	AB
F11	A1	E1	x	x	x	2C	AC
F12	A2	E2	x	x	x	2D	AD
D CHR I CHR	A3	E3	x	x	x	2F	AF

Table B-2 (continued): Hexadecimal Key Codes

KEY	NOT SHIFTED	SHIFTED	CONTROL	CONTROL SHIFT	CAPS LOCK	DOWN CODE	UP CODE
DEL LINE INS LINE	A4	E4	x	x	x	2E	AE
↑	A5	E5	x	x	x	3B	BB
↑	A6	E6	x	x	x	3A	BA
→	A7	E7	x	x	x	33	B3
←	A8	E8	x	x	x	3F	BF
HOME	A9	E9	x	x	x	37	B7
BREAK	AA	EA	x	x	x	47	C7
- (kpd)	AD	ED	x	x	x	39	B9
. (kpd)	AE	EE	x	x	x	40	C0
0(kpd)	B0	F0	x	x	x	41	C1
1 (kpd)	B1	F1	x	x	x	34	B4
2 (kpd)	B2	F2	x	x	x	3C	BC
3 (kpd)	B3	F3	x	x	x	30	B0
4 (kpd)	B4	F4	x	x	x	35	B5
5 (kpd)	B5	F5	x	x	x	3D	BD
6 (kpd)	B6	F6	x	x	x	31	B1
7 (kpd)	B7	F7	x	x	x	36	B6
8 (kpd)	B8	F8	x	x	x	3E	BE
9 (kpd)	B9	F9	x	x	x	32	B2
REPEAT	x	x	x	x	x	60	E0
CAPS LOCK	x	x	x	x	x	61	El
SHIFT (right)	x	x	x	x	x	62	E2
CTRL	x	x	x	x	x	63	E3
SHIFT (left)	x	x	x	x	x	64	E4

Table B-3: ASCII Keypad Codes - Key Expansion Mode Enabled

	MODES			
KEY(S) PRESSED	NORMAL UNSHIFTED	NORMAL SHIFTED	ALTERNATE UNSHIFTED	ALTERNATE SHIFTED
.ENTER	ENTER	ENTER	ESC?M	ENTER
.	.	.	ESC?n	.
-	-	-	ESC ? m	-
0	0	0	ESC ? p	0
1	1	ESC L	ESC ? q	ESC L
2	2	ESC B	ESC ? r	ESC B
3	3	ESC M	ESC ? s	ESC M
4	4	ESC D	ESC ? t	ESC D
5	5	ESC H	ESC ? u	ESC H
6	6	ESC C	ESC ? v	ESC C
7	7	ESC (@)/ESC 0[1]	ESC ? w	ESC (@)/ESC 0[1]
8	8	ESC A	ESC ? x	ESC A
9	9	ESC N	ESC ? y	ESC N
SHIFT ENTER	ENTER	ENTER	ENTER	ESC ? M
SHIFT.	.	.	.	ESC ? n
SHIFT -	-	-	-	ESC ? m
SHIFT 0	0	0	0	ESC ? p
SHIFT 1	ESC L	1	ESC L	ESC ? q
SHIFT 2	ESC B	2	ESC B	ESC ? r
SHIFT 3	ESC M	3	ESC M	ESC ? s
SHIFT 4	ESC D	4	ESC D	ESC ? t
SHIFT 5	ESC H	5	ESC H	ESC ? u
SHIFT 6	ESC C	6	ESC C	ESC ? v
SHIFT 7	ESC @/ESC 0[1]	7	ESC (@)/ESC 0[1]	ESC ? w
SHIFT 8	ESC A	8	ESC A	ESC ? x
SHIFT 9	ESC N	9	ESC N	ESC ? y

1. Toggles between codes.

**Table B-4:   ASCII Function Key Codes –
                 Key Expansion Mode Enabled**

KEY PRESSED	UNSHIFTED CODE	SHIFTED CODE
F0	ESC J	ESC E
F1	ESC S	ESC 1 A
F2	ESC T	ESC 1 B
F3	ESC U	ESC 1 C
F4	ESC V	ESC 1 D
F5	ESC W	ESC 1 E
F6	ESC P	ESC 1 F
F7	ESC Q	ESC 1 G
F8	ESC R	ESC H
F9	ESC 0 I	ESC 1 I
F10	ESC 0 J	ESC 1 J
F11	ESC 0 K	ESC 1 K
F12	ESC 0 L	ESC 1 L
ICHR / D CHR	ESC@ / ESC O[1]	ESC N
DEL LINE / INS LINE	ESC L	ESC M
↑	ESC A	ESC A
↓	ESC B	ESC B
→	ESC C	ESC C
←	ESC D	ESC D
HOME	ESC H	ESC H
BREAK	ESC |	ESCI
HELP	ESC ~	ESC -

[1]Toggles between codes.

Table B-5: Escape Codes - Cursor Functions

ASCII SEQUENCE	HEXADECIMAL SEQUENCE	DESCRIPTION
ESC A	1B 41	Move the cursor up one line.
ESC B	1B 42	Move the cursor down one line.
ESC C	1B 43	Move the cursor right one position.
ESC D	1B 44	Move the cursor left one position.
ESC H	1B 48	Move the cursor to the upper-left corner of the screen (home position).
ESC I	1B 49	Reverse index (reverse line feed).
ESC Y	1B 59	Direct cursor addressing.
ESC j	1B 6A	Save the current cursor position.
ESC n	1B 6E	Return the cursor position report.
ESC k	1B 6B	Position the cursor to the last position saved.

Table B-6: Escape Codes- Erasing and Editing

ASCII SEQUENCE	HEXADECIMAL SEQUENCE	DESCRIPTION
ESC E	1B 45	Clear the display and move the cursor to the home position.
ESC J	1B 4A	Erase to the end of the page (screen)
ESC K	1B 4B	Erase to the end of the current line.
ESC L	1B 4C	Insert line.
ESC M	1B 4D	Delete line.
ESC N	1B 4E	Delete character.
ESC 0	1B 4F	Exit the insert character mode.
ESC @	1B 40	Enter the insert character mode.
ESC b	1B 62	Erase to the beginning of the display.
ESC I	1B 6C	Erase the current line.
ESC o	1B 6F	Erase to the beginning of the current line.

Table B-7: Escape Codes - Modes of Operation

ASCII SEQUENCE	HEXADECIMAL SEQUENCE	DESCRIPTION
ESC F	1B 46	Enter the graphics mode.
ESC G	1B 47	Exit the graphics mode.
ESC =	1B 3D	Enter the alternate keypad mode.
ESC >	1B 3E	Exit the alternate keypad mode.
ESC p	1B 70	Enter the reverse video mode.
ESC q	1B 71	Exit the reverse video mode.
ESC t	1B 74	Enter the keypad shifted mode.
ESC u	1B 75	Exit the keypad shifted mode.

Table B-8: Escape Codes - Configuration

ASCII SEQUENCE	HEXADECIMAL SEQUENCE	DESCRIPTION
ESC r x	1B 72 xx	Modify the baud rate

x	xx	BAUD RATE
A	41	110
B	42	150
C	43	300
D	44	600
E	45	1200
F	46	1800
G	47	2000
H	48	2400
I	49	3600
J	4A	4800
K	4B	7200
L	4C	9600

ASCII SEQUENCE	HEXADECIMAL SEQUENCE	DESCRIPTION
ESC x yy	1B x yy	Set modes

x	yy	ACTION
1	31	Enable the 25th line.
2	32	Disable key click.
3	33	Enter the hold screen mode.
4	34	Enable block cursor.
5	35	Turn cursor off.
6	36	Enter keypad shifted mode.
7	37	Enter alternate keypad mode.
8	38	Enable automatic line feed when carriage return (CR) is received.
9	39	Enable automatic carriage return when line feed (LF) is received.
3B		Enable solid (nonblinking) cursor.
<	3C	Disable keyboard automatic repeat.
?	3F	Enable key expansion mode.
(k	40	Enable event-driven (key up / down) mode.

Table B-8 (continued): Escape Codes- Configuration

ASCII SEQUENCE	HEXADECIMAL SEQUENCE	DESCRIPTION
ESC y x	1B 79 xx	Reset modes

x	xx	ACTION
1	31	Disable 25th line.
2	32	Enable key click.
3	33	Exit hold screen mode.
4	34	Enable underscore cursor.
5	35	Enable cursor.
6	36	Exit shifted keypad mode.
7	37	Exit alternate keypad mode.
8	38	Disable automatic line feed.
9	39	Disable automatic carriage return.
3B		Enable blinking cursor.
<	3C	Enable keyboard automatic repeat.
?	3F	Disable key expansion mode.
(6>	40	Disable event-driven mode (key up/down).

ASCII SEQUENCE	HEXADECIMAL SEQUENCE	DESCRIPTION
ESC z	1B 7A	Reset to power-up configuration

Table B-9: Escape Codes - Additional Functions

ASCII SEQUENCE	HEXADECIMAL SEQUENCE	DESCRIPTION
ESC Z	1B 5A	Identify as a VT52 terminal (1B 2F 4B).
ESC #	1B 23	Transmit the page.
ESC]	1B 5D	Transmit the 25th line.
ESC ^	1B 5E	Transmit the current line.
ESC _	1B 5F	Transmit the character at the cursor.
[SC i 0	1B 69 30	Identify as Zenith terminal.
ESC m f b	1B 6D xxxx	Set foreground (f) and background (b) colors.

ascii	hex	COLOR
0	30	Black
1	31	Blue
2	32	Red
3	33	Magenta
4	34	Green
5	35	Cyan
6	36	Yellow
7	37	White

ESC {	1B 7B	Enable keyboard.
ESC }	1B 7D	Disable keyboard.
ESC v	1B 76	Enable wraparound at end of line.
ESC w	1B 77	Discard at end of line.

Monitor Program Command Summary

The monitor program can perform several functions. One of its primary uses is the load (boot) the disk operating system from disk into memory. The boot command can automatically be activated (autoboot) when the system is turned on if the switch settings in the computer are set appropriately (see Appendix I). Most factory assembled computers are shipped with autoboot activated.

Table C-1 is a summary of the monitor program commands.

Table C-1: Monitor Program Command Summary

COMMAND	NAME	DESCRIPTION
B	Boot	Use this command to load the operating system from a disk.
C	Color bar	Use this command to display a color bar pattern on the screen.
D	Dump	Use this command to display the contents of a block or portion of memory in hexadecimal and ASCII.
E	Examine	Use this command to examine and/or change the contents of memory location(s).
F	Fill	Use this command to fill a specified range of memory locations with data.
H	Help	Use this command or the HELP key to display the list of monitor program commands.
HELP key	Help	See the H command.
I	Input	Use this command to get the contents of a port.
O	Output	Use this command to sends a value to a port.
S	System	Use this command to display the system parameters (memory size, video RAM devices, video type: color or monochrome).
T	Test	Use this command to activate the diagnostic test menu.
V	Version	Use this command to display the version number of the ROM program installed in your computer.
E	Execute	Use this command to initiate a machine language program at a specified memory address.

The Monitor Program Commands

To use any monitor program command (except for autoboot), the computer must be in the manual mode. If the computer is set for autoboot, press the DELETE key to disable it right after you turn the computer on or reset it. The hand prompt will be displayed when the computer is in the manual mode.

The monitor program commands, like MS-DOS have a specific syntax which must be followed or the command may not be executed as you intend. In the following material, the syntax notation in Table C-2 is used. if you make a mistake when you enter a command, the computer will beep and wait for you to enter the correct syntax.

Table C-2: Monitor Program Syntax Notation

SYNTAX NOTATION	DESCRIPTION
nnnn	A two-byte value that expresses the start segment address.
mmmm	A two-byte value that expresses the start offset address.
oooo	A two-byte value that expresses the end offset address. A single byte.
[...]	Indicates an optional entry.
x | y	Either a choice of *x or y*.

Boot

The boot command is used to load the operating system from a disk. The following line illustrates the form of the command.

B[F1lF2|F3][0|1|2|3][:partition name]

The boot command supports up to four drives of each of the three disk types that are available for the Z-100: 5.25-inch floppy disk drives, 8-inch floppy disk drives, and Winchester disk drives. Note that not all operating systems (this includes MS-DOS) support more than 2 of each type of floppy disk drive.

The following procedure illustrates the use of the boot command.

⌐ Make sure the computer is on and the hand prompt is showing on the screen.

⌐ Press the B key. The computer will display the following.

   Boot

⌐ Use one of the following three procedures to complete the operation.

1. Press the **RETURN** key. The computer will examine switch S101 on the main board and boot from the device selected by switch section 0, 1, and 2 (see Appendix I). If the device is a floppy disk drive, the computer will attempt to boot the system from the disk in drive zero (drive A or drive C).
2. Press either the **F1, F2,** or **F3** key and then the **RETURN** key. The computer will ignore switch S101 and boot from the specified drive type. F1 specifies the 5.25-inch floppy disk drives, F2 specifies the 8-inch floppy disk drives, and F3 specifies the Winchester disk drive. If the device is a floppy disk drive, the computer will attempt to boot the system from the disk in drive zero (drive A or drive C).

   You can boot from any drive by entering the drive number (0, 1, 2, or 3) after specifying the drive type by pressing the F1, F2, or F3 key. Number 0 indicates the first drive, 1 indicates the second drive, 2 indicates the third drive, and 3 indicates the fourth drive. However, MS-DOS supports only two drives for each drive type.

   To boot the computer from the second 8-inch floppy disk drive, press the B key, the **F2** key, the 1 key, and the **RETURN** key, in that order. If the drive specified is not connected or is faulty (for instance, it may not be turned on), an error message will be displayed after about 30 seconds.

3. You can boot the computer from any partition of the Winchester drive by entering the partition name. Like a floppy disk, the partition must contain an operating system on it or the No system message will be displayed. To boot from a partition, press the B key, the **F3** key, the : (colon) key, and enter the partition name. Then press the **RETURN** key.

Color Bar

The color bar command is used to display a color bar pattern on the screen. To execute this command, press the C key. The screen will clear and a color bar pattern will be displayed along the top half of the screen.

Use this pattern to adjust a color monitor that may be attached to your computer.

If your computer does not have a color monitor attached to it, the monochrome display will show a gray-scale pattern with black on the left side of the screen gradually increasing in brightness to white on the right side of the screen.

If your computer does not have the color option installed or selected, a white box will fill the upper-right quarter of the screen.

Dump

The dump command is normally used by machine language programmers to display the contents of a block (256 bytes) or portion of memory in hexadecimal and ASCII. Use the following format for the dump command.

D[nnnn:mmmm-oooo]

It you do not enter the addresses, the computer will display a block of 256 bytes, starting with the last-displayed address (+ 1). When you first turn on the computer, the starting address will be 0:0.

Examine

The examine command is used by machine language programmers to examine and/or change the contents of memory location(s). Use the following format for the examine command.

E[nnnn:mmmm]

When you enter an address, the computer will display the hexadecimal value that is stored at that memory location. If you do not enter a number at this point, but press the RETURN key, no changes to memory are made and the next address and value will be displayed. If you do enter a number, it will be stored in the memory location specified by the displayed address and then the next address and the value stored there will be displayed. To exit the command, press the **DELETE** key.

Fill

The fill command is used by machine language programmers to fill a specified range of memory locations with data. Use the following format for the fill command.

Fnnnn:mmmm-oooo,nn

When you enter this command, the entire memory range will be filled with the hexadecimal byte, *nn.* This command can be used to clear memory (enter 00 for byte value).

Help

This command is used to display the list of monitor program commands. When you press either the H key or the HELP key, the following will be displayed:

Boot

Color Bar

Dump

Examine

Fill

Help

<HELP Key>

Input

Output

System

Test

Version

Xecute

Input

This command is used to retrieve a byte of data at a port. Use the following format to execute the input command.

I*port*

The single byte at port *nn* will be returned as a hexadecimal value.

Output

This command is used to send a value to a port. Use the following format ;to execute the output command.

O*port,nn*

The value *nn* will be sent to the specified *port*.

System

This command is used to display the system parameters (memory size, video RAM devices, and video type: color or monochrome). To use the command, press the S key. The computer will display a message similar to the following.

> 128Kb of contiguous RAM
> 32Kb Video memory
> Monochrome

The memory capacity (RAM) is measured in 64Kb increments. The video memory may be either 32Kb or 64Kb. The video type may be either monochrome (as shown) or color.

Test

This command is used to display the diagnostic test menu. The tests can help you isolate a problem or make sure that the various sections of the computer are operating correctly. To display the test menu, press the T key. The computer will display the following menu.

> CHOOSE ONE OF THE FOLLOWING
>
> 1. DISK READ TEST
> 2. KEYBOARD TEST
> 3. MEMORY TEST
> 4. POWER-UP TEST
> 5. EXIT
>
> ENTER YOUR CHOICE:

Press the key that corresponds to the test you want to run. The following describes each test.

- Disk read test - This test repeatedly reads the boot tracks and writes it into memory. Each time the test is successfully completed, a counter (displayed on the screen) is incremented by one. If an error occurs, the test will stop.

- Keyboard test - This test fills the screen with the character that you enter on the keyboard. If you press a key that does not correspond to a printable character (for instance, if you press the RETURN key or LINE FEED key), the screen will display the message NON-DISPLAYABLE CHARACTER.

- Memory test - This test performs a moving inversion test on the first two banks of memory and the green bank of video memory if 64-kilobit parts are installed. If 32-kilobit parts are installed, a different test is used. If an error occurs, the test is halted. Otherwise, you will hear a tick, which indicates the test is running. The test is rather lengthy and so the counter displayed on the screen will be updated about every five minutes.

- Power-up test - This test repeats the initial self-tests that the computer performs each time it is turned on. The test will continue until an error is detected.

If you want to stop any test, press the **DELETE** key. However, if you are running the memory test, up to five minutes may pass before the system will respond. To stop the memory test in less time, press the **CTRL** and **RESET** keys to reset the computer.

Version

This command is used to display the version number of the ROM program installed in your computer. To use the command, press the V key. The computer will display the version number of the ROM.

Execute

This command is used by machine language programmers to run a machine language program at a specified memory address. The command sets the CS:IP to the address specified and then performs a jump to that address. Once you execute this command, the only way control can be returned to the monitor is by a command from the program being executed or by resetting the computer.

MS-DOS Command Summary

This appendix contains a summary of the control key combinations and commands that are available while you are using MS-DOS on the Z-100 Computer.

In addition, it contains instructions for using these commands if you only have one disk drive in your computer.

Table D-1 is a summary of the control key functions active while using MS-DOS.

Table D-1: Control Key Functions

KEY(S) PRESSED	ACTION
BACK SPACE	Back space and delete character.
CTRL-C	Exit from the current function.
CTRL-N	Disable printer echo.
CTRL-P	Enable printer echo.
CTRL-S	Suspend all operation. Press any key to continue.
CTRL-X	Cancel current line.
LINE FEED	Extend current logical line to next physical line.
RETURN	Execute current command line.
TAB	Move cursor to next tab column.

Command Summary

Table D-2 is a summary of the filename conventions.

Table D-2: File Name Conventions

NAME	DESCRIPTION	EXAMPLES
[...]	Optional parameter	[comment][filename]
<...>	Specified parameter	<filename>
filespec	device with filename	B: BIN\ABODE. MAC
d:	drive name	A: B: C: D:
pathname	name of directory path	BIN\ DEV\ DEVEL\
filename	name of file	MYPROG OLDFILE
|	either/or	ON|OFF

Commands

<filename>.BAT[<parameters>]
>   Execute a file with a.BAT extension as a batch processing file.

APPLY [d:]<filespec><command>[/switch]
>   Execute a given command multiple times, substituting a
>   selected parameter.
>   Switch: /S Silent - suppress the display of command lines
>   executed through the APPLY command.

ASSIGN [<hardware unit:>][<partition name>[<;system name>] d:]
>   Assign a logical drive name to a Winchester disk partition.

BACKUP [filespec[+ filespec ...]] [d :][filename][/switch]
>   Create a single archive file from one or more active files.
>   Switches: /A Back up files with date after that specified.
>   /B Back up files with date before that specified.
>   /D Display (as a directory) all master backup
>   files.
>   /E Back up files except those specified.
>   /F Format destination disks automatically.
>   /G Backup files in all subdirectories as well as
>   the current directory.
>   /L List directory of the backup file.
>   /N Do not format destination disks.
>   /0 Query yes/no for each file to be backed up.
>   /R Review selected files before backing them up.
>   /T Back up files with current system date.
>   /V Verify backup files after copy.
>   /W Back up files that have been written since
>   last backed up.

BREAK [ONIOFF]
>   Turn on or off "check for CTRL-C" whenever system access is
>   performed.

CD
>   See CHDIR.

CHDIR [d:][pathname]
Change or display the current directory.

CHKDSK [d:][filename][/switch]
Examine directory and file allocation table and report status.
Switches /F Fix any common disk errors.
/V   Display status messages and disk directory.

CIPHER <keyword> >j< filespec[1] [> filespec[2]]
Encrypt or decrypt a file.

CLS
Clear the screen.

COMMAND [d:][pathname][ctty device][/switch]
Execute the command processor.
Switches: /C Execute specified string as a command.
/D Disable time and date prompt.
/P Place COMMAND.COM in system memory.

CONFIGUR
Configure system input/output parameters.

COPY <filespec> [d :] <filenamelpathname>[/switch]
Copy one or more files.
Switches: /V Verify copy operation.

CREF
Build a cross reference file.

CTTY <device>
Change command input/output device to AUX or CON.

DATE [M/D/Y]
Display and/or change current system date.

DEBUG
Activate the debugging utility.

DEL
    See ERASE.

DIR [d:][<filespec>l<pathname>][/switch]
    Display all or selected entries of the current or specified directory.
        Switches: /P Page mode.
                      /W Wide display mode.

DISKCOMP [d: [d:]]
    Compare two disks.

DISKCOPY[/switch] [d: [d:]]
    Duplicate a disk.
        Switch: /V Verify duplication operation.

ECHO [ON |OFF| message]
    Control display during batch processing.

EDLIN
    Create and maintain ASCII text file.

ERASE <filespec>l<[d:]<pathname>[\<filespec>]
    Delete (erase) one or more files/paths.

EXE2BIN <filespec> [filespec]
    Convert.EXE file to binary format (.COM).

EXIT
    Exit the command processor to previous level.

FC[/switch] <filespec1 > <filespec2>
    Compare two files.
        Switches: /B Binary comparison.
                      /C Ignore upper- and lowercase differences.
                      /# Number of lines to be compared for a match.
                      /W Compress white space.

FIND[/switch] string [filespec...]
    Search for a string in one or more files.
        Switches: /C Count lines (display number of lines that have
                        string).
                        /I Ignore upper- and lowercase differences.
                        /N Display line number(s) where string was
                        found.
                        /V Display lines that do not have string.

FONT [filespec]
    Enable font editor or load alternate character set.

FOR ... IN ... DO ...
    Loop processing feature of batch processor.

FORMAT [d :][/switch]
    Formats disk surface.
        Switches: /A Format 8-inch disk as single-sided, single-
        density
                        /C Do not format disk, but initialize directory only
                        /9 Format 5.25-inch disks using 9 sectors per
                        track
                        /M Format disk as single-sided
                        /N Suppress operator prompts
                        /S Record system files on disk
                        /V Verify format and lock out bad sectors

GOTO ...
    Unconditional branch feature of batch processor.

IF [NOT]
    Conditional feature of batch processor.

LIB
    The library manager.

LINK
    Creates executable files from object code.

MAP [d:u [...]]
    Reassign logical drive names to different physical drive.

MD
    See MKDIR

MKDIR [d:]pathname
    Create a directory.

MORE
    Send output one screen at a time.

PATH [d:][pathname[;[d:]pathname]...]
    Specify directory or directories to be searched to execute external MS-DOS
    commands.

PAUSE [comment]
    Suspend action of batch processor.

PRINT <filespec[/switch]> [filespec[/switch]]...
    Initiate background printing of file(s).
        Switches: /A Do not print specified files in the queue until /S is encountered.
                         /Cn Print n copies of specified file(s).
                         /F Form feed at end of specified file(s.)
                         /Ln Set left margin to n.
                         /Pn Set page length to n.
                         /Rn Set right margin to n.
                         /S Turn spooler back on (after /A switch).
                         /T Terminate printing.

PROMPT [$][text]
    Change MS-DOS system prompt.

PSC[printer name]
    Load screen dump utility into memory.

RDCPM [DIR d:[filespec][/switch]<filespecl >[filespec2][/switch]
    Read CP/M directories or copy CP/M files to MS-DOS.
        Switch: /Z Copy from Zenith CP/M formatted disk.

RECOVER d:|filespec
    Recover file(s) that have been erased or deleted from the disk.

REM [remark]
     Display message during batch processing.

REN
     See RENAME.

RENAME <filespec> <filename> Rename a file.

RESTORE [filespec[filespec[+filespec...]]][/switch]
     Restore archived files.
          Switches: /A Restore files with date after that specified.
                        /B Restore files with date before that specified.
                        /D Display all archive files.
                        /E Do not restore specified files.
                        /F Restore all files to current directory.
                        /L List directory of archive file contents.
                        /M Restore files to specified drive.
                        /0 Overwrite existing files on destination disk.
                        /Q Query yes/no for each file in archive file to be
                        restored.
                        /R Review selected files.
                        /T Restore only files with current system date.
                        /V Verify files after restoration.

RD
     See RMDIR.

RMDIR [d:]pathname
     Remove specified directory.

SEARCH [filespec][/switch]
     Locate a file.
          Switches: /C Search current directory only.
                        /D List directories as they are searched.
                        /T Display directory structure as searched.

SET [string = (string = string]
     Set one string equivalent to another.

SHIFT
    Allows more than 10 parameters in batch processor.

SORT [/switch]
    Displays results in sorted order.
        Switches: /R   Reverse order (Z to A).
                      /+n Start sort key at column n.

SYS d:
    Transfer MS-DOS system files from default drive disk to destination disk.

TIME [h:m:s.c]
    Display and/or change current system time.

TYPE <filespec>
    Display contents of specified file.

VER
    Display the version numbers of MSDOS.SYS and IO.SYS.

VERIFY [ON|OFF]
    Display or change condition of verify function.

VOL [d:]
    Display volume name of disk in default or specified drive.

MS-DOS With Single Drive Computers

In the "Disk Operating System" chapter of this manual, we explained in detail how to use some of the MS-DOS commands with computers that have two disk drives. If your system has only one floppy disk drive, there are some things you need to know.

- All instructions are identical for single-drive and two-drive systems.
- Your computer "thinks" it has two 5.25-inch floppy disk drives even if it has only one.
- You will be prompted by your computer to swap disks whenever necessary.

As long as you remember that you must insert the proper disk into the single 5.25-inch disk drive when prompted, everything will be fine. If you insert the wrong disk, you may have problems (such as incomplete copies and/or damaged files).

The two prompts you will see follow.

>   Place disk B in drive A.   Place disk A in drive A.
>   Press any key when ready.   Press   any   key   when
>   ready.

Any command that can access more than one drive will be affected. These commands include: DIR, RENAME, ERASE, COPY, TYPE, CHKDSK, FORMAT, and DISKCOPY.

A sample of handling the DISKCOPY command to duplicate a disk follows. The computer will show the following, after you turn it on and boot MS-DOS.

>   A>

⌐
‾ Enter the following command line.

DISKCOPY/V A: B:

⌐
‾ Press the **RETURN** key. The computer will read the utility into memory from the disk. Then, it will show a display similar to the following.

>   DISKCOPY version 2.20
>   Copyright(C) 1984 Zenith Data Systems Corporation
>
>   Place source disk in drive A and destination disk in drive B.
>   Press RETURN when ready.

⌐
‾ Since you don't have drive B, place the source disk in your only drive and press the **RETURN** key. The computer will display a message similar to the following.

>   Formatting destination... Place disk B in drive A.
>   Press any key when ready.

☐ Remove the source disk from your disk drive.

☐ Insert the destination disk in the drive and press any key (most people use the RETURN key). After about a minute, the computer will display the following message.

Copy... Place disk A in drive A. Press any key when ready.

☐ Now remove your destination disk and insert your source disk in the disk drive and press any key. The computer will sound a tone and display the following message.

   Place disk B in drive A. Press any key when ready.

☐ Swap disks and press any key. Again the computer will sound a tone and display the message to exchange disks.

Here is what is happening: the computer is reading sections of the source disk into memory. When it has finished reading a section of the source disk, the computer will attempt to write (record) that same information onto the destination disk. Since you have only one drive, the computer senses this and prompts you to exchange disks. You must exchange disks because the operating system will not check to make sure you did.

☐ Swap disks each time the computer prompts you to exchange disks. After you have swapped disks all of the times needed to duplicate the disk, the computer will start the verification process. Again, it will prompt you to swap disks as it reads the contents of each disk and compares them to make sure that they are the same. When the entire process is finished, the computer will return you to the operating system prompt.

The operation is complete. If you want to copy a file which contains a lot of information or if you want to copy more than one file, you will be prompted to change disks more than once.

If your computer has one 5.25-inch disk and either 8-inch disks or a Winchester disk system, you may want to use the larger-capacity systems as a temporary storage device when you duplicate 5.25-inch disks. If this is the case, you must use the FORMAT and COPY commands instead of the DISKCOPY command. DISKCOPY will not duplicate disks that do not have the same physical characteristics.

BASIC Command Summary

This appendix contains a summary of Z-BASIC and GW-BASIC, version 2. Included are the control characters, commands, statements, functions, and characteristics for these two versions of BASIC.

Table E-1 provides a list of the control character combinations recognized by BASIC.

Table E-1: Control Characters

CONTROL CHARACTER	Z-BASIC	GW-BASIC	DESCRIPTION
CTRL-A	x	n/a	Prints the last line entered (not including the line number).
CTRL-B	x	x	Moves the cursor one word to the left.
CTRL-C	x	x	Interrupts program execution and returns control to the BASIC command level.
CTRL-E	x	x	Erases line from cursor to the end of the line.
CTRL-F	x	x	Moves the cursor one word to the right.
CTRL-G	x	x	Sounds a tone from the speaker.
CTRL-H	x	x	This combination has the same action as the BACK SPACE key. It moves the cursor one position to the left and deletes the character.
CTRL-I	x	x	This combination has the same action as the TAB key. It moves the cursor to the next tab stop (every eighth column).
CTRL-J	x	x	This combination has the same action as the LINE FEED key. It acts as a continuation of the logical line, but starts subsequent text at the beginning of the next physical line.
CTRL-L	x	x	This combination has the same action as the CLS statement. The screen is cleared and the cursor is moved to the home position (location 1,1).
CTRL-M	x	x	This combination has the same action as the RETURN key. Any direct statement will be executed and any indirect statement (program line) will be saved.
CTRL-N	x	x	Moves the cursor to the end of the current program line.
CTRL-P	n/a	x	Toggles printer echo on or off.
CTRL-R	n/a	x	This combination has the same action as the INS LINE key. The insert mode is toggled on or off.
CTRL-S	x	x	Suspends program execution.
CTRL-T	x	x	Toggles the display of the function keys on the 25th line.

Table E-1 (continued): Control Characters

CONTROL CHARACTER	Z-BASIC	GW-BASIC	DESCRIPTION
CTRL-Q	x	x	Resumes program execution after being suspended by CTRL-S.
CTRL-W	x	x	Deletes the word at the current cursor position.
CTRL-U	x	n/a	Deletes the line that is currently being typed.
CTRL-X	n/a	x	Displays the previous program line.
CTRL-Y	n/a	x	Displays the next line.
CTRL-Z	x	x	Clears from the current cursor position to the end of the screen.
(CTRL-RESET	x	x	Resets the computer. This reset cannot be disabled by disabling the keyboard.
Left arrow	x	x	Moves the cursor one character to the left.
Right arrow	x	x	Moves the cursor one character to the right.
Up arrow	x	x	Moves the cursor up one line.
Down arrow	x	x	Moves the cursor down one line.
HOME	x	x	Moves the cursor to the home position.
I CHR	x	n/a	Toggles insert mode on/off.
INS	n/a	x	Toggles insert mode on/off.
D CHR	x	n/a	Deletes character at cursor position.
DELETE	x	n/a	Deletes character at cursor position.
DEL	n/a	x	Deletes character at cursor position.
BACKSPACE	x	x	Deletes character to left of cursor.
TAB	x	x	Moves cursor to next tab column.

Table E-2: Variable Specifications

VARIABLE TYPE	RANGE	NUMBER OF DIGITS	EXPONENTIAL FORM	VARIABLE DECLARATION SYMBOL
Integer	-32768 to 32767	n/a	n/a	&
Single precision	10E-38 to 10E + 38	7 (printed) 6 (stored)	E	!
Double precision	10D-38 to 10D + 38	17 (printed) 16 (stored)	D	#
String	n/a	255	n/a	$

Hexadecimal prefix &H
Octal prefix: &O

Table E-3: Arithmetic Operators

OPERATOR	DESCRIPTION
^	Exponentiation
-	Negation
*	Multiplication
/	Floating point division
\	Integer division
MOD	Modulus arithmetic
+	Addition
-	Subtraction

Table E-4: Relational Operators

OPERATOR	DESCRIPTION
=	Equality
<>	Inequality
<	Less than
>	Greater than
< =	Less than or equal to
> =	Greater than or equal to

Table E-5: Logical Operators

OPERATOR	EXAMPLE	DESCRIPTION
AND	A AND B	The logical product of A and B. A AND B has the value of true only if A and B are both true. A AND B has the value of false if either A or B is false.
EQV	A EQV B	A is logically equivalent to B. A EQV B is true if A and B are both true or both false; otherwise, A EQV B is false.
IMP	A IMP B	The logical implication of A and B. A IMP B is false if and only if A is true and B is false; otherwise, the value is true.
NOT	NOT A	The logical negative is A. If A is true, NOT A is false.
OR	A OR B	The logical sum of A and B. A OR B has the value of true if either A or B is true. A OR B has the value of false if both A and B are false.
XOR	A XOR B	The logical exclusive OR of A and B. A XOR B is true if either A or B (but not both) is true; otherwise, A XOR B is false.

Table E-6: Truth Table for Logical Operators

X	Y	NOT X	X AND Y	X OR Y	X XOR Y	X IMP Y	X EQV Y
1	1	0	1	1	0	1	1
1	0	0	0	1	1	0	0
0	1	1	0	1	1	1	0
0	0	1	0	0	0	1	1

Table E-7: BASIC Color Attributes

COLOR NUMBER	COLOR
0	Black
1	Blue
2	Green
3	Cyan
4	Red
5	Magenta
6	Yellow
7	White

Table E-8: String Operators

OPERATOR	DESCRIPTION
+	Concatenation Equality
< > Inequality	Less than Greater than
=	Less than or equal to
=	Greater than or equal to

Table E-9: Arrays

SPECIFICATION	Z-BASIC	GW-BASIC
Number of dimensions	255	255
Number of elements/dimension	32766	32767

BASIC Commands, Functions, and Statements

In the following summary, variables are represented by X, Y, Z, and the variable declaration symbol where used.

ABS(X)
    A function that returns the absolute value of X.

ASC(X$)
    A function that returns the first character in the string as an ASCII value.

ATN(X)
    A function that returns the arctangent of X, a value in radians.

AUTO [line#], [increment]
    A command that enables automatic line numbering.

BEEP
    A statement that causes a tone to be sounded from the speaker.

BLOAD filespec [,memory location (offset)]
    A command that loads a memory image file into memory.

BSAVE filespec, memory location (offset), file length
    A command that saves a portion of memory onto disk.

CALL X [argument(s)]
    A statement that executes a machine language program.

CDBL(X)
    A function that returns the double-precision value of X.

CHAIN [MERGE] filespec [,[line number][,ALL][,DELETE range]
    A statement that loads another program into memory and allows variable values to be passed.

CHDIR pathname
> A statement that changes the directory of the default disk (GW-BASIC only).

CHR$(X)
> A function that converts the value X to the equivalent ASCII character.

CINT(X)
> A function that converts the value X to an integer value after rounding the decimal portion.

CIRCLE(X,Y),radius[,color[,start, end[,aspect]]]
> A statement that draws a circle with a center point of X,Y and the radius, color, starting and ending points, and aspect ratio specified in the parameters.

CLEAR[,[high memory (Z-BASIC)|work space (GW-BASIC)][,stack space]]
> A statement that initializes variables, sets the high memory location for Z-BASIC or the work space size for GW-BASIC, and sets the stack space for the BASIC interpreter (default is 256 bytes in Z-BASIC and 512 bytes in GW-BASIC).

CLOSE [file number(s)]
> A statement that closes opened files.

CLS
> A statement that clears the screen and moves the cursor to the home position (location 1,1).

COLOR [foreg round][, background]
> A statement that allows you to change the foreground and background colors (see Table E-7).

COM(n) ON|OFF|STOP
> A statement that enables or disables the trapping of communication activity at the specified port.

COMMON variable(s)
> A statement that passes variables to a program that has been chained to the current program.

CONT
  A command that allows a halted program (where execution has been suspended by a STOP statement or the CTRL-C key combination) to be continued.

COS(X)
  A function that returns the cosine of X, a value in radians.

CSNG(X)
  A function that returns the single-precision value of X.

CSRLIN
  A function that returns the current row (line) location of the cursor.

CVD(X$)
  A function that returns the double-precision numeric value of the eightbyte string X$.

CVI(X$)
  A function that returns the integer numeric value of the two-byte string X$.

CVS(X$)
  A function that returns the single-precision numeric value of the fourbyte string X$.

DATA constant(s)
  A statement that stores constant values which may be read by the READ statement.

DATE
  A function that returns the day of the year currently stored in the computer (Z-BASIC only).

DATE$[= X$]
  A statement that sets or retrieves the date stored in the computer.

DEF FNname[(arguments)] = expression
  A statement that names and defines a function.

DEF SEG[=segment]
> A statement that assigns a memory segment for used by
> BLOAD, BSAVE, CALL, USR, PEEK, and POKE.

DEF USRn = memory location
> A statement that assigns a memory location in the segment for
> a machine language routine.

DEFDBL variable(s)
> A statement that declares variables as double-precision.

DEFINT variable(s)
> A statement that declares variables as integers.

DEFSNG variable(s)
> A statement that declares variables as single-precision.

DEFSTR variable(s)
> A statement that declares the variables as strings.

DELETE[line number][-line number]
> A command that deletes the specified line number(s).

DIM variable(s)
> A statement that sets up limits for arrays.

DRAW X$
> A statement that draws the pattern specified in X$. Refer to
> Table E-1 0 for a description of the directions recognized by
> the DRAW statement. The distance moved, indicated by *n in*
> the table, is determined by the scale factor.

Table E-10: Directions Recognized by the DRAW Statement

LETTER	DESCRIPTION
U*n*	Move up *n* places.
D*n*	Move down *n* places.
L*n*	Move left n places.
R*n*	Move right n places.
E*n*	Move up and right n places.
F*n*	Move down and right *n* places.
G*n*	Move up and left *n* places.
H*n*	Move up and right *n* places.
M*x,y*	Move ±x places and ±*y* places (absolute or relative).
A*ang/e*	Set angle; 0 = 0 degrees, 1 = 90 degrees, 2 = 180 degrees, 3 = 270 degrees.
B	Move but do not plot any points (invisible movement).
N	Move but return to original starting position. C*n* Set color to *n*
S*n*	Set scale factor to *n*. This factor is multiplied with the movement number to obtain the actual distance (in pixels) moved.
X	string Execute substring.
T*An*	Turn the angle ±*n* degrees (range is ± 360 degrees). *GW-BASIC* only.
P*c,b*	*Fill* the figure with the color c, bordered by the color *b*.

EDIT line number |.
 A command that displays the specified line for editing. Refer to Table E-1 for the control characters that are used to edit BASIC program lines.

ELSE
 A statement that is part of the IF ... THEN ... ELSE statement.

END
 A statement that terminates program execution.

ENVIRON parameter
 A statement that modifies the MS-DOS through the GW-BASIC environment string table (GW-BASIC only).

ENVIRON$ parameter
 A function that returns the contents of the GW-BASIC environment string table (GW-BASIC only).

EOF(file number)
A function that returns a true (-1) if the end of file marker has been reached.

ERASE array name(s)
A statement that erases arrays.

ERDEV
A function that returns the numeric value representing an error which has occurred in a device (see ERDEV$). GW-BASIC only.

ERDEV$
A function that returns the name of the device in which an error has occurred. (see ERDEV). GW-BASIC only.

ERL
A function that returns the line in which an error has occurred (see ERR).

ERR
A function that returns the numeric value representing an error which has occurred (see ERL).

ERROR X
A statement that simulates an error, the value of which is X.

EXP(X)
A function that returns the exponential value of X.

FIELD #n, nn as X$
A statement that allocates buffer space for local variables.

FILES X$
A statement that will list the file(s) on the (default) disk.

FIX(X)
A function that returns the truncated integer value of X.

FOR X = n1 TO n2 [STEP n3]...NEXT X
Statements (FOR and NEXT) that provide for a repetitive execution loop.

FRE(0)
> A function that returns the number of bytes of unused memory recognized by BASIC.

GET *n,* record number
> A statement that retrieves a record from a disk file or, in GW-BASIC only, a communications file, and places it in a buffer.

GET (XI,Y1)-(X2,Y2),X
> A statement that moves a screen image to an array.

GOSUB line number ... RETURN
> Statements that control branching to a subroutine and return to the main program.

GOTO line number
> A statement that unconditionally branches to another part of the program being executed.

HEX$(X)
> A function that returns the hexadecimal value of X.

IF expression THEN ... ELSE...
> A statement that provides a conditional branch or execution of the program.

INKEY$
> A function that returns a character from the keyboard buffer.

INP(port)
> A function that returns a byte from the port.

INPUT[prompt;|,]variable...
> A statement that accepts data from the keyboard.

INPUT$(X[,Y])
> A function that returns X characters from the keyboard or file Y.

INPUT #*n*
> A statement that retrieves data from sequential file *n.*

INSTR([nn,]X$,Y$)
>A function that returns the first location of Y$ in X$, starting at nn.

INT(X)
>A function that returns the largest integer of X.

IOCTL #n,X$
>A statement that sends control data (X$) to a file device (GW-BASIC only).

IOCTL$ #n
>A function that returns control data (X$) from a file device (GW-BASIC only).

KEY[n,X$]j[LISTjONjOFF]
>A statement that sets or displays the programmable function keys.

KEY(n) ON|OFF|STOP
>A statement that enables or disables branching when a function key is pressed.

KILL filespec
>A command that deletes the specified file(s) from the disk.

LEFT$(X$,nn)
>A function that returns the left nn character(s) of X$.

LEN(X$)
>A function that returns the number of characters in X$.

[LET]variable = expression
>A statement that assigns the value of the expression to the variable.

LINE [(X1,Y1)]-(X2,Y2)[,color][,Box][Fill]][,mask]
>A statement that draws a line, square, or box. Mask is only available in GW-BASIC.

LINE INPUT[prompt;j,]X$...
>A statement that accepts data from the keyboard.

LINE INPUT #n,X$
    A statement that reads data from a sequential file.

LIST [line number][-[line number]]
    A command that lists the program or specified lines to the screen.

LLIST [line number][-[line number]]
    A command that lists the program or specified lines to the printer.

LOAD filespec[,R]
    A command that loads (and executes, with the R parameter) a
    program from disk.

LOC(n)
    A function that returns the current position in the specified file.

LOCATE [row][, [column][,cursor on/off]]
    A statement that positions the cursor to the designated row and
    column.

LOF(n)
    A function that returns the number of bytes allocated to the
    specified file.

LOG(X)
    A function that returns the natural logarithm of X.

LPOS(n)
    A function that returns the current position of the print head.

LPRINT expression(s)
    A statement that sends data to the printer.

LPRINT USING A$;X
    A statement that sends formatted data to the printer.

LSET A$ = expression
    A statement that assigns data in the expression to A$.

MERGE filespec
    A command that merges a program from disk with the one in
    memory.

MID$(X$,i,nn)
>A function that returns the string of *nn* characters starting at i in X$.

MID$(X$,nn,i) =Y$
>A statement that replaces *nn* characters of X$ starting at i with Y$.

MKDIR pathname
>A statement that creates a directory on the specified disk (GW-BASIC only).

MKD$(X)
>A function that returns the eight-byte string representation of the doubleprecision variable X.

MKI$(X)
>A function that returns the two-byte string representation of the integer variable X.

MKD$(X)
>A function that returns the four-byte string representation of the singleprecision variable X.

NAME oldfile AS newfile
>A statement that renames the disk file oldfile with the name newfile.

NEW
>A command that deletes the program in memory.

NULL *nn*
>A statement that sets *nn* nulls to be printed at the end of each line (Z-BASIC only).

OCT$(X)
>A function that returns the octal value of X.

ON COM(n) GOSUB line number
>A statement that transfers program control to a subroutine when a communication channel is active.

ON ERROR GOTO line number
    A statement that enables error trapping to a subroutine.

ON expression GOSUB line number(s)
    A statement that evaluates the expression and transfers program
    control to the subroutine(s).

ON expression GOTO line number(s)
    A statement that evaluates the expression and transfers program
    control to the line(s) specified.

ON KEY(n) GOSUB line number
    A statement that enables key trapping and transfers program
    control to a subroutine when the specified function key is
    pressed.

ON PEN GOSUB line number
    A statement that enables program control transfer to a
    subroutine when the light pen is activated (GW-BASIC only).

ON TIMER (n) GOSUB line number
    A statement that transfers control to the subroutine after n
    seconds (GW-BASIC only).

OPEN "mode",n,"device filespec"[,record length]
    A statement that opens a file for input and/or output.

OPEN "device filespec" [FOR mode] AS n [LEN = record length]
    A statement that opens a file or device for input and/or output.

OPEN "COMn:[speed][,[parity][,[word size][,[stop bits]]]][,
  LF][,ASC]"AS n [LEN = record length]
    A statement that opens a communication channel for input and
    output.

OPTION BASE n
    A statement that sets the minimum value for array subscripts (0
    or 1).

OUT port,byte
    A statement that sends a byte to a port.

PAINT (X,Y)[,[color][,border]
    A statement that fills an area starting at X,Y with the specified
    color and limited by a border of the specified color. This
    statement, in GW-BASIC only, permits paint tiling.

PEEK (memory location)
    A function that returns the byte at the specified memory location.

PEN(n)
    A function that returns the light pen coordinates or status
    (GW-BASIC only).

PEN ON|OFF|STOP
    A statement that enables or disables the PEN function and
    trapping routines (GW-BASIC only).

PMAP(point coordinate,n)
    A function that maps physical coordinates to world
    coordinates or vice versa (GW-BASIC only).

POINT(X,Y)|(n)
    A function that returns the color of the specified point or the
    current coordinate(s).

POKE memory location,byte
    A statement that places the specified byte into the specified
    memory location.

POS(0)
    A function that returns the current column position of the cursor.

PRESET(X,Y)[,color]
    A statement that resets the point at the specified coordinates to
    the background or specified color.

PRINT expression(s)
    A statement that sends data to the screen.

PRINT USING A$;X
    A statement that send formatted data to the screen. Table E-1 1
    contains the descriptions of the field specifiers.

Table E-11: USING Field Specifiers

FIELD SPECIFIER	DESCRIPTION
!	Prints the first character of the string.
\nnn\	Prints two + nnn characters of the string.
&	Prints the entire string.
#	Specifies a digit location.
.	Specifies the decimal point location.
+	Prints the sign if negative or positive. This symbol also specifies the location of the sign (either preceding or following the value).
-	Prints the sign, only if negative, following the value.
**	Fills leading spaces with asterisks.
$$	Prints the leading dollar sign.
*$	Prints a leading dollar sign and fills the remaining leading spaces with asterisks.
,	Prints a comma to the left of every third digit on the left side of the decimal point.
^ ^ ^ ^	Specifies exponential format.
_	Specifies that the next character is a literal character.

PRINT n,X

A statement that sends data to a sequential file.

PRINT n, USING A$,X

A statement that sends formatted data to a sequential file. See Table E-1 1 for the field specifiers.

PSET (X,Y)[,color]

A statement that sets a point at coordinates X,Y to the specified color.

PUT n, record number

A statement that records data from buffer n to the specified disk record number or to a communications device (record number then specifies the number of bytes).

PUT (X1,Y1)-(X2,Y2),X,verb

A statement the transfers an image stored in memory to the screen. The verbs that may be used with this command are described in Table E-12.

Table E-12: Image Transfer Action Verbs

VERB	DESCRIPTION
PSET	Transfer the image verbatim (without any modification).
PRESET	Transfer the image and make it negative. Bit values are inverted.
AND	Transfer those portions of the stored image that exist in the existing image.
OR	Superimpose the stored image onto existing image.
XOR	Used for animation. It causes the points on the screen to be inverted where a point exists in the array image. When XOR is used to put an image on a complex background *twice,* the background is restored intact.

RANDOM IZE(X|TIMER)

A statement that seeds the random number generator. The timer function is available only under GW-BASIC.

READ variable(s)

A statement that reads and assigns values (from corresponding DATA statements) to variables.

REM remark(s)

A statement that allows a remark to be placed in the middle of a program. The single quote mark may be used in place of the REM statement. Remarks that fall in a program line must be the last statement in that line.

RENUM new number, old number, increment

A command that will renumber the lines of the program in memory.

RESET

A command that will close all open disk files and update the disk directory. This command is intended to be used on a system before the disk is removed from the disk drive.

RESTORE [line number]

A statement that will reset the data pointer to the beginning or a specified line in the DATA statements.

RESUME[0|NEXT|line number]
> A statement that transfers program control: to the statement that caused the error; to the statement immediately following that which caused the error; or to the specified line number.

RETURN[line number]
> A statement that transfers program control from a subroutine back to the main program or to the specified line.

RIGHT$(X$,nn)
> A function that returns the right *nn* characters of X$.

RMDIR path name
> A statement that removes the specified directory from the disk (GW-BASIC only).

RND[(X)]
> A function that returns a random number between 0 and 1.

RSET A$ = expression
> A statement that assigns data in the expression to A$.

RUN filespec[,R] [line number]
> A command that loads and executes a program stored on disk (the R option causes the files to remain open) or executes the program currently in memory, optionally starting at the specified line number.

SAVE filespec[,A|,P]
> A command that saves the program currently in memory. The A option saves the program in ASCII format. The P option saves the program as a protected program.

SCREEN (X,Y[,n])
> A function that returns the ASCII code that represents the character at the location X,Y. If *n is* specified, the color attribute of the character is returned instead.

SCREEN graphics mode, video mode
> A statement that sets screen attributes on or off. The graphics
> mode can be set to display Z-19 graphics, the video mode can
> be set to reverse video.

SGN(X)
> A function that returns the sign of X.

SHELL [command]
> A statement that allows another program to be executed (from
> DOS). GW-BASIC only.

SIN(X)
> A function that returns the sine of X, which must be expressed
> in radians.

SPACE$(nn)
> A function that returns a string of *nn* spaces.

SPC(nn)
> A function that returns *nn* blanks (to be printed).

SQR(X)
> A function that returns the square root of X, which must be
> greater than or equal to zero.

STOP
> A statement that halts program execution. Program execution
> may be continued with the CONT command.

STR$(X)
> A function that returns the string representation of X.

STRING$(nn,X|X$)
> A function that returns *nn* characters of the ASCII code X or X$.

SWAP variable 1, variable 2
> A statement that exchanges the values of variable 1 with the
> value of variable 2. The two variables must be of the same type.

SYSTEM
> A command that returns control to MS-DOS (the operating system).

TAB(nn)
> A function that positions the cursor or print head to the column *nn* when used with PRINT or LPRINT.

TAN(X)
> A function that returns the tangent of X, which must be in radians.

THEN...
> A part of the IF ... THEN ... ELSE statement, a conditional branch and/or execution statement.

TIME
> A function that returns the number of seconds that have elapsed since the current date started (midnight). Z-BASIC only.

TIMER
> A function that returns the number of seconds that have elapsed since the current date started (midnight). GW-BASIC only.

TIMER ON|OFF|STOP
> A statement that enables or disables timer event trapping (GW-BASIC only).

TIME$[= X$]
> A statement that sets or retrieves the current system time.

TRON
> A command that turns the program tracer on.

TROFF
> A command that turns the program tracer off.

USR[n](arguments)
> A function that calls a machine language routine.

VAL(X$)
> A function that returns the numeric value of X$.

VARPTR(variable |file number)
    A function that returns the memory location of the specified
    variable or file buffer.

VARPTR$(variable)
    A function that returns the memory location of the specified
    variable as a three-byte string (GW-BASIC only).

VIEW([[SCREEN][(X1,Y1)-(X2,Y2)[,[color][,[border]]]]])
    A statement that sets the parameters of a viewport, to which
    window contents will be mapped (GW-BASIC only).

VIEW PRINT [top screen line TO bottom screen line]
    A statement that sets the text screen area (GW-BASIC only).

WAIT port,X,Y
    A statement that suspends program execution until the input
    port meets the specified parameters.

WEND
    The end statement for a WHILE ... WEND loop.

WHILE ... WEND
    Statements that set the parameters and boundaries of a program
    loop.

WIDTH [device,|file number,]nn
    A statement that sets the limit to *nn* (columns) of a device. The
    only recognized device in Z-BASIC is LPRINT. GW-BASIC
    recognizes LPT1:, COM1:, and files.

WINDOW [[SCREEN][(X1,Y1)-(X2,Y2)]
    A statement that sets the coordinates of the screen (referred to
    as world coordinates). GW-BASIC only.

WRITE [expression][,|; expression]
    A statement that sends data to the screen.

WRITE #n,X
    A statement that send data to a sequential file.

System Configuration

The Z-100 Computer may be connected to many different types of printers, modems, and other devices which make use of either a Centronics-type parallel signal or RS-232 serial signals. This appendix will show you how to use the MS-DOS CONFIGUR utility to make your computer ready for use with different devices.

CONFIGUR will guide you through each phase of selecting the necessary operating conditions for your computer when it is used with printers, modems, and disk drives. If you are configuring a printer, you will need to determine the type of interface (parallel or serial) being used by the printer. The printers and other devices supported directly by CONFIGUR are listed in Table F-1.

Table F-1: Devices Directly Supported by CONFIGUR

PARALLEL OR SERIAL	DEVICE NAME AND MODEL	COMMUNICATIONS PROTOCOL
Parallel[1]	Diablo 930	Centronics-type parallel interface.
Parallel	Epson MX-80	Centronics-type parallel interface.
Serial	QUME Sprint 11	4800 baud, DTR positive (pin 20).
Serial	Epson MX-80	4800 baud, DTR positive (pin 20).
Serial	Heath H-25 and H-125	4800 baud, RTS positive (pin 4).
Serial	Zenith Z-25 and Z-1 25	4800 baud, RTS positive (pin 4).
Serial	Heath H-14 and WH-24	4800 baud, RTS negative (pin 4).
Serial	Diablo 630	1200 baud, ETX/ACK.
Serial	Diablo 1640	1200 baud, ETX/ACK.
Serial	Diablo 620	300 baud, ETX/ACK.
Serial	Heath/Zenith WH-23 modem	300 baud, no handshaking.
Serial	Heath/Zenith WH-33 modem	300 baud, no handshaking.
Serial	Heath/Zenith WH-34 modem	300 baud, no handshaking.
Serial	Heath/Zenith WH-1 2 Votrax Type-N-Talk	4800 baud, RTS positive (pin 4).

1. Most devices that use a Centronics-type parallel interface are supported by this configuration without further modification. However, some parallel devices not sold by Zenith Data Systems may require special communications protocol not supported by the Z-100.

If your peripheral is not listed in the table, you will need to determine whether it can be configured to match one of the devices listed. Otherwise, you will need to determine the type of interface (parallel or serial) you will be using and if you are using a peripheral that requires serial communications, you will need to know the baud rate, parity status, number of stop bits, word length, and handshaking information.

NOTE: Some peripherals (not sold by Zenith Data Systems Corporation or Heath Company) may require making a custom cable for proper operation.

The CONFIGUR Utility

The CONFIGUR utility that is included with Zenith Data Systems' MS-DOS version 2 for the Z-100 makes use of a number of menus and displays. This appendix has been laid out by display screen, with appropriate instructions to guide you to the next screen according to each selection you make.

To use the CONFIGUR utility, enter the following command line.

CONFIGUR

Press the **RETURN** key. Your computer's screen will clear and then show a display similar to Display 1. Proceed to Display 1.

Display 1

CONFIGUR version 2.20
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Use one of the following options to configure a device.

Options	Current settings
A. Configure PRN device	**(J1,4800,RTS Pos,1 Stop Bit,8 bit word)**
B. Configure AUX device	**(J2,9600,1 Stop Bit,8 bit word)**
C. Configure CON device	**(System CRT)**
D. Configure Disk step rate	**(A: = 30,B: = 30,C: = 15,D: = 15)**

E. Exit with no changes
Enter your selection (A-E):

The PRN device is the printer, which may require either serial or parallel signals; the AUX device is for serial communications, which may include a second printer or other peripheral; the CON device is the system console, including keyboard and display. Note that the CON device may be routed to a remote display or printing terminal, providing remote control of the computer. Likewise, you may configure the disk step rate, which is the speed that is allowed by the system for the disk drives to move the read/ write head from one track to the next.

You will also note the current configuration is shown opposite the devices. As it is shipped from the factory, MS-DOS is configured for a serial printer through J1 that communicates at 4800 baud, recognizes RTS positive handshaking, and works with 8-bit data words and 1 stop bit. The AUX device is configured to work at 9600 baud, no handshaking, 8-bit data words, and 1 stop bit. The CON device is the system keyboard and display. The disk drive step rates are set at 30 milliseconds for 5.25-inch disk drives and 15 milliseconds for 8-inch disk drives.

To exit the program without making any changes to the way the operating system is configured, press the E key. The program will return control to MS-DOS (the MS-DOS prompt will be displayed on your screen).

⌐ To configure the PRN (printer) device, press the A key and proceed to Display 2.

⌐ To configure the AUX (auxiliary) input/output device, press the B key and proceed to Display 3.

⌐ To configure the CON (console) device, press the C key and proceed to Display 4.

⌐ To set the step rate of any or all disk drives, press the D key and proceed to Display 5.

Display 2

Use one of the following options to select the PRN device.

A.   **Centronics, Diablo 630, or NIX-80 Parallel (Parallel)**

B.   **QUME Sprint 11/MX-80 Serial (Serial A(R), 4800 baud, DTR Pos. (pin 20))**

C.   **H/Z-25 (Serial A(R), 4800 baud, RTS Pos. (pin 4))**

D.   **H-14/WH-24 (Serial A(R), 4800 baud, RTS Neg. (pin 4))**

E.   **Diablo 630/1640 (Serial A(R), 1200 baud, ETX/ACK)**

F.   **Diablo 620 (Serial A(R), 300 baud, ETX/ACK)**

G.   **WH-23/WH-33/WH-43 modem (Serial A(R), 300 baud, No handshake)**

H.   **WH-12 Votrax Type-N-Talk (Serial A(R), 4800 baud, RTS Pos. (pin 4))**

I.   **System CRT**

J.   **User defined**

K.   **Exit with no changes**

NOTE: Option G may require a special cable.

Enter selection (A-K):

⌐ To select a Centronics-type parallel interface printer, such as those in option A, press the A key and proceed to Display 18.

⌐ To select one of the serial printers represented in options B through F, press the appropriate key. Proceed to Display 19.

⌐ To select a modem that communicates at 300 baud with no
   handshaking, press the G key. Proceed to Display 19.

⌐ To select the Votrax Type-N-Talk speech synthesizer, press the
   H key. Proceed to Display 19.

⌐ If you elect to use the system's display monitor for output, press
   the I key. Proceed to Display 9.

⌐ If you do not want to make any changes, press the K key.
   Proceed to Display 8.

⌐ If you wish to custom configure the PRN device, press the J key
   and proceed to Display 9.

Display 3

Use one of the following options to select the AUX device.

A. Centronics, Diablo 630, or MX-80 Parallel (Parallel)

B. QUME Sprint 11/MX-80 Serial (Serial B(J2), 4800 baud, DTR Pos. (pin 20))

C. H/Z-25 (Serial B(J2), 4800 baud, RTS Pos. (pin 4))

D. H-14/WH-24 (Serial B(J2), 4800 baud, RTS Neg. (pin 4))

E. Diablo 630/1640 (Serial B(J2), 1200 baud, ETX/ACK)

F. Diablo 620 (Serial A(J1), 300 baud, ETX/ACK)

G. WH-23/WH-33/WH-43 modem (Serial B(J2), 300 baud, No handshake)

H. WH-12 Votrax Type-N-Talk (Serial B(J2), 4800 baud, RTS Pos. (pin 4))

I. System CRT

J. User defined

K. Exit with no changes

NOTE: Options A though F and H may require a special cable.
Enter selection (A-K):

⌐ To select a Centronics-type parallel interface printer, such as
   those shown in option A, press the A key and proceed to Display 18.

⌐ To select one of the serial printers represented in options B through F, press the appropriate key. Proceed to Display 20.

⌐ To select a modem that communicates at 300 baud with no handshaking, press the G key. Proceed to Display 19.

⌐ To select the Votrax Type-N-Talk speech synthesizer, press the H key. Proceed to Display 20.

⌐ If you elect to use the system's display monitor for output, press the I key. Proceed to Display 9.

⌐ If you do not want to make any changes, press the K key. Proceed to Display 8.

⌐ If you wish to custom configure the AUX device, press the J key and proceed to Display 9.

Display 4

Use one of the following options to select the CON device.

A.   Centronics, Diablo 630, or MX-80 Parallel (Parallel)

B.   QUME Sprint 11/MX-80 Serial (Serial A(R), 4800 baud, DTR Pos. (pin 20))
C.   H/Z-25 (Serial A(R), 4800 baud, RTS Pos. (pin 4))
D.   H-14/WH-24 (Serial A(R), 4800 baud, RTS Neg. (pin 4))
E.   Diablo 630/1640 (Serial A(JI), 1200 baud, ETX/ACK)
F.   Diablo 620 (Serial A(R), 300 baud, ETX/ACK)
G.   WH-23/WH-33/WH-43 modem (Serial A(R), 300 baud, No handshake)
H.   WH-12 Votrax Type-N-Talk (Serial A(R), 4800 baud, RTS Pos. (pin 4))
I.   System CRT
J.   User defined

K.   Exit with no changes

NOTE: Option G may require a special cable.

Enter selection (A-K):

⌐ To select a Centronics-type parallel interface printer, such as those shown in option A, press the A key and proceed to Display 18.

⌐ To select one of the serial printers represented in options B through F, press the appropriate key. Proceed to Display 19.

⌐ To select a modem that communicates at 300 baud with no hand-shaking, press the G key. Proceed to Display 19.

⌐ To select the Votrax Type-N-Talk speech synthesizer, press the H key. Proceed to Display 19.

⌐ If you elect to use the system's display monitor for output, press the I key. Proceed to Display 9.

⌐ If you do not want to make any changes, press the K key. Proceed to Display 8.

⌐ If you wish to custom configure the CON device, press the J key and proceed to Display 9.

Display 5

Select which Disk Drive you wish to Display/Alter

A. Display/Alter step rate for drive A:
B. Display/Alter step rate for drive B:
C. Display/Alter step rate for drive C:
D. Display/Alter step rate for drive D:
E. Exit back to main menu

Enter selection (A-E):

⌐ To display and/or alter the step rate of the 5.25-inch floppy disk drive, drive A, press the A key and proceed to Display 6.

⌐ To display and/or alter the step rate of the 5.25-inch floppy disk drive, drive B, press the B key. Display 6 is similar to the display you will see. Follow the directions given with Display 6.

To display and/or alter the step rate of the 8-inch floppy disk drive, drive C, press the C key and proceed to Display 7.

To display and/or alter the step rate of the 8-inch floppy disk drive, drive D, press the D key and follow the directions given with Display 7.

If you do not want to display or alter the step rate of any of the floppy disk drives that are supported by MS-DOS, press the E key and proceed to Display 8.

Display 6

Drive A: Step rate is currently 30mS. Select new step rate.

A. 6 mS

B. 12 mS C. 20 mS D. 30 mS
E. No change

Enter selection (A-E):

The 5.25-inch, 48-tpi, double-sided, double-density floppy disk drives supplied by Zenith Data Systems will handle a step rate of 6 milliseconds.

To select a 6 millisecond step rate, press the A key and proceed to Display 5.

To select a 12 millisecond step rate, press the B key and proceed to Display 5.

To select a 20 millisecond step rate, press the C key and proceed to Display 5.

⌐ To select a 30 millisecond step rate, press the D key and proceed to Display 5.

⌐ If you do not want to change the current step rate, press the E key and proceed to Display 5. 5.

Display 7

Drive C: Step rate is currently 15mS. Select new step rate.

A. 3 mS
B. 6 mS C. 10 MS D. 15 mS
E. No change

Enter selection (A-E):

The 8-inch, 48-tpi, double-sided, double-density floppy disk drives supplied by Zenith Data Systems will handle a step rate of 3 milliseconds.

⌐ To select a 3 millisecond step rate, press the A key and proceed to Display 5.

⌐ To select a 6 millisecond step rate, press the B key and proceed to Display 5.

⌐ To select a 10 millisecond step rate, press the C key and proceed to Display 5.

⌐ To select a 15 millisecond step rate, press the D key and proceed to Display 5.

⌐ If you do not want to change the current step rate, press the E key and proceed to Display 5.

Display 8

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Use one of the following options to configure a device.

Options	Current settings
A. Configure PRN device	(J1,4800,RTS Pos,1 Stop Bit,8 bit word)
B. Configure AUX device	(J2,9600,1 Stop Bit,8 bit word)
C. Configure CON device	(System CRT)
D. Configure Disk step rate	(A: = 30,B: = 30,C: = 15,D: = 15)

Use the following options to modify an existing system.

E. Exit program

F. Make changes to disk
G. Make changes to memory
H. Make changes to both disk and memory

Enter your selection (A-H):

This display will allow you to make your selections final or make further changes to the system configuration.

To exit the program without making any changes to the way the operating system is configured, press the E key. The program will return control to MS-DOS (the MS-DOS prompt will be displayed on your screen).

To configure the PRN (printer) device, press the A key and proceed to Display 2.

To configure the AUX (auxiliary) input/output device, press the B key and proceed to Display 3.

To configure the CON (console) device, press the C key and proceed to Display 4.

To set the step rate of any or all disk drives, press the D key and proceed to Display 5.

To configure the operation system in memory only, press the G key. The system in memory will be modified according to your instructions. The screen will clear and once again show Display 8.

To configure the operating system on the disk only, press the F key; or on the disk and in memory, press the H key. The screen will display the following prompt.

Enter drive name with system to modify (A-H):

Press the key that corresponds to the drive which contains the disk to be modified. The drive access indicator will come on and when the disk has been modified, the screen will clear and once again show Display 8.

Display 9

A. System CRT

B. Serial device

C. Parallel device

Enter your device type:

If you want to use your computer's monitor for output, press the A key and proceed to Display 10. Remember that you are selecting the computer's monitor.

If you want to use a serial device, press the B key and proceed to Display 10. Remember that you are selecting a serial device.

If you want to use a parallel device, press the C key and proceed to Display 10. Remember that you are selecting a parallel device.

Display 10

Answer the following questions with Y for Yes and N for No.

Strip parity on input? (Y/N) <N>

Parity checking is used throughout your computer. If you do not want parity checking on input, press either the N key or the **RETURN** key. Otherwise, press the Y key. The computer will now display the following fine.

Strip parity on output? (Y/N) <N>

Usually your answer for this question will be the same as for the previous one. After you press the appropriate key, the computer will display the following line.

Map lowercase to uppercase on input? (Y/N) <N>

Some software and devices are incapable of utilizing lowercase characters. This question gives you the opportunity to change all lowercase coming into the system to uppercase automatically. If you want lowercase characters converted to uppercase, press the Y key. Otherwise, press the N key or the **RETURN** key. The computer will display the following tine.

Map lowercase to uppercase on output? (Y/N) <N>

This gives you the ability to convert lowercase characters to uppercase characters before they are transmitted. Press the Y key if you want to do this. Otherwise, press the N key or the **RETURN** key.

⌐ Proceed to Display 11 if you selected the system CRT or parallel device at Display 9.

⌐ Proceed to Display 12 if you selected a serial device at Display 9.

Display 11

If you do not wish a pad character, simply press the
RETURN key, and then enter a zero as the number of
pad character; otherwise press the actual key
character you wish to pad.

For example, to pad after all line feeds, press the
key marked LINE FEED.

Press the key corresponding to your desired pad characters:

Pad characters are added to allow extra time for a device to respond to a
command. For instance, blank characters (pad characters) are sent
following a line feed to allow a printer to properly position its print head to
the beginning of the next line. Not all devices require pad characters.
Refer to your printer's documentation.

⌐ To use this feature, press the key which corresponds to the character
which precedes the required pad characters. In most characters, this
will be the line feed (LF) or RETURN (CR) key.

⌐ If you do not need or want to use this feature, press the **RETURN** key.

The computer will display the following.

Enter the number of pad characters to send (0-255):

⌐ Enter a number between 0 and 255 which corresponds to the number of
characters that must be transmitted and press the **RETURN** key.

⌐ If you are not using this feature, press the 0 key and then the **RETURN**
key.

⌐ Proceed as follows:

If you selected:	Proceed to:
System CRT	Display 8
Serial port A	Display 19
Serial port B	Display 20
Parallel device	Display 18

Display 12

Select one of the following I/0 ports.

A. Serial A(J1) (E8H)
B. Serial B(J2) (ECH)

Enter your port selection:

The choice you make here will determine which connector on the back of the computer you will use.

⌐ If you want to use port E8 hexadecimal, which is connector J1, press the A key.

⌐ If you want to use port EC hexadecimal, which is connector J2, press the B key.

⌐ Proceed to Display 13.

Display 13

Select one of the following baud rates.

A.	45.5	I.	1200
B.	50	J.	1800
C.	75	K.	2000
D.	110	L.	2400
E.	134.5	M.	4800
F.	150	N.	9600
G.	300	0.	19200
H.	600	P.	38400

Enter the baud rate selection:

⌐ Press the key that corresponds to the baud rate you want and proceed to Display 14.

Display 14

Use the following to select a handshake protocol.

> **A. No Handshaking**
> **B. ETX/ACK C. DC3/DC1**
> **D. RTS Positive (pin 4)**
> **E. RTS Negative (pin 4)**
> **F. DTR Positive (pin 20)**
> **G. DTR Negative (pin 20)**
>
> **Enter one of the handshake values:**

Handshaking is a way for a serial device to signal the computer that it is ready or not ready to receive information. This option allows you to select the handshaking method that you need for your device. Select choice C for XON/XOFF operation.

⌐ Press the key that corresponds to the handshaking method your device uses and proceed to Display 15.

Display 15

> **Use one of the following stop bit values.**
>
> **A. 1 Stop bit**
> **B. 1.5 Stop bits**
> **C. 2 Stop bits**
>
> **Enter one of the stop bit values:**

⌐ Press the key that corresponds to the number of stop bits your serial device will use. The computer will display the following.

> Do you wish to use parity? (Y/N) <N>

⌐ If you do not want to use parity checking, press the N or press the **RETURN** key and proceed to Display 17.

⌐ If you want to use parity checking, press the Y key and proceed to Display 16.

Display 16

Use one of the following parity selections.

A.. Odd parity
B.   Even parity

Enter one of the parity values:

⌐ If you are using odd parity, press the A key.

⌐ If you are using even parity, press the B key.

⌐ Proceed to Display 17.

Display 17

Use one of the following word length selections.

NOTE: Word length is exclusive of stop bits and parity.

A 5 bit words
B. 6 bit words
C. 7 bit words
D. 8 bit words

Enter one of the word length values:

⌐ Press the key that corresponds to the number of bits each character will use. Proceed to Display 11.

Display 18

This display illustrates the back panel of the Z-100. It instructs you to plug your parallel cable into J3. Press any key to continue and proceed to Display 8.

Display 19

This display illustrates the back panel of the Z-100. It instructs you to plug your serial cable into J1. Press any key to continue and proceed to Display 8.

Display 20

This display illustrates the back panel of the Z-100. It instructs you to plug your serial cable into J2. Press any key to continue and proceed to Display 8.

Printer Configuration

Many of the printers that can be connected to your computer have switches that can be used to adapt the printer to different computers. This flexibility can make it appear that the printer or computer is malfunctioning when, in fact, both are operating correctly.

In order to simplify printer and computer configuration, you should first consult your printer's documentation and configure it to match the operating characteristics of one of the printers listed in Table F-1 and then use the CONFIGUR utility to match the computer to the printer you selected. If the printer cannot be matched with one of the printers listed in the table, or if you want to use other operating characteristics (perhaps to improve performance while being used as a serial device) then you should first configure the printer and then match the characteristics you have selected with the User-defined option of the CONFIGUR utility.

To configure your printer, consult the printer's documentation for setting the proper switches. Then, after you have set the printer, run the MS-DOS configuration utility to set the computer output characteristics to match that which you have selected for your printer.

Changing Hardware Configuration

Your computer may be configured a number of ways by changing internal switches and jumpers. The information presented in this appendix will allow you to custom configure your computer to your needs.

NOTE: You will need to open the cabinet and disassemble the computer. You may want to consult and have your ZDS dealer make the changes for you. Otherwise, you may use the instructions in this appendix to disassemble your computer, make the changes, and then reassemble your computer.

Disassembly

CAUTION: If your computer has a Winchester Disk Drive installed in it, run the Winchester SHIP utility **before** you start to disassemble your computer. Refer to your Winchester documentation for instructions.

WARNING: Before you remove the cabinet of your computer, turn it off and unplug it from the AC power source. There are hazardous voltages inside the cabinet with the power cord plugged into the wall.

To disassemble your computer, proceed to either All-in-One Model or LowProfile Model.

All-in-One Model

⌐ Unplug the line cord from the AC power source.

⌐ Refer to Figure G-1 and use a small, flat-blade screwdriver to move the metal slides all the way toward the front of the computer until they stop and then 1/4" toward the back of the computer as shown.

⌐ Carefully lift the top portion of the cabinet straight up and set it to one side.

⌐ At this point, you may remove the disk controller card to change the switch settings on the Z-207 disk controller card. The instructions for changing the switch settings are provided later in this section.
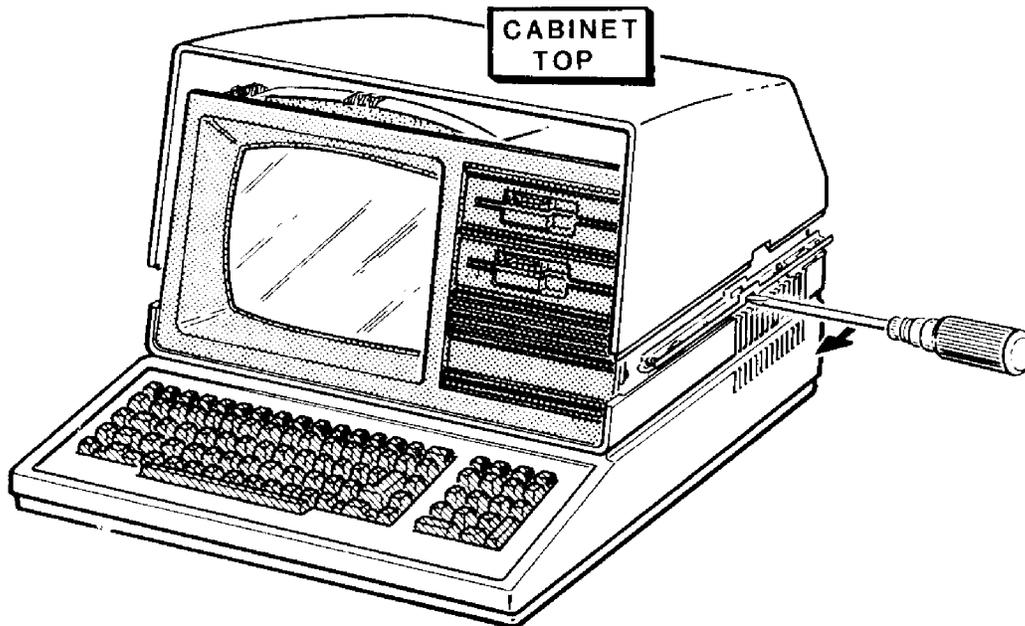
Figure G-1:   All-in-One Cabinet Removal

Refer to Figure G-2 and remove the back screws at positions A and B. These two screws hold the back of the slide in place.

Pivot the back of each latching slide away from the computer as shown in the figure.

Remove the five screws at positions **C, D, E, F,** and G. Your computer may or may not have ground straps at positions E and F. You will need to make sure these straps are reconnected during reassembly if they are present in your computer.

Carefully lift the drive/video subassembly up and to the front of the computer about 4 or 5 inches; set it down gently in the forward position for the following steps.
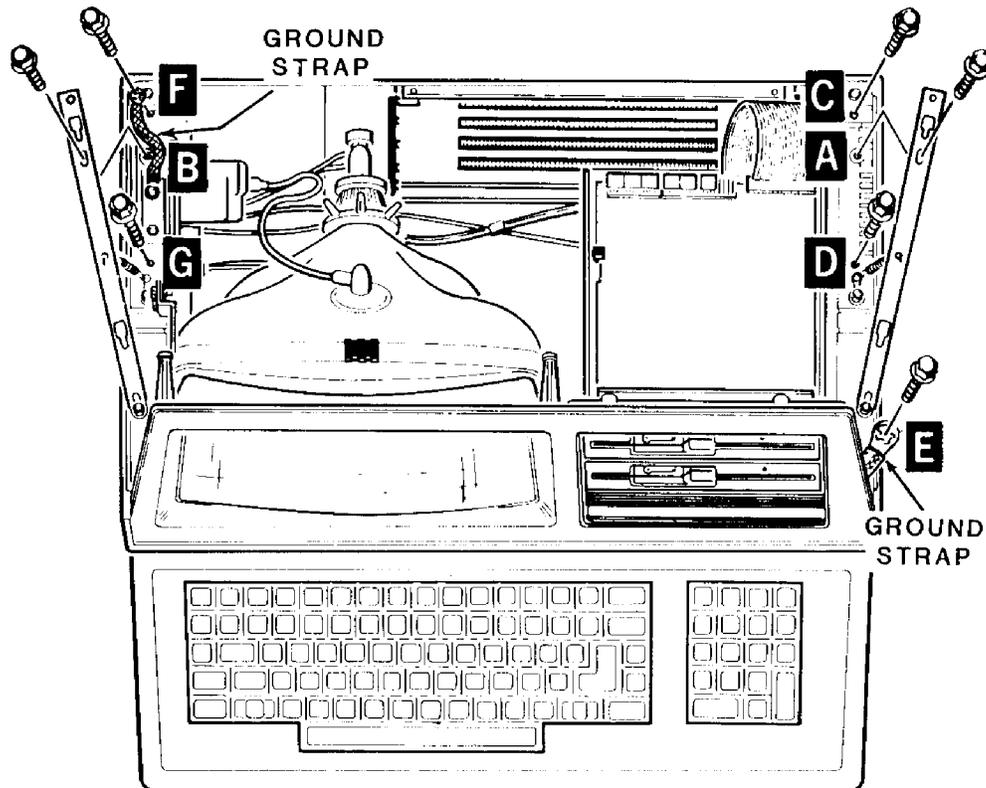
Figure G-2:   Unfastening the Drive/Video Subassembly

⌐

Refer to Figure G-3 and carefully unplug the signal/power cable from the video circuit board.

⌐

Carefully unplug the flat cable from each disk drive as shown in the figure.

⌐

Carefully unplug the power cables from each disk drive.
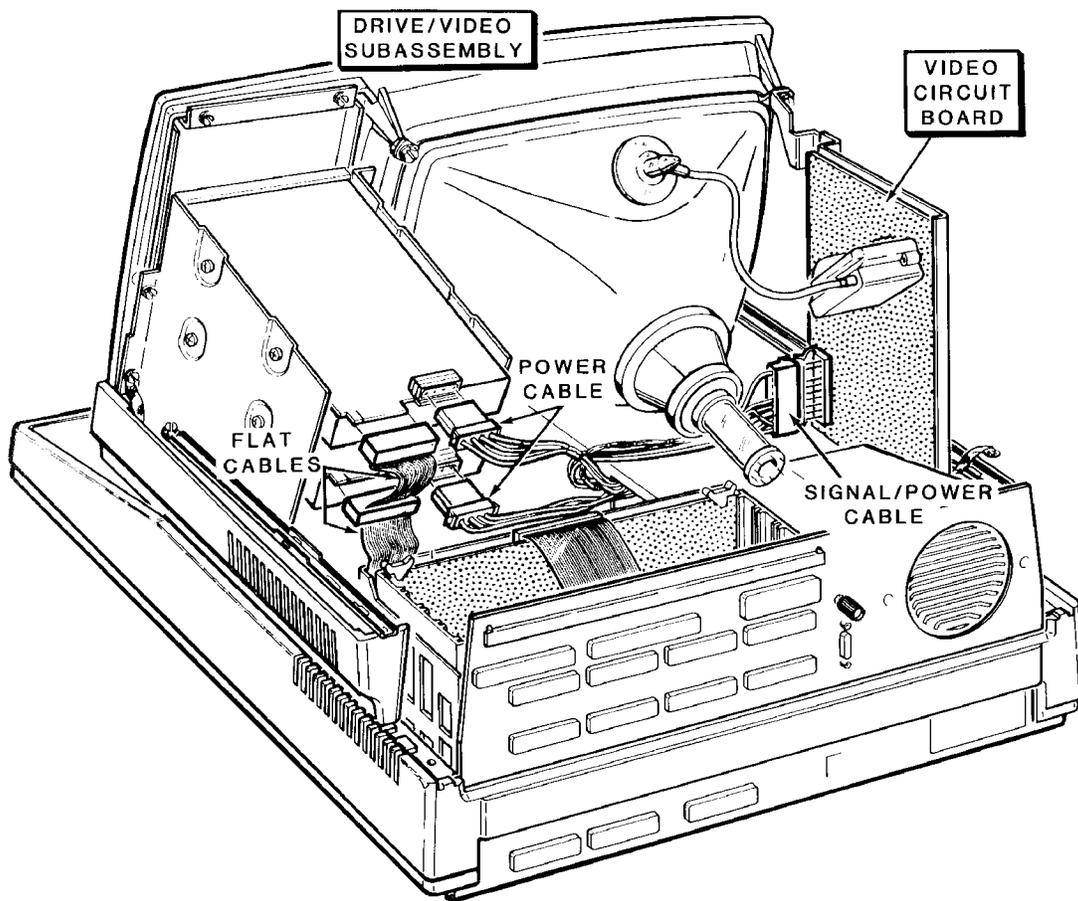
Figure G-3:   Disconnecting the Floppy Disk Drives

⌐ `Remove the drive/video subassembly and set it carefully to one side.

⌐ If your computer has a Winchester disk drive, refer to Figure G-4 and unplug cable 134-1279 and cable 134-1281 from the Winchester controller card.

⌐ Unplug the power supply cable from the Wincester data separator board and the power supply cable from the Winchester disk drive.
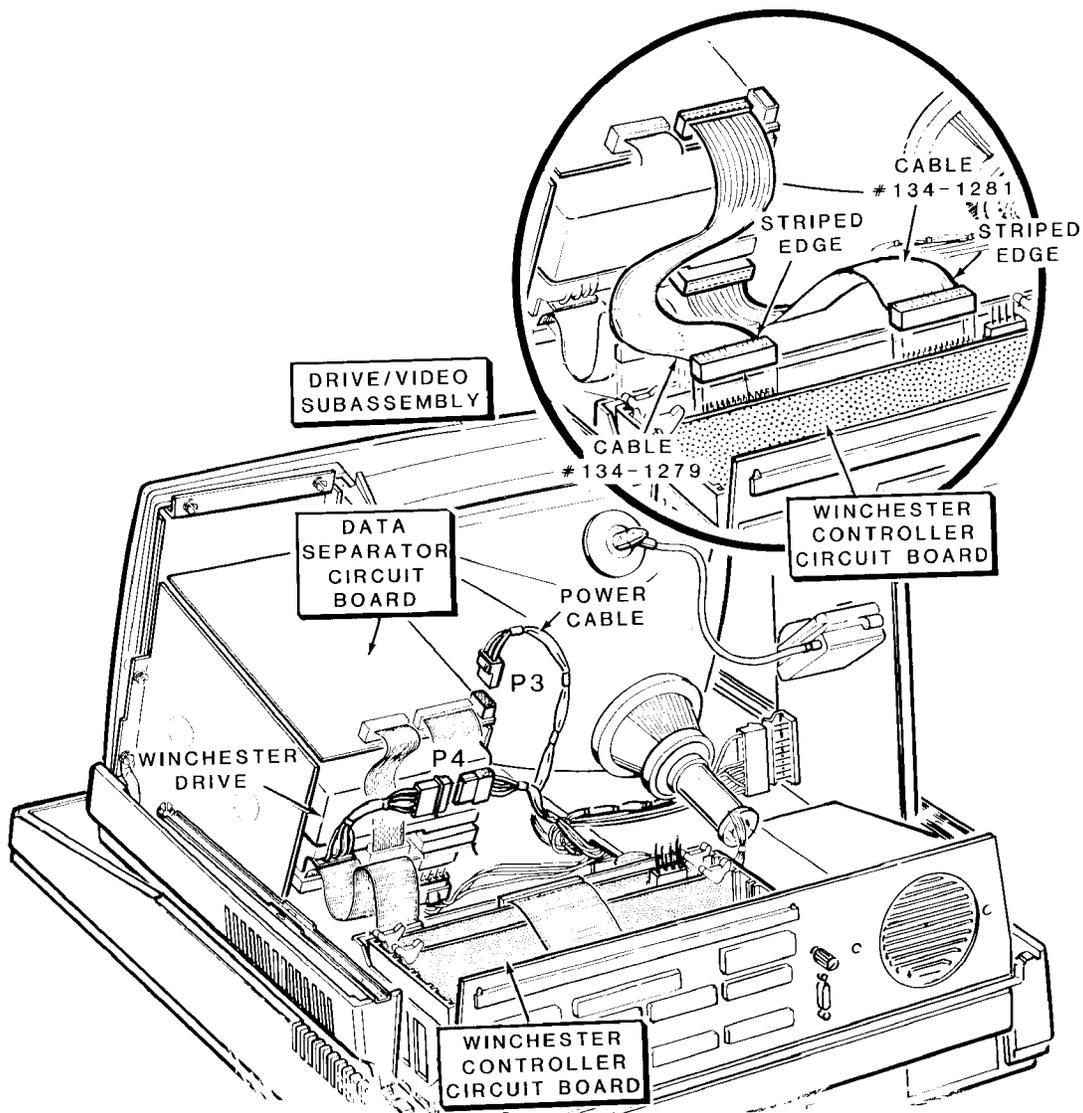
Figure G-4:   Disconnecting the Winchester Disk System

⌐
At this point, you may access switch S101 on the main board of the computer to change the switch settings. The instructions for changing the switch settings are provided later in this section.

⌐
Proceed to Final Disassembly.

Low-Profile Model

⌐
Unplug the line cord from the AC power source.

⌐
Refer to Figure G-5 and inspect the back of each metal slide. If the shipping plugs (not illustrated) are still present, remove them by pulling them up, out of the back of each metal slide.

⌐
Pull the metal slides all the way to the back of the computer. Then push them 1/4" to the front as illustrated in the figure.

⌐
Carefully lift the top case straight up and set it to one side.

⌐
At this point, you may remove the disk controller card to change the switch settings on the Z-207 disk controller card. The instructions for changing the switch settings are provided later in this section.

PULL METAL SLIDES
ALL THE WAY BACK.
THEN PUSH FORWARD
1/4".
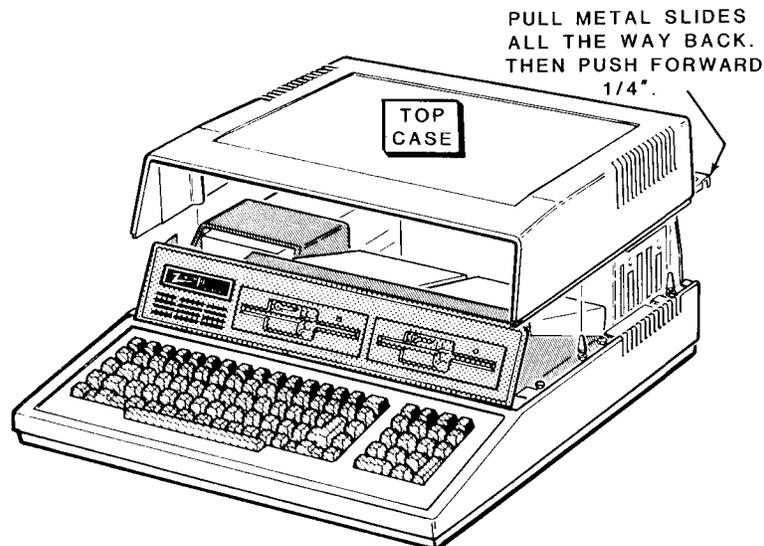
TOP CASE

Figure G-5:   Removing the Top Case

Refer to Figure G-6 and remove the four screws at positions A, B, **C,** and **D.**

Remove the two locking pins at E, and F.

Carefully lift the drive subassembly up and to the front of the computer about 2 inches. Set it carefully back down in the forward position for the following steps.
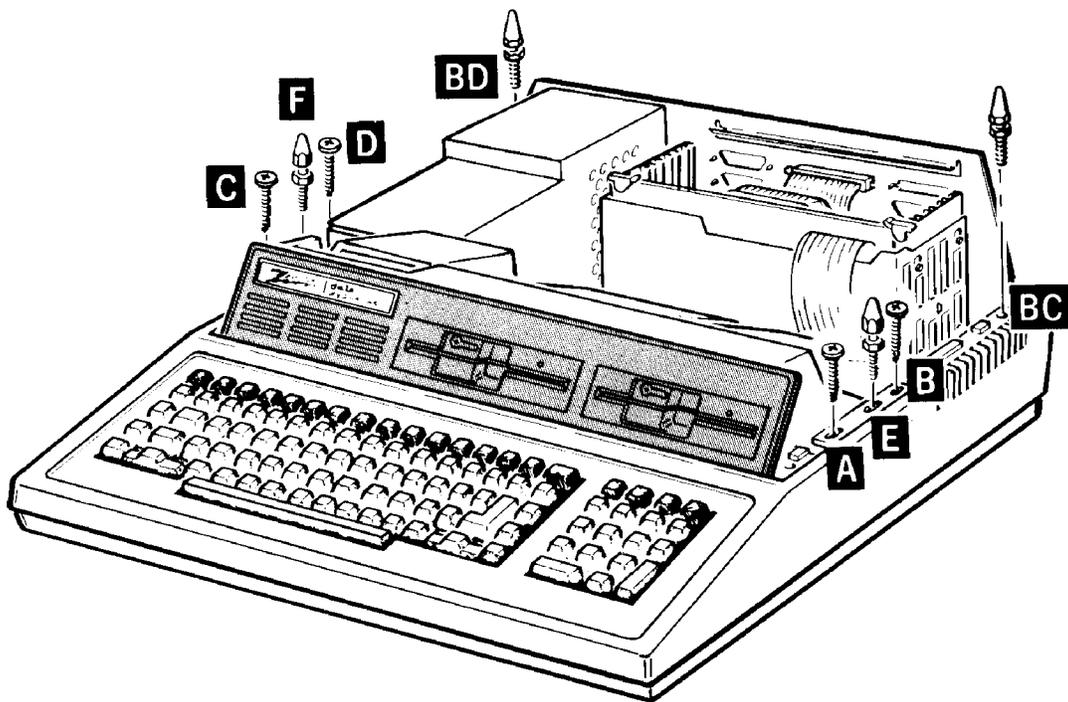
Figure G-6:   Unfastening the Drive Subassembly

⌐
Refer to Figure G-7 and carefully unplug the flat cable from each disk drive as shown.

⌐
Carefully unplug the power cables from each disk drive.
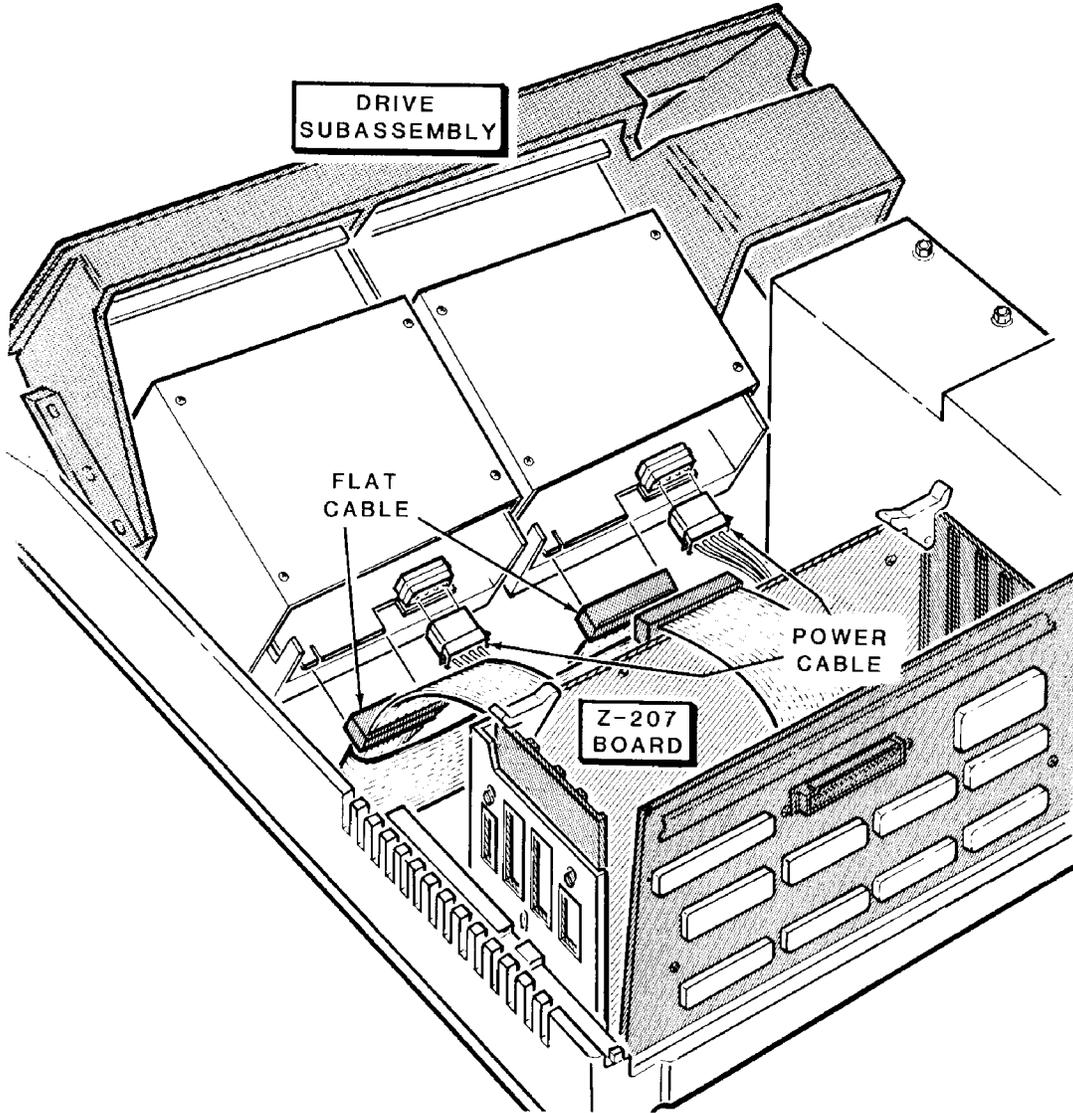
Figure G-7:   Disconnecting the Floppy Disk Drives

☐ If your computer has a Winchester disk drive installed in it, refer to Figure G-8 and carefully unplug cable 134-1281 and cable 1341279 from the Winchester controller card.

☐ Unplug the power supply cable from the data separator board and the power supply cable from the Winchester disk drive.

☐ Remove the drive subassembly and carefully set it to one side.

☐ At this point, you may access switch S101 on the main board of the computer to change the switch settings. The instructions for changing the switch settings are provided later in this section.

☐ Proceed to Final Disassembly.
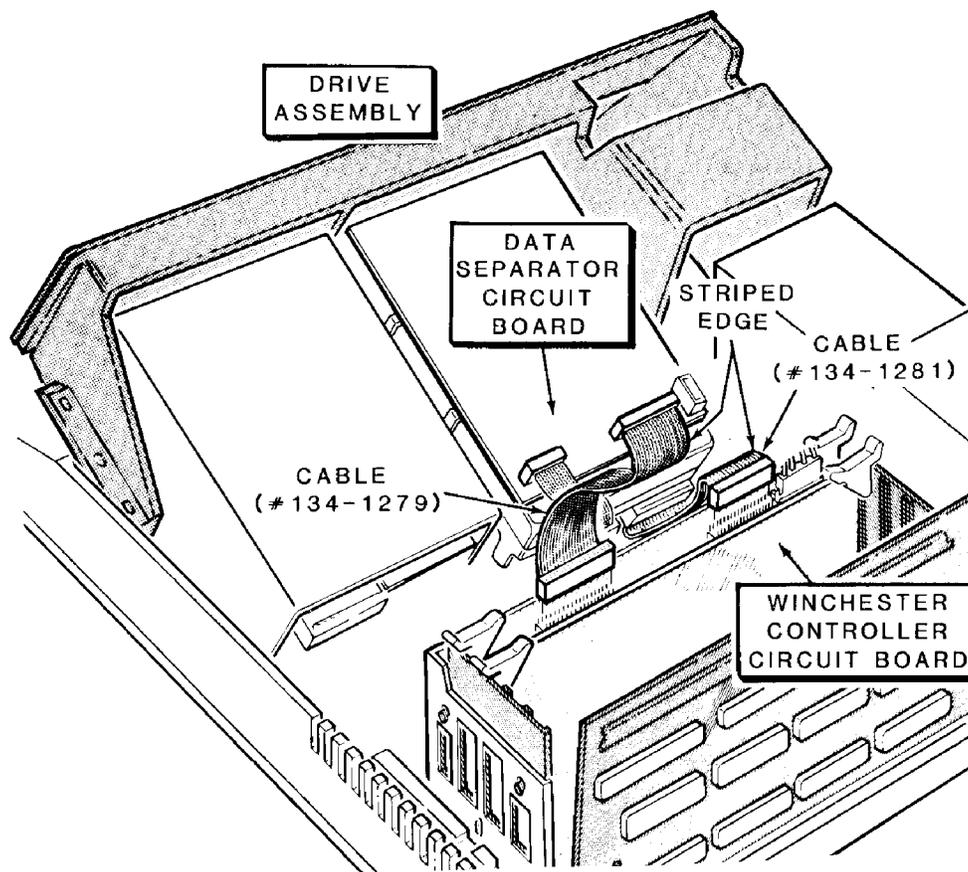
Figure G-8: Disconnecting the Winchester Disk Drive

Final Disassembly

⌐
Refer to Figure G-9 and remove the two screws at positions **BA** and **BB** in the keyboard/base cover.

⌐
If your computer is a Low-Profile model, remove the two locking pins at positions **BC** and **BD**. The All-in-One computer does not have these pins.

⌐
Remove the keyboard/base cover by lifting it up and to the back of the computer to clear the covers, controls, and connectors on the back panel. Set the keyboard/base cover to one side.
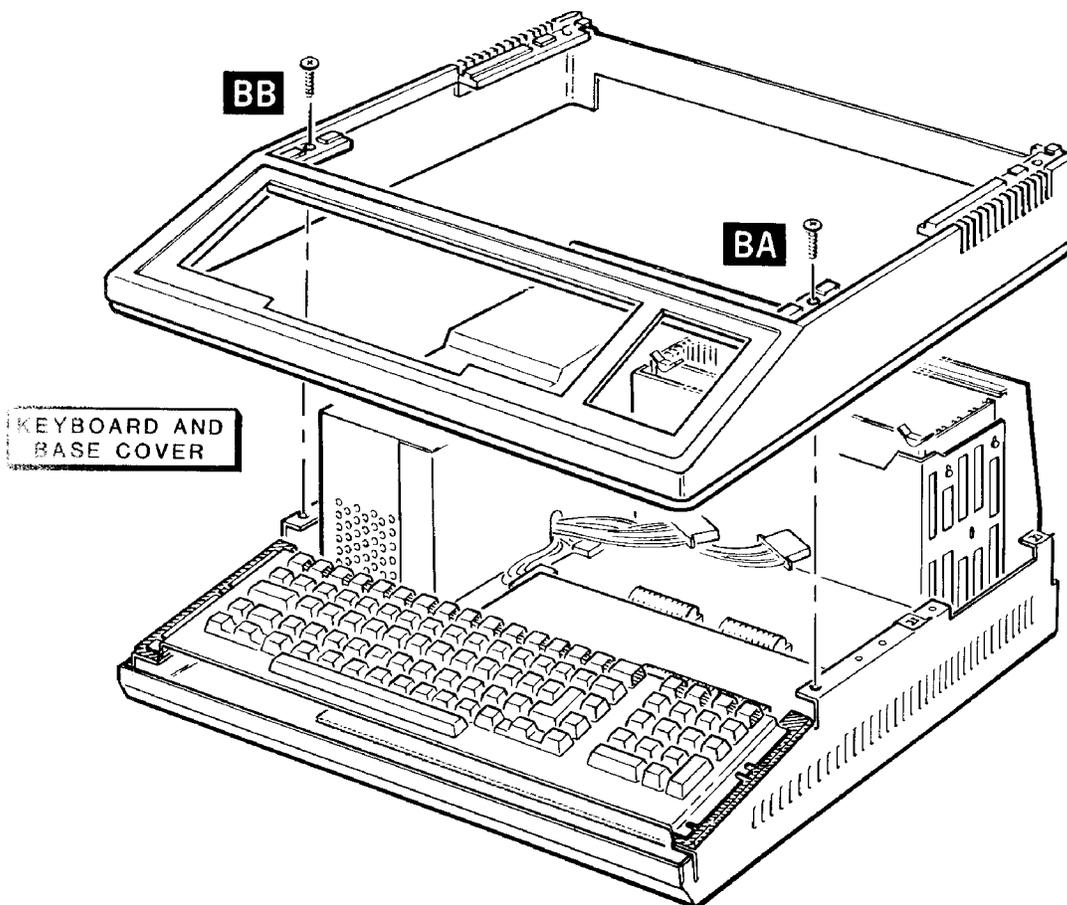
Figure G-9:   Removing the Keyboard/Base Cover

⌐ Refer to Figure G-10 and carefully lift the keyboard up and position it to the front of the computer.

⌐ Carefully remove the three screws at positions **BE, BF,** and BG on the video board.

⌐ At this point you can access the video board jumpers. The description of the settings of these jumpers are provided later in this appendix.

⌐ If you are installing accessories in your computer, refer to the installation manual that accompany those accessories.
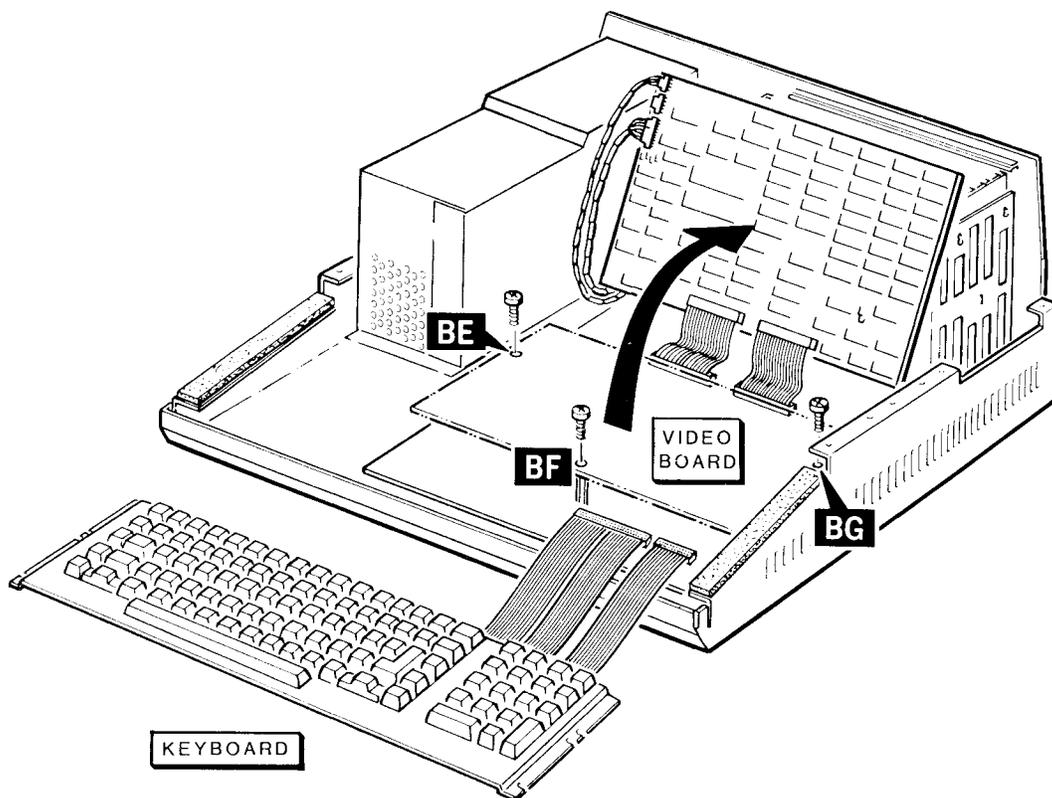
Figure G-10:   Removing the Video Board

Reassembly

⌐ Refer to Figure G-1 1 and reposition the video circuit board as shown in the figure.

⌐ Install and tighten the three screws you removed during disassembly at positions **BE, BF,** and **BG.**
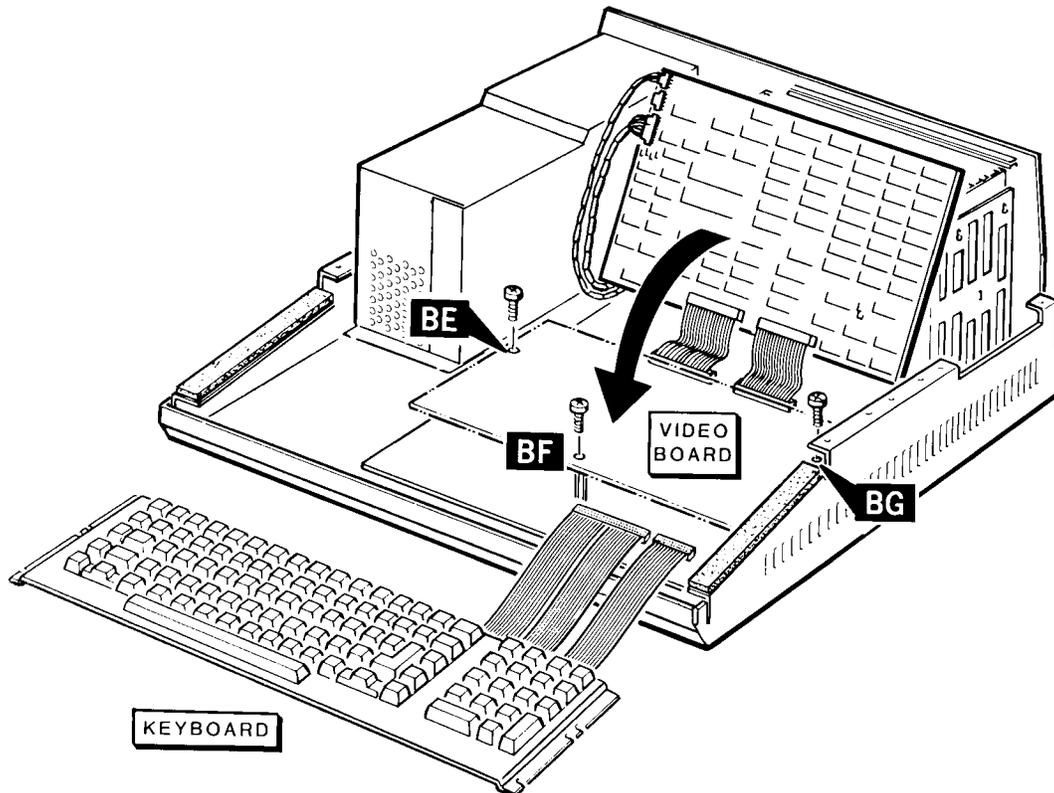
Figure G-11:   Installing the Video Board

⌐ Refer to Figure G-1 2 and position on the base.

⌐ Lower the keyboard/base cover onto the base. Make sure the keys of the keyboard do not bind on the keyboard/base cover. The keyboard assembly can be shifted in one direction or another so that none of the keys bind.

⌐ Install and tighten the two screws (you removed during disassembly) at positions **BA** and **BB.** Check to make sure the keys do not bind.

⌐ If you have an All-in-One model, proceed to All-in-One Reassembly. If you have a Low-Profile model, proceed to Low-Profile Reassembly.
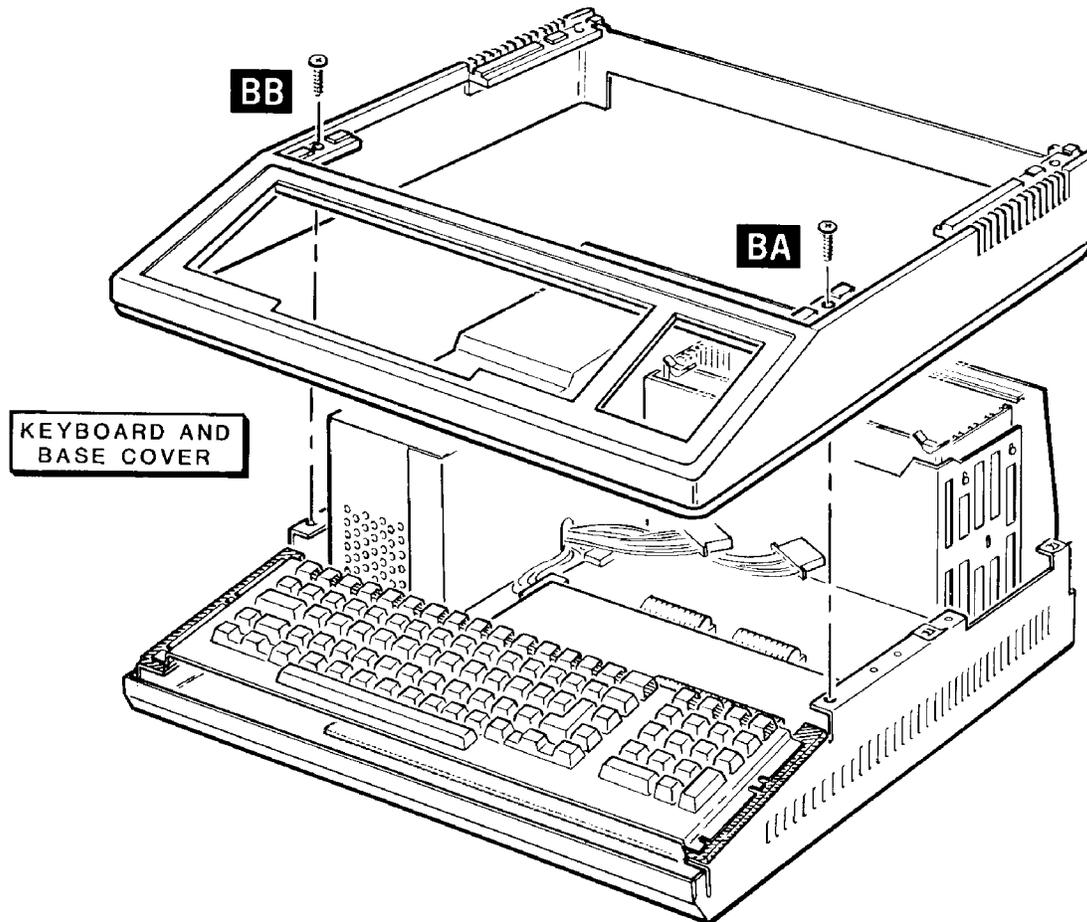
Figure G-12:   Installing the Keyboard/Base Cover

All-in-One Reassembly

⌐ Refer to Figure G-1 3 and carefully position the drive/video subassembly about 4 inches in front of its normal position on the base.

⌐ Plug the signal/power cable onto its connector on the video driver board.

⌐ Plug the power cables into each floppy disk drive.

⌐ Position the small triangle (marked on the flat cable connector) or marked edge of the flat cable toward the outside (right side) of the computer.

⌐ Plug the flat cable from the floppy disk controller card (Z-207 card) onto the disk drives as shown in the figure.
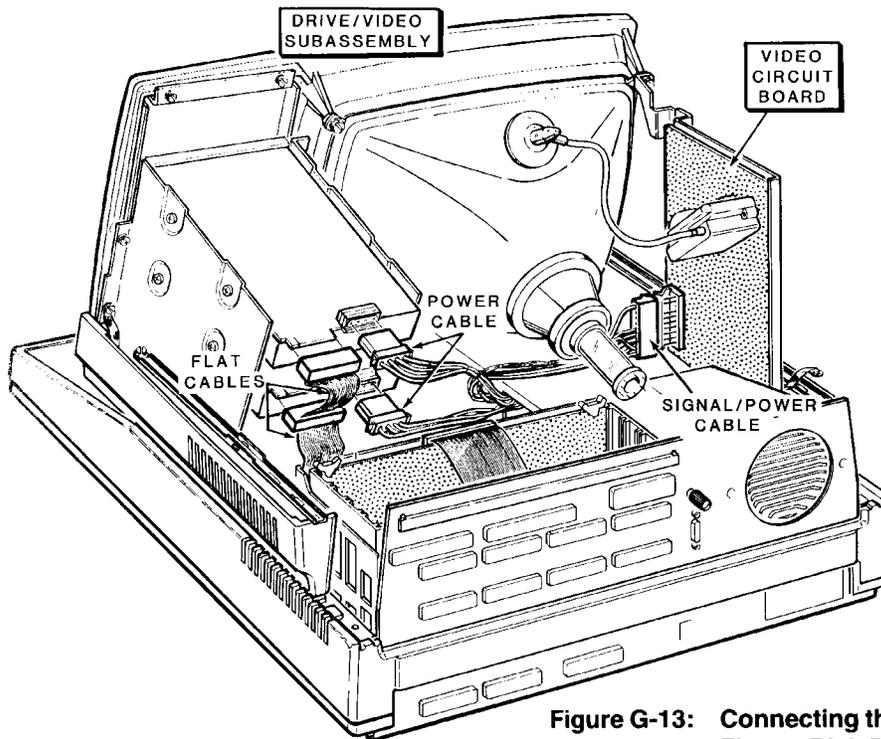
Figure G-13:   Connecting the Signal/Power and Floppy Disk Drive Cables

⌐ Refer to Figure G-14 and if you have a Winchester disk system, and plug the power supply cable into the Winchester disk drive.

⌐ Plug the power supply cable into the data separator board.

⌐ Plug cable 134-1279 (from the data separator board) into the Winchester controller card as shown in the figure.

⌐ Plug cable 134-1281 (from the Winchester disk drive) into the Winchester controller card.
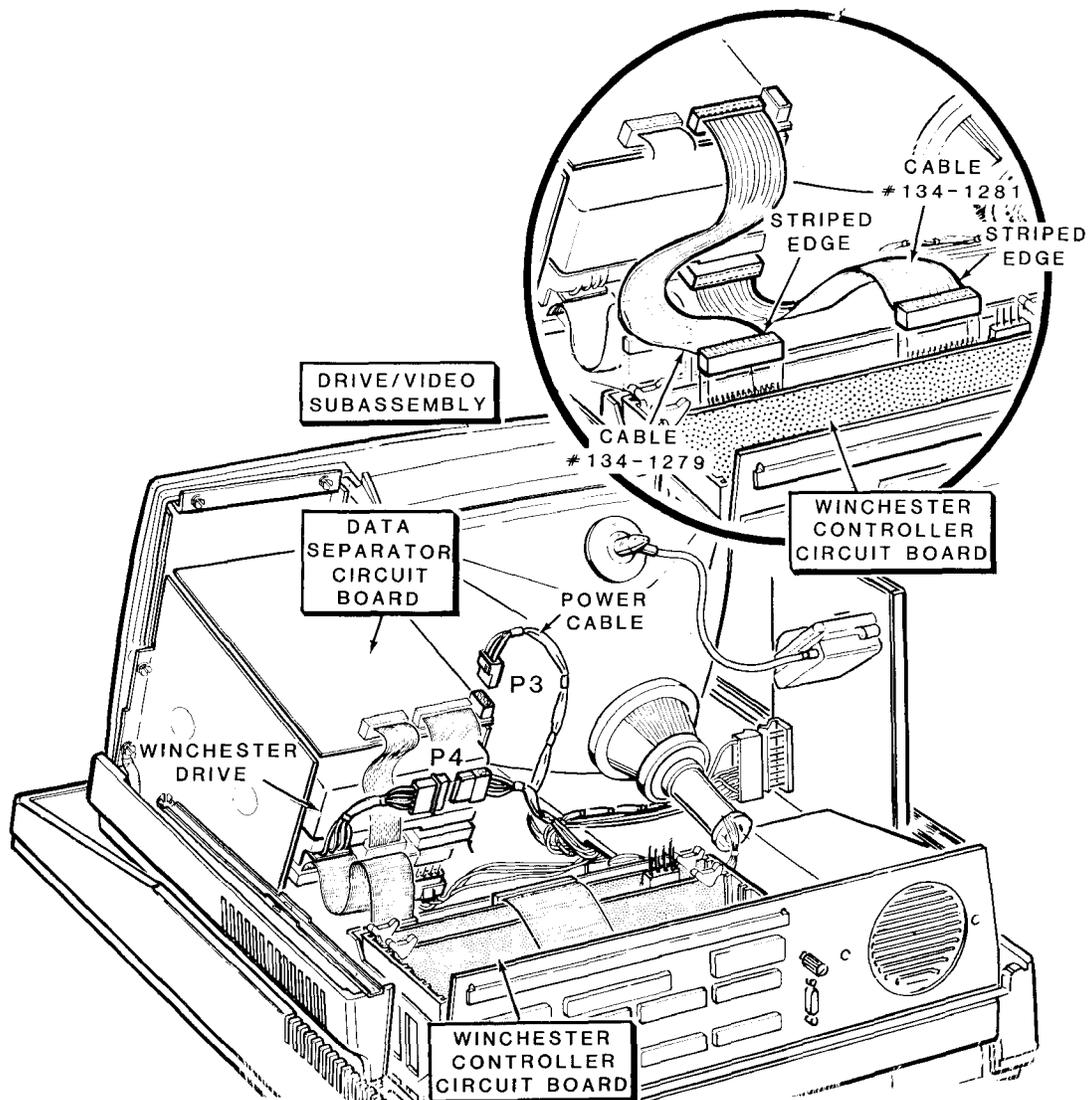
Figure G-14:   Connecting the Winchester Disk Drive

⌐ Move the drive/video subassembly to its normal position.

⌐ Refer to Figure G-15 and install and tighten the five screws at positions **C, D, E, F,** and G. Fasten the ground straps if they are present (that were unfastened during disassembly) at positions E and F.

⌐ Swing the latching slides back into their normal positions and replace the two screws at positions A and B. Make sure the slides move freely.
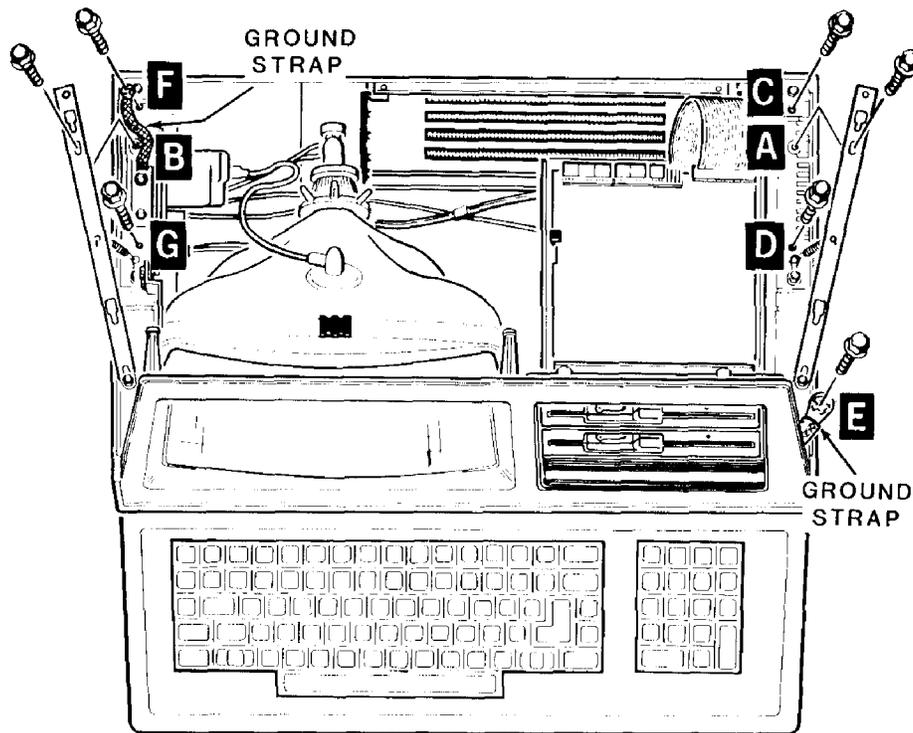
Figure G-15: Fastening the Drive/Video Subassembly to the Base

Refer to Figure G-16. Replace the top portion of the cabinet by bringing it straight down into position. Use a small, flat-blade screwdriver and move the latches all the way to the front if they do not snap into place.
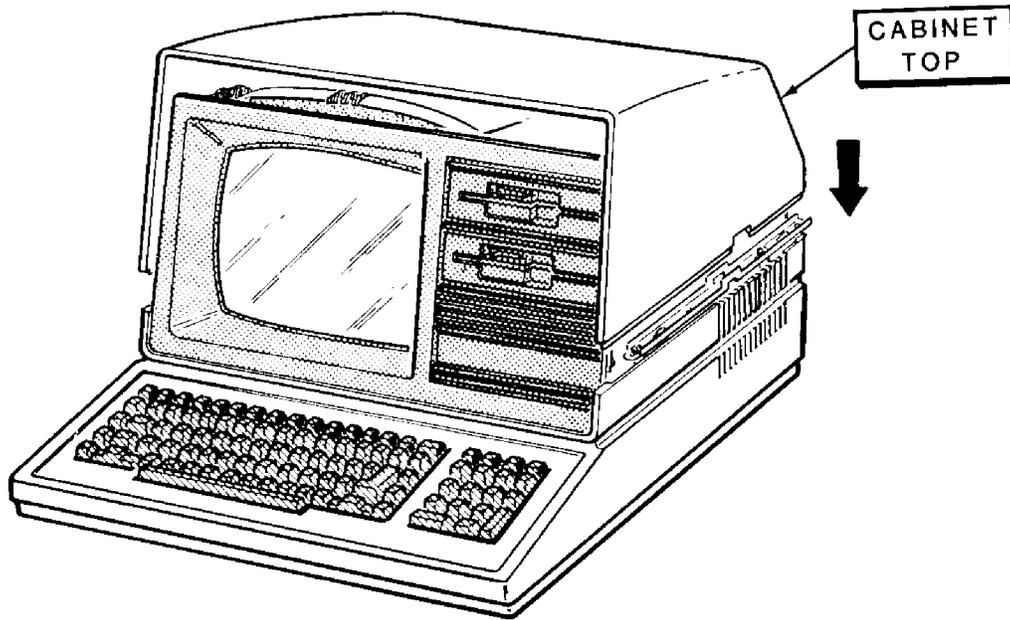
CABINET
TOP

Figure G-16:   Replacing the Cabinet Top

Low-Profile Model

⌐
Refer to Figure G-1 7 and carefully place the drive subassembly about 2 inches
to the front of its normal position on the base.

⌐
Refer to the figure and inset #1. Plug the power cables into each of the floppy
disk drives.

⌐
Refer to the figure and inset #2. Position the small triangle (marked on the
flat cable connector) or marked edge of the flat cable toward the outside
(right side) of the computer.

⌐
Plug the flat cable from the floppy disk controller card (Z-207 card) onto the
disk drives as shown in the figure.
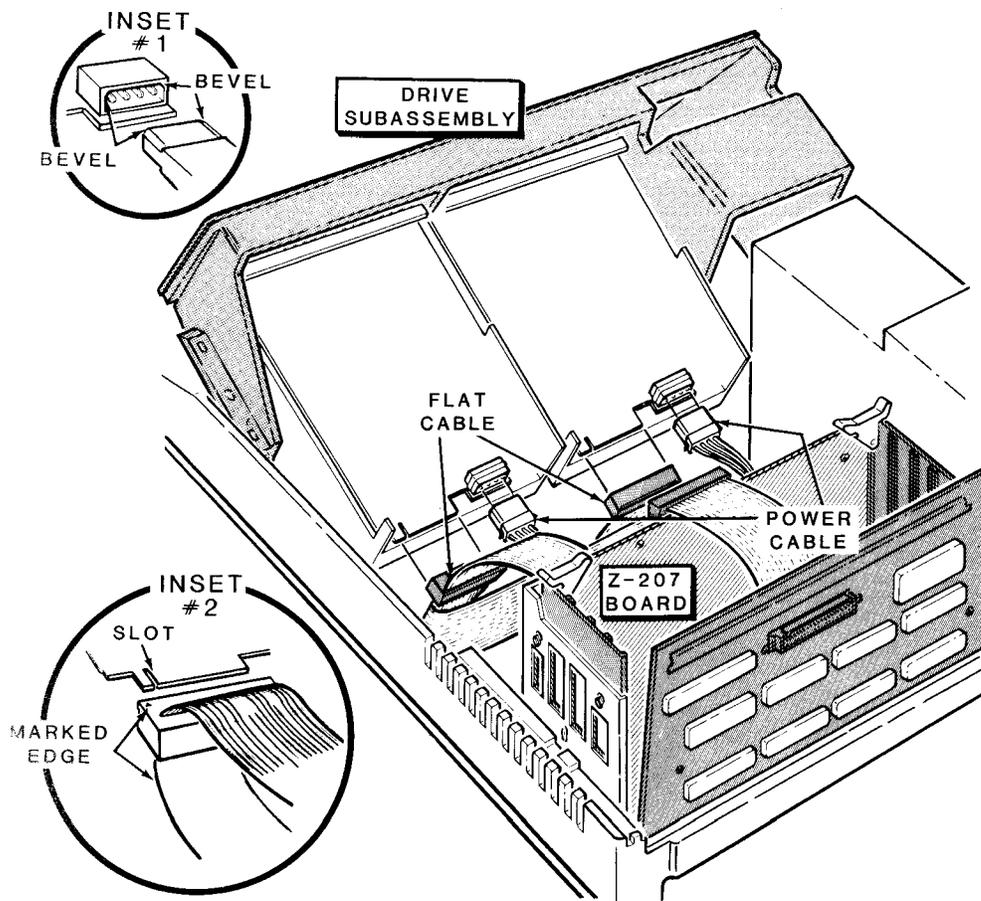
Figure G-17:   Connecting the Floppy Disk Drive Cables

⌐
        Refer to Figure G-18 and if you have a Winchester disk system plug the power supply cable into the Winchester disk drive.

⌐
Plug the power supply cable into the data separator board.

⌐
Plug cable 134-1279 (from the data separator board) into the Winchester controller card as shown in the figure.

⌐
Plug cable 134-1281 (from the Winchester disk drive) into the Winchester controller card.
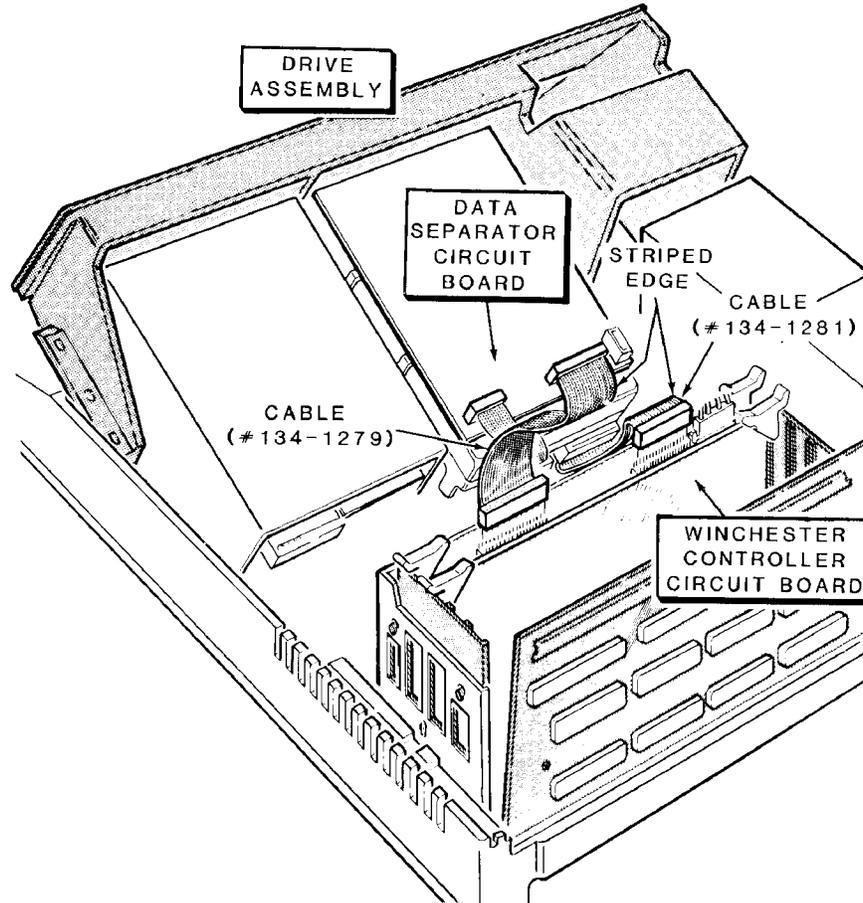
Figure G-18:   Connecting the Winchester Disk Drive

⌐ Move the drive subassembly to its normal position. Refer to Figure G-19.

⌐ Install and tighten the two locking pins at positions **BC** and **BD.** Install and tighten the four screws at positions A, **B, C,** and **D.** Install and tighten the two locking pins at positions E and F.
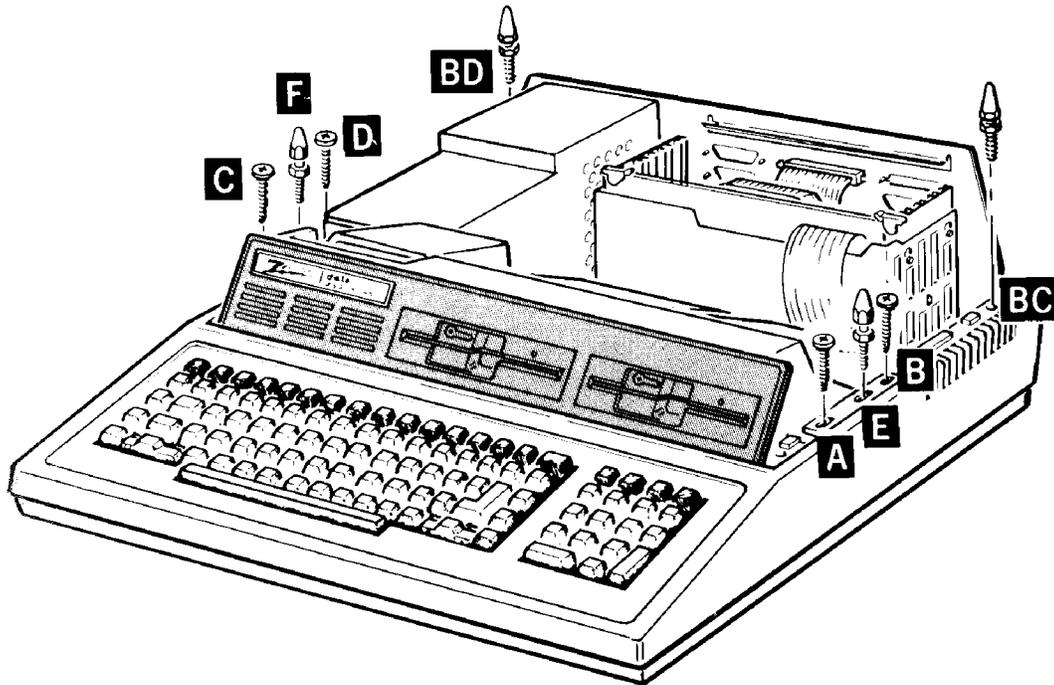
Figure G-19:   Fastening the Drive Subassembly and Base

Refer to Figure G-20. Replace the top case by bringing it straight down into its normal position. Push the latches all the way forward if they do not snap into place. If your computer had shipping inserts still installed in the latches, you do not need to reinstall them unless you are planning the ship your computer to another location.
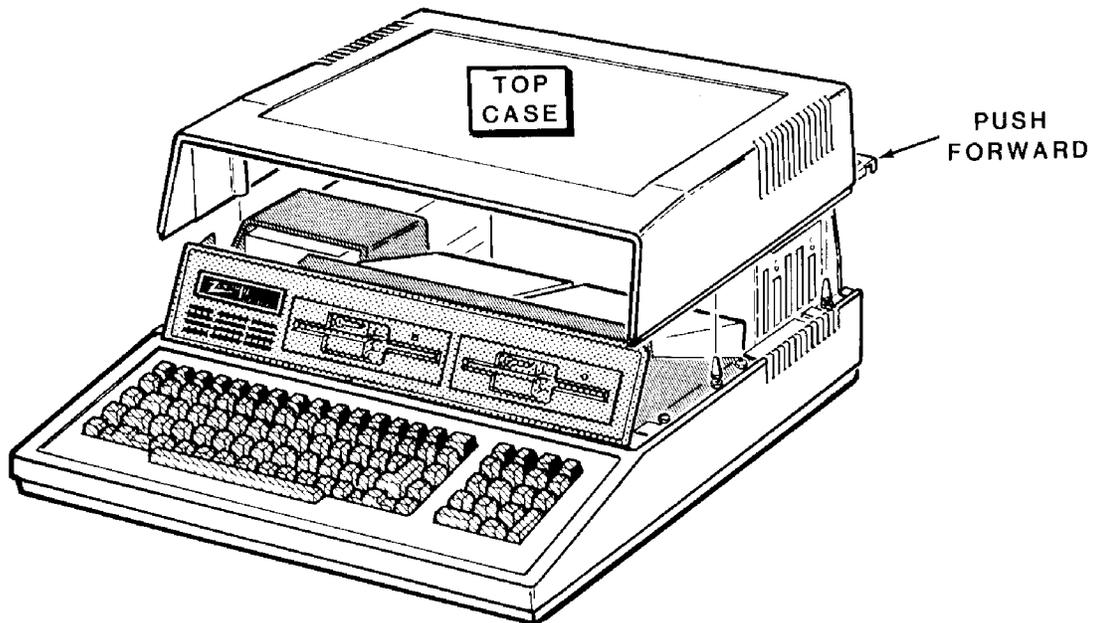
Figure G-20: Replacing the Cabinet Top

Switch S101

Switch S101 is located on the main board just in front of the card cage. To change any settings on the main switch you should remove the disk drive assembly. Once you have disassembled the computer to this point, refer to Figure G-21.
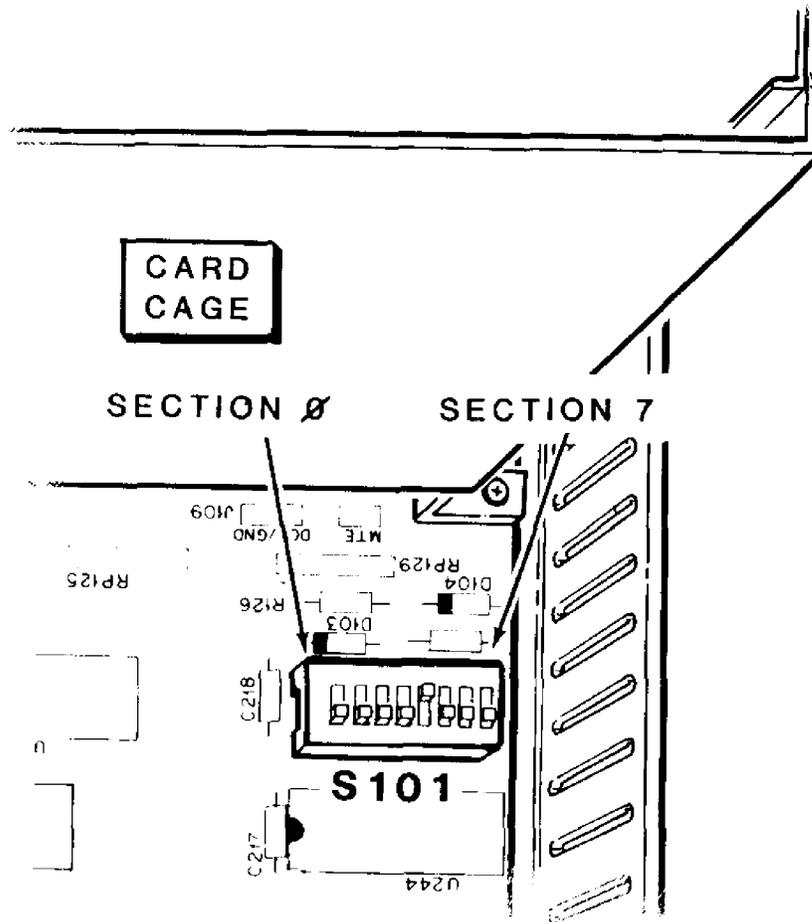
Figure G-21:　Switch S101 (Main Board)

Although the sections of the switch are not marked on the main board itself, the positions should be counted (numbered) from left to right as shown in the figure. The ON side of the switch may be installed toward the front or back of the computer. The ON side will always indicate the ON position of the switch. Move the switch sections to the ON or OFF position as needed to configure your system. The sections are described in Table G-1.

Table G-1: S101 Switch Settings

SECTION   DESCRIPTION

0,1,   These sections establish the default boot device, which is the drive
and 2   type used to boot the operating system if you press the B key and the
            RETURN key at the hand prompt. The switch positions should be
            set to reflect the type of drive you want to use as the default boot
            device.

Section			
0	1	2	Default boot device
OFF	OFF	OFF	5.25-inch internal floppy disk drives.
ON	OFF	OFF	8-inch floppy disk drives.
OFF	ON	OFF	Winchester disk system.

3   This section establishes whether autoboot is ON or OFF. Position the
            switch section to the ON position if you want to enable auto boot.

4   This position is not used.

5   This position is not used.

6   This position is not used.

7   This section selects the scan rate frequency. Position the switch
            section to ON for 50 Hz operation or OFF for 60 Hz operation.

Floppy Disk Controller

DS1 Switch Settings

Switch DS1 is located on the floppy disk card. To change any settings on the main switch you should remove the disk drive assembly. Once you have disassembled the computer to this point, refer to Figure G-22.
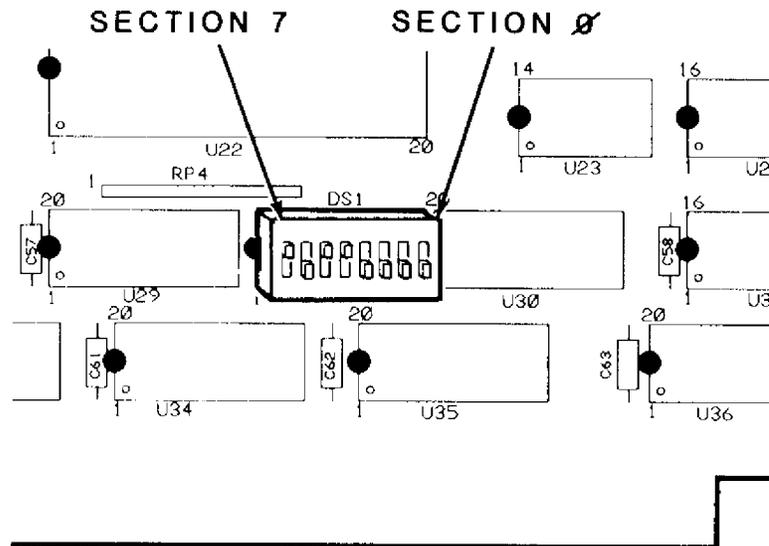
Figure G-22:   Switch DS1 (Floppy Disk Card)

Although the sections of the switch are not marked on the card itself, the positions should be counted (numbered) from right to left as shown in the figure. The ON side of the switch may be installed toward the front or back of the computer. The ON side will always indicate the ON position of the switch. Move the switch sections to the ON or OFF position as needed to configure your system. The sections are described in Table G-2.

Table G-2: DS1 Floppy Disk Controller Switch Settings

SECTION   DESCRIPTION

0   This section selects the 5.25-inch disk drive type. Position the switch section to ON if you want to used 96 tpi disk drives or to OFF if you want to use 48 tpi disk drives. Your computer and software normally support 48 tpi, 5.25-inch disk drives.

1   This section selects precompensation for 5.25-inch disk drives. Position this section to ON if you want precompensation or to OFF if you do not want precompensation.

2   This section is not used.

3 to 7   These sections are used to establish the port base address of the floppy disk controller board. Normally the switches are:

                    (3) OFF,

                    (4) ON,

                    (5) ON,

                    (6) OFF, and

                    (7) ON.

Video Board Jumpers

The jumpers on the video board determine the type of video RAM devices used in the computer, RGB or monochrome output, and the RGB video output synchronization signals. The pinouts of the RGB connector (J9) are described in Table G-3 and illustrated in Figure G-23. The jumpers are described in Table G-4 and their locations are shown in Figure G-24.
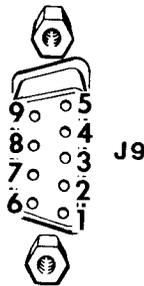
Figure G-23:   RGB Connector (J9)

Table G-3: RGB Connector (J9) Pinouts

PIN	SIGNAL
1	Ground
2	Ground
3	Red
4	Green
5	Blue
6	Not connected
7	Not connected
6	Horizontal sync
9	Vertical or composite sync
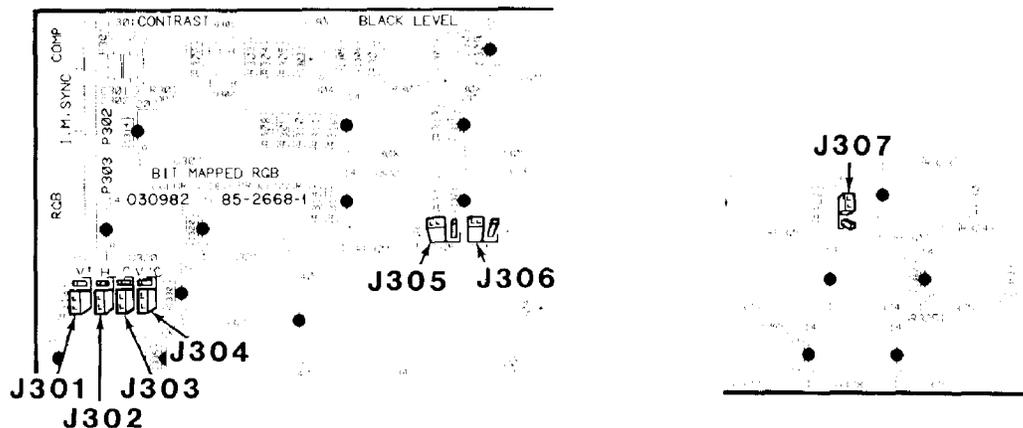
Figure G-24:   Video Board Jumpers

Table G-4: Video Board Jumpers

JUMPER   DESCRIPTION

J301   This jumper selects the vertical synchronization polarity for use by the internal monitor of the All-in-One model. The "-" position will produce a negativegoing synchronization signal.

J302   This jumper selects the horizontal synchronization polarity at pin 8 of the RGB connector. The " " (unmarked) position will produce a negative-going synchronization signal at pin 8.

J303   This jumper selects the signal sent out of pin 9 of the RGB connector. If the jumper is in the "C" position, then pin 9 will have a composite synchronization (combined horizontal and vertical synchronization) signal. If the jumper is in the "V" position, pin 9 will carry the vertical synchronization signal.

J304   This jumper selects the polarity of either the composite or vertical synchronization signal on pin 9 of the RGB connector.

Table G-4 (continued): Video Board Jumpers

JUMPER   DESCRIPTION

   J305   This jumper selects an RGB (the color option if all three banks of video RAM is filled) or a monochrome display output. Used in conjunction with J306. Place both jumpers in the "RGB" position to select the color option (all three banks of video RAM must be installed) or in the "G" position to select a monochrome output. Note that this selects the video capability of the system; you may use either type of the display (color or monochrome) with the computer.

   J306   This jumper is used with J305 and selects an RGB or monochrome output. Set this jumper so that it is in the same position (RGB or G) as J305. See the description for J305.

   J307   The position of this jumper indicates the video memory addressing option and type of video memory ICs used. No jumper indicates that the memory ICs will be 32-kilobit devices addressed to high memory (the upper 32 kilobytes of the possible 64 kilobytes in each bank). A jumper in the "32" position indicates that the ICs are 32-kilobit devices and addressed to low memory (the lower 32 kilobytes of 64 kilobytes in each bank). A jumper in the "64" position indicates that the ICs are 64-kilobit devices.

System Specifications

This appendix lists the specifications of the Z-1 00 Computer and its integral peripheral products.

CPU

8-bit processor 8085.

CLock	5 MHz.
Type	8-bit CPU.
Wait states	Memory, 1; input/output, 2.

16-bit processor	8088.
Clock	5 MHz or 8 MHz.
Type	16-bit CPU.
Wait states	Memory, 0; input/output, 2.

On-board memory	64K to 192K in 64K increments, 128K or 192K standard, parity checked; or 256K to 768K bytes in 256K increments, 256K standard, parity checked.
Memory space	1 megabyte.
Monitor program space	One 64K page (16K used).
Video RAM space	Three 64K pages - one 64K page for each color: red, green, blue.
User-memory space	3/4 megabyte (768K).

Interrupts	
Controller	Dual 8259A integrated circuits.
System	15-level priority vector interrupt.

Video Display

CRT (All-in-One model)	12" diagonal, green nonglare screen.
Display format	25 rows of 80 characters.
Display size	6.5" high x 8.5" wide.
Character size	0.2" high x 0.1 "wide (approximately)
Character type	5 x 9 dot matrix.
Character set	Dynamically redefinable.
Dot resolution	640 dots horizontally x 225 dots vertically.
Colors (optional)	Eight: black, blue, cyan, green, magenta, red, white, and yellow. Gray scale Eight levels when you are using a monochrome display and the color option is installed in the computer.

Options	
Interlace mode	640 x 512 pixel resolution.
Pages	A second page of display.
Light pen	One-pixel resolution.
Outputs	Red, green, blue, composite monochrome video, composite sync, separated horizontal and vertical sync.

Bus Structure

Type	ANSI/IEEE Std 696-1983 (S-100).
Number of card slots	Five.
Data bus width	Eight bits.
Address bus width	24 bits.
input/output addressing	Eight bits.

Timer

Type   Programmable.

Keyboard

Type   95 keys (61-key alphanumeric and 16-key
                                      function and control section (main
                                      keyboard), plus an 18-key numeric and
                                      control section (keypad).

Maximum key debounce   5 milliseconds.
Modes   Two: ASCII and event driven.
Processor   8041 A universal peripheral interface.
Buffer   FIFO (first-in, first-out) buffer (17
character).

Key click   May be disabled.
Auto repeat   11 keys per second. May be disabled.
Fast repeat   28 keys per second.

Floppy Disk Controller

The floppy disk controller is located on an S-100 card and therefore, may he omitted from the computer system.

Type	Western Digital WD1 797.
Drives supported	Up to four of each type.
5.25-inch	Single- and double-sided, 48 or 96 tracks per inch, single- and double-density.
8-inch	Single- and double-sided, single- and double-density.
Data separator	Phase-locked loop.
Precompensation	Independently variable for both 5.25inch and 8-inch disk drives.
Data transfer	Programmed using wait states.
Type	Interrupt or polling.
Internal disk drives	
Size	5.25-inch
Sides	One or two (software selectable)
Tracks per inch	48 or 96
Capacity (formatted)	160K, 180K, 320K, 360K, 640K, or 720K, depending upon the number of sides, tracks per inch, and operating system used.
Track format	8 or 9 sectors of 512 bytes each, dependent upon the operating system.
Stepping speed	6 milliseconds per track or faster.
External 8-inch disk drives	Optional.
Size	8-inch.
Sides	One or two (disk dependent).
Compatibility	Shugart.
Winchester disk drive	Optional.
Number	One or two, replacing one or both internal 5.25-inch floppy disk drives.
Capacity (formatted)	5, 10, or 20 megabytes.
Compatibility	Seagate.

Input/Output

Serial input/output	Dual RS-232 ports, one DTE and one DCE type.
Baud rate	110 to 38400 baud (software selectable).
Operation	Asynchronous RS-232 or synchronous.
Stop bits	One, one and one-half, or two bits.
Word length	Five, six, seven, or eight bits.
Parity	Odd, even, or no parity.
Break capability	Detection and generation.
Parallel output	
Compatibility	Centronics-type.

Power Supply

Input, volts	115 or 230 VAC.
Input, hertz	50 or 60 Hz.
Operating temperature	15.6 to 32.2 degrees Celsius (60 to 90 degrees Fahrenheit).
Operating humidity	8 to 80% noncondensing.

NOTE: Zenith Data Systems Corporation reserves the right to discontinue products and to change specifications at any time without incurring any obligation to incorporate new features in products previously sold.

CP/M-85
Disk Operating System

Several alternative operating systems are available for your computer. One of the systems is CP/M-85 from Digital Research, Inc. It is similar to MS-DOS, but has several important differences. The tables in this appendix highlight those differences.

NOTE: CP/M-86 is an optional operating system that is very similar to CP/M-85, but takes advantage of the faster 8088 16-bit processor in the Z-100.

The commands are listed in alphabetical order where possible, according to the commands in MS-DOS.

Table I-1: MS-DOS and CP/M-85 Control Functions

KEY(S) PRESSED	MS-DOS	CP/M-85	DESCRIPTION
BACK SPACE	x	x	Back space and delete character.
CTRL-C	x	x	Exit from the current function (CP/M: force a warm reboot of the operating system).
CTRL-E		x	Extend current logical line to next physical line.
CTRL-L		x	Substitute CR and LF.
CTRL-N	x		Disable the printer echo.
CTRL-P	x	x	Enable the printer echo (CP/M: toggle the printer echo on or off).
CTRL-R		x	Display the current command line.
CTRL-S	x	x	Suspend all operation. Press any key to continue.
CTRL-U		x	Delete the current command line.
CTRL-X	x	x	Cancel the current line.
CTRL-Z		x	End input from keyboard (PIP and ED).
LINE FEED	x	x	Extend current logical line to next physical line.
RETURN	x	x	Execute current command line.
TAB	x	x	Move cursor to next tab column.

Table 1-2: MS-DOS and CP/M-85 Commands

MS-DOS	CP/M	DESCRIPTION
<filename>.BAT	SUBMIT filename.SUB XSUB	Execute a file with a .BAT extension as a batch processing file. CP/M uses a file with a SUB extension. XSUB is an extended batch processor and allows many of the same functions that are in the MS-DOS batch processor.
APPLY	—	Execute a given command multiple times, substituting a selected parameter.
—	ASM	Create object code files from assembly language code. Note that this is an 8-bit 8080 assembler which produces code recognized by the 8085 in the Z-100. An optional software package, *The Programmer's Utility Pack* contains an assembler for MS-DOS, MASM, which produces code for the 8088 processor in the Z-1 *00*.
ASSIGN	ASSIGN	Assign a logical drive name to a Winchester disk partition.
BACKUP	BACKUP	Create a single archive file from one or more active files.
BREAK	—	Turn on or off check for CTRL-C whenever system access is performed.
CD/CHDIR	USR	Change or display the current directory. USR changes the user number. The user feature of CP/M is similar to the subdirectories of MS-DOS except that CP/M does not have a hierarchal directory structure. Each user in CP/M is treated as if it were the only directory on the disk; the other directories are invisible to the current user.

Table 1-2 (continued): MS-DOS and CP/M-85 Commands

MS-DOS	CP/M	DESCRIPTION
CHKDSK	STAT	Examine directory and file allocation table and report status. CP/M does not check for consistency, since the type of inconsistency checked by MS-DOS cannot occur in the CP/M system. CP/M does provide information on a by-file basis, if requested.
CIPHER	—	Encrypt or decrypt a file.
CLS	—	Clear the screen.
COMMAND	—	Execute the command processor.
CONFIGUR	CONFIGUR	Configure system input/output parameters. This utility is not considered part of either MS-DOS or CP/ M, but is provided by Zenith Data Systems so that you can interface MS-DOS (or CP/M) with your computer.
COPY	PIP	Copy one or more files.
CREF	—	Build a cross reference file.
CTTY	—	Change command input/output device to AUX or CON.
DATE	—	Display and/or change current system date.
DEBUG	DDT	Activate the debugging utility.
DEL/ERASE	ERA	Delete (erase) one or more files. CP/M does not support multiple directories, but it does support multiple user directories.
DIR	DIR	Display all or selected entries of the current/specified directory.

Table 1-2 (continued): MS-DOS and CP/M-85 Commands

MS-DOS	CP/M	DESCRIPTION
DISKCOMP	DUP	Compare two disks. CP/M uses a feature of DUP to accomplish the task.
DISKCOPY	DUP	Duplicate a disk.
ECHO	—	Control display during batch processing.
F.EDLIN	ED	Create and maintain ASCII text file.
EXE2BIN	LOAD	Convert EXE file to binary format (COM). LOAD, in CP/M, has the ability to convert a hexadecimal file into a .COM file.
EXIT	—	Exit the command processor to previous level.
FC	—	Compare two files.
FIND	—	Search for a string in one or more files.
FONT	—	Enable font editor or load alternate character set.
FOR...IN...DO...	—	Loop processing feature of batch processor.
FORMAT	FORMAT	Formats disk surface.
GOTO...	—	Unconditional branch feature of batch processor.
IF [NOT]	—	Conditional feature of batch processor.
LIB	—	The library manager.
LINK	PREL	Creates executable files from object code.

Table 1-2 (continued): MS-DOS and CP/M-85 Commands

MS-DOS	CP/M	DESCRIPTION
—		LOAD Load a hexadecimal file from disk into memory. Convert a hexadecimal file into a .COM file. DEBUG, in MS-DOS, has the ability to load a hexadecimal file from disk into memory. EXE2BIN, in MS-DOS, has the ability to convert EXE files into .COM files.
MAP	STAT	Reassign logical drive names to different physical drive. STAT can also report the status of individual file names and disk space remaining. In the regard, it is much like the MS-DOS command, CHKDSK.
MD/MKDIR	USR	Create a directory. USR is used in a similar manner, except the directories are treated differently. See the comments under CD/CHDIR.
MORE	—	Send output a screen at a time.
—	MVCPM207/217	Prepare the operating system for transfer to another disk type (floppy disk to Winchester system or vice versa).
PATH	—	Specify directory or directories to be searched to execute external MS-DOS commands.
PAUSE	—	Suspend action of batch processor.
PRINT	—	Initiate background printing of file(s).
PROMPT	—	Change MS-DOS system prompt.
PSC	—	Load screen dump utility into memory.

Table 1-2 (continued): MS-DOS and CP/M-85 Commands

MS-DOS	CP/M	DESCRIPTION
RDCPM	—	Read CP/M directories or copy CP/M files to **MS-DOS. CP/M-85** has no equivalent utility. However, the Zenith Data Systems version of CP/M-86 has a utility that can read MS-DOS disks and copy files to the CP/M operating system disks.
RECOVER	—	Recover file(s) that have been erased or deleted from the disk.
REM	;	Display message during batch processing.
REN/RENAME	REN	Rename a file.
RESTORE	RESTORE	Restore archived files.
RD/RMDIR	—	Remove specified directory.
—	SAVE	Save a file (machine code) to disk. This feature is part of the **MS-DOS** utility, DEBUG.
SEARCH	—	Locate a file.
SET	—	Set one string equivalent to another.
SHIFT	—	Allow more than 10 parameters in batch processor.
SORT	—	Displays results in sorted order.
SYS	**SYSGEN/BSYSGEN**	Transfer operating system files from source drive disk to destination disk.
TIME	—	Display and/or change current system time.
TYPE	DUMP/LIST	Display contents of specified file.
VER	—	Display the version numbers of MSDOS.SYS and IO.SYS.

Table 1-2 (continued): MS-DOS and CP/M-85 Commands

MS-DOS	CP/M	DESCRIPTION
VERIFY	—	Display or change condition of verify function.
VOL	—	Display volume name of disk in default or specified drive.

Using Z-89 Software
on the Z-100

Most Zenith Data Systems/Heath Z-89 software application packages that are distributed to run under CP/M versions 2.2.02, 2.2X03, 2.2.03, and 2.2.04 (referred to as CP/M-80 software) may be converted to run on the Z-1 00. A list of convertible software packages appears in Table J-1.

CP/M-80 software is widely used on computers that use the 8080 or Z80 microprocessors. The Zenith Data Systems Z-89 and Z-90 computers and the Heath H-88, H-89, and H-8 computers are represented by "Z-89" in this appendix.

The convertible CP/M-80 software is distributed on three different types of media: 5.25-inch hard-sectored disks, 5.25-inch soft-sectored disks, and 8-inch soft-sectored disks. The instructions contained in this appendix will allow you to transfer CP/M-80 software to disks that can be used by the Z-100 with CP/M-85. The step-by-step procedure and equipment you will need is outlined on the following pages.

Your computer is shipped with one or two 5.25-inch disk drives that work with soft-sectored disks containing data formatted on 48-tracks per inch, single- or double-density, single- or double-sided media. Because the computer cannot read data stored on disks in other formats, the files contained on most CP/M-80 disks must first be converted to a Z-100-compatible format.

As an alternative, a Z-89 with the appropriate controller and disk drive(s) and a Z-100 with two 5.25-inch disk drives and CPS (or other communications transfer software) for CP/M-80 on the Z-89 and CPS (or other communications transfer software) for CP/M-85 on the Z-100. You will also need an RS-232 cable to connect the two computers via their RS-232 ports. Then you may use the software on each computer and transfer your files directly from the Z-89 to the Z-1 00.

The way you convert from one format to another depends upon the format, type, and size of the disks that now hold your CP/M-80 software.

⌐   If your files are stored on 5.25-inch, soft-sectored, 48 tracks per inch disks, or on 8-inch soft-sectored disks, then follow procedure one.

⌐   If your files are stored on 5.25-inch, hard-sectored disks, then follow procedure two.

If your files are stored on 5.25-inch, soft-sectored, 96 tracks per inch disks, then follow procedure three.

NOTE: The procedures describe the sequence of activities necessary to transfer software stored on any CP/M-80 disk to a disk for use with the Z-1 00. The application software instructions are contained in the documentation that accompanies that software.

Transfer Procedure One

If you have CP/M-80 software on 5.25-inch, soft-sectored, 48-tracks per inch disks, or on 8-inch soft-sectored disks, they may be used directly on the Z-100 without modification. However, the Z-100 cannot use the CP/M-80 operating system. Use the following procedure to convert the application software to CP/M-85 disks.

Equipment Needed

To convert 5.25-inch CP/M-80 software to 5.25-inch CP/M-85 disks, you will need a Z-100 with two 5.25-inch disk drives; CP/M-85 configured as a working disk that contains FORMAT.COM, BSYSGEN.COM, and PIP.COM; and a sufficient quantity of 5.25-inch soft-sectored blank disks to accommodate the number of files you wish to transfer.

To convert 8-inch CP/M-80 software to 5.25-inch CP/M-85 disks, you will need a Z-100 with one 5.25-inch disk drive and one 8-inch disk drive; CP/M-85 configured as a working disk that contains FORMAT.COM, BSYSGEN.COM, and PIP.COM; and a sufficient quantity of 5.25-inch soft-sectored blank disks to accommodate the number of files you wish to transfer.

To convert 8-inch CP/M-80 software to 8-inch CP/M-85 disks, you will need a Z-1 00 with two 8-inch disk drives; CP/M-85 configured as a working disk that contains FORMAT.COM, BSYSGEN.COM, and PIP.COM; and a sufficient quantity of 8-inch soft-sectored blank disks to accommodate the number of files you wish to transfer.

Transfer Procedure

If you are using 8-inch disks for both CP/M-80 and CP/M-85 files, the procedure will the same you would use for 5.25-inch disks except that you will be using 8-inch disks in 8-inch disk drives instead of 5.25-inch disks in 5.25-inch disk drives.

⌐ Prepare a label for each blank disk, using the names of the files you wish to transfer to it and the name, "Transfer Disk."

⌐ Turn on your computer and boot the CP/M-85 operation system. When it is loaded, the display will show the following default drive prompt.

    A>

⌐ Insert your CP/M-85 working disk into drive A.

⌐ Format each of your transfer disks in drive B by inserting the disk into drive B. Then enter the following command line.

    FORMAT B: [N]

⌐ Press the **RETURN** key. If you are using 5.25-inch disks, you computer will format the disk for double-sided, double-density use. If you wish to use another format, you will have to answer to prompts for the number of sides and density. Format all your blank disks now.

⌐ Prepare each of your transfer disks with SYSGEN. Insert the blank, formatted disk in drive B and enter the following command line.

    BSYSGEN B: =A: [B,N]

⌐ Press the **RETURN** key. BSYSGEN will copy the CP/M-85 operating system to the disk. Do this with all your transfer disks now.

⌐ Now copy the Peripheral Interchange Program (PIP.COM) to each transfer disk. Insert the transfer disk in drive B and enter the following command line.

    PIP B: =A: PIP. COM [V]

Press the **RETURN** key. PIP will copy the program (itself) to the transfer disk. (if you wish to copy additional CP/M programs (files) to the transfer disk, do so now by using PIP, specifying the appropriate file names. You will find instructions in the CP/M-85 documentation.) Copy PIP.COM (along with any other CP/M-85 programs) to all your transfer disks now.

Remove your CP/M-85 working disk from drive A.

Insert one of the prepared transfer disks into drive A.

If you are transferring either 5.25-inch CP/M-80 files to 5.25-inch CP/M-85 disks or 8-inch CP/M-80 files to 8-inch CP/M-85 disks, continue with the following. Otherwise, if you are transferring 8-inch CP/M-80 files to 5.25inch disks, proceed to "8-inch Source Disks."

5.25-inch Source Disks

Transfer the CP/M-80 software to the prepared transfer disks. Insert one of the CP/M-80 disks into drive B and enter the following command line.

    PIP A: =B: *. * [V]

Press the **RETURN** key. The computer will load the PIP program into memory and transfer the files from the disk in drive B to the CP/M-85 disk in drive A.

CP/M-85 uses the wild card * . * to transfer all the files from the CP/M-80 disk to the CP/M-85 transfer disk. After all the files have been transferred, your computer will once again display the CP/M-85 prompt.

At this point, remove both disks. If you have more files to transfer to the CP/M-85 system, insert the appropriate CP/M-80 disk into drive B and a new CP/M-85 transfer disk in drive A and repeat the process.

8-inch Source Disks

⌐ Transfer the CP/M-80 software to the prepared transfer disks. Insert one of the CP/M-80 disks into your 8-inch disk drive (referred to as drive C) and enter the following command line.

> PIP A: =C: *. * [V]

⌐ Press the **RETURN** key. The computer will load the PIP program into memory and transfer the files from the 8-inch disk in drive C to the 5.25-inch CP/M-85 disk in drive A.

CP/M-85 uses the wild card *. * to transfer all the files from the CP/M-80 disk to the CP/M-85 transfer disk. After all the files have been transferred, your computer will once again display the CP/M-85 prompt.

NOTE: There is a possibility that your 8-inch disk may hold more files than the 5.25-inch CP/M-85 disk can accommodate. If this is the case, an error message will be generated and you will have to split the files from your 8-inch disk between two or more 5.25-inch transfer disks.

⌐ At this point, remove both disks. If you have more files to transfer to the CP/M-85 system, insert the appropriate CP/M-80 disk into drive B and a new CP/M-85 transfer disk in drive A and repeat the process.

Transfer Procedure Two

To transfer CP/M-80 software on 5.25-inch hard-sectored disks, you will first have to transfer it to 5.25-inch, 48-tracks per inch, soft-sectored disks and then to Z-100 disks (if you wish to boot from them).

Equipment Needed

You will need a Z-89 computer with a soft-sectored controller (Z-89-37) and at least one 5.25-inch, 48-tracks per inch disk drive; one hard-sectored disk controller and at least one 5.25-inch, 48-tracks per inch disk drive; CP/M-80 properly configured for the hard/soft-sectored system containing FORMAT.COM and PIP.COM; A Z-100 computer with two 5.25-inch disk drives; CP/M-85 configured as a working disk with FORMAT.COM, BSYSGEN.COM, and PIP.COM; and a sufficient quantity of blank 5.25'rich disks to accommodate at least twice the number of files you wish to transfer.

NOTE: As you can see, a considerable amount of equipment is required. If you do not have all the necessary equipment, you may wish to contact your Zenith Data Systems full-line dealer regarding the use of his demonstration equipment to make the transfer of this software.

Transfer Procedure

⌐   Prepare labels for about half of the 5.25-inch disks, using the names of the files that you will transfer to them and the words "Conversion Disk."

⌐   Boot the Z-89 system using CP/M-80.

⌐   Format each of the soft-sectored conversion disks by inserting them, one at a time, into the 5.25-inch, 48-tracks per inch disk drive and entering the following command line.

       FORMAT

Press the **RETURN** key and answer the prompts. If you plan to use the 5.25-inch disks directly on your Z-100, enter 2 for the number of sides and D for density. Refer to your CP/M-80 documentation for instructions to use the FORMAT command of CP/M-80. Use the same procedure to format all the conversion disks now.

Place the operation system on each of the conversion disks. Insert each disk into the soft-sectored drive (the same drive you used to format the disks) and enter the following command line.

> **SYSGEN**

Press the **RETURN** key. When the following line is displayed, enter the name of the drive that contains your source disk (this is the disk from which you booted the Z-89).

> SOURCE DRIVE NAME (OR RETURN TO SKIP):

When the following line is displayed, press the Y key.

> COPY BIOS.SYS (Y/N):

When the following line is displayed, press the key that corresponds to the name for that drive. This will be the same drive name you used to format the conversion disks.

> DESTINATION DRIVE NAME (OR RETURN TO REBOOT):

Use this same procedure and put the system on the remainder of the conversion disks now.

Place the Peripheral Interchange Program (PIP.COM) on each of the conversion disk with PIP. Use the proper drive names for the source and destination disk drive. (They will be the same as you used in the previous procedure.) Do this for each of the conversion disks now.

⌐
  Copy your CP/M-80 software to the conversion disks. Run the
  Peripheral Interchange Program (PIP) as instructed in the
  CP/M documentation. Be sure you know which files you are
  transferring to your conversion disks. Do this for all the CP/M-80
  software now.

You have completed your work with the Z-89 computer. Follow
transfer procedure one to complete the transfer process (if you want
to make Z-1 00-bootable disks) of your CP/M-80 files. Whenever
transfer procedure one calls for a CP/M-80 disk, use the conversion
disk instead.

Transfer Procedure Three

CP/M-80 software supplied on 5.25-inch, soft-sectored, 96-tracks
per inch disks must be transferred to 48-tracks per inch disks to use on
the Z-1 00.

Equipment Needed

You will need a Z-89 computer with a soft-sectored controller (Z-89-
37) and one 5.25-inch, 48-tracks per inch disk drive connected to
one disk output port and one 5.25-inch, 96-tracks per inch disk drive
connected to the other disk output port; CP/M-80 with PIP.COM and
STAT.COM, configured for the two different types of disk drives; a
Z-100 computer with two 5.25-inch disk drives; a CP/M-85 working
disk (bootable) that contains FORMAT.COM, BSYSGEN.COM, and
PIP.COM; and sufficient 5.25-inch soft-sectored disks to
accommodate at least twice the number of files you wish to
transfer.

Even though Zenith Data Systems does not support the mixed-drive
density required on the Z-89 in this procedure, you can transfer files
from 96-tpi disks to 48-tpi disks with little or no difficulty once CP/M-
80 is properly configured.

Transfer Procedure

⌐ Prepare labels for about half of the 5.25-inch disks, using the names of the files that you will transfer to them and the words "Conversion Disk."

⌐ Boot the Z-89 system from the 5.25-inch, 96-tpi disk drive, with CP/M80.

⌐ Format each of the conversion disks by inserting them, one at a time, into the 5.25-inch, 48-tracks per inch disk drive and entering the following command line.

   FORMAT

⌐ Press the **RETURN** key and answer the prompts. If you plan to use the 5.25-inch disks directly on your Z-100, enter 2 for the number of sides and D for density. Refer to your CP/M-80 documentation for instructions to use the FORMAT command of CP/M-80. Use the same procedure to format all the conversion disks now.

⌐ Place the operation system on each of the conversion disks. Insert each disk into the soft-sectored drive (the same drive you used to format the disks) and enter the following command line.

   SYSGEN

⌐ Press the **RETURN** key. When the following line is displayed, enter the name of the drive that contains your source disk (this is the disk from which you booted the Z-89).

   SOURCE DRIVE NAME (OR RETURN TO SKIP):

⌐ When the following line is displayed, press the Y key.

   COPY BIOS.SYS (Y/N):

⌐ When the following line is displayed, press the key that corresponds to the name for that drive. This will be the same drive name you used to format the conversion disks.

DESTINATION DRIVE NAME (OR RETURN TO REBOOT):

⌐ Use this same procedure and put the system on the remainder of the conversion disks now.

⌐ Place the Peripheral Interchange Program (PIP.COM) and STAT.COM on each of the conversion disks with PIP. Use the proper drive names for the source and destination disk drive. (They will be the same as you used in the previous procedure.) Do this for each of the conversion disks now.

⌐ Copy your CP/M-80 software to the conversion disks. You may need more than one conversion disk per CP/M-80 distribution disk. To copy the software, run the Peripheral Interchange Program (PIP) as instructed in the CP/M documentation. Be sure you know which files you are transferring to your conversion disks. Do this for all the CP/M80 software now.

You have completed your work with the Z-89 computer. Follow transfer procedure one to complete the transfer process (if you want to make Z-1 00 bootable disks) of your CP/M-80 files. Whenever transfer procedure one calls for a CP/M-80 disk, use the conversion disk instead.

Convertible Software

The list of CP/M-80 software products in Table J-1 may be converted and/or run on the Z-100 while you are using CP/M-85. In the Disk Format column of the table, "hard" refers to the hard-sectored disk format and "soft" refers to the soft-sectored disk format.

NOTE: The list in the table is a list of convertible software that may or may not still be available from your Zenith Data Systems dealer or Heath Company.

Table J-1: Convertible CP/M-80 Software

PROGRAM NAME	MODEL	DISK FORMAT	DESCRIPTION
SuperCalc™*	HSC-817-1 HSC-837-1 HSC-847-1	5.25-inch hard 5.25-inch soft 8-inch soft	SuperCalc is a worksheet pro gram that is used for viewing and calculating business data. It performs math operations on all relevant statistics throughout the 63column, 254-row range of the worksheet. It also provides screen-displayed help messages.
General Ledger II	SF-9104 SFS-9104	5.25-inch hard 5.25-inch soft	General Ledger II is a low-cost accounting program for small business bookkeeping. It enables you to enter a custom chart of accounts, verifies equality of all double-entered debits and credits and displays balance statements. General Ledger II requires BASIC-80 to run.
Small Business Inventory	SFS-9105	5.25-inch soft	Small Business Inventory is an inventory program that displays and prints twelve statistics describing up to 1,000 parts that you stock.

Table J-1 (continued): Convertible CP/M-80 Software

PROGRAM NAME	MODEL	DISK FORMAT	DESCRIPTION
Microstat	HES-817-1 HES-837-1 HES-847-1	5.25-inch hard 5.25-inch soft 8-inch soft	Microstat is a flexible, menu-dri ven program for statistical analy sis and data manipulation. It per- forms math operations, time series analysis, and several other functions.
WordStar™	HMP-817-2 HMP-837-2 HMP-847-2	5.25-inch hard 5.25-inch sof 8-inch soft	WordStar is a word processing program with advanced text edit ing/printing capabilities and screen-displayed help messages.
MailMergen™	HMP-817-3 HMP-837-3 HMP-847-3	5.25-inch hard 5.25-inch soft 8-inch soft	MailMerge is a WordStar supple ment that enhances WordStar's printing capabilities by enabling you to print form letters, merging variable text, and to automatically print a number of files in succes- sion. This program requires WordStar to operate.
Magic Wand	HRS-817-9 HRS-837-9 HRS-837-9	5.25-inch hard 5.25-inch soft 8-inch soft	Magic Wand is a word process ing program with video screen text editing and form letter printing capabilities.
SuperSort™	HMP-817-1 HMP-837-1 HMP-837-1	5.25-inch hard 5.25-inch soft 8-inch soft	SuperSort is a data organization program that quickly sorts and combines data from several dif- ferent files. It accepts data from many different record formats and provides screen-displayed help messages.
DataStar™	HMP-817-4 HMP-837-4 HMP-837-4	5.25-inch hard 5.25-inch soft 8-inch soft	DataStar is a data organization program that enables you to gen erate forms for entering data, to store the data in files, and to re- trieve the data quickly. It can per- form math operations on the data and provides screen-displayed help messages.

Table J-1 (continued): Convertible CP/M-80 Software

PROGRAM NAME	MODEL	DISK FORMAT	DESCRIPTION
WordMaster™	HMP-817-1 HMP-837-1 HMP-847-1	5.25-inch hard 5.25-inch soft 8-inch soft	WordMaster is an economical text editing utility program that enables you to compose text files and store them on disk for program development and/or correspondence.
Despool	HDR-817-3 HDR-837-3	5.25-inch hard 5.25-inch soft	Despool is a time-saving utility that coordinates printing operations.
SID/ZSID	HDR-817-2 HDR-837-2 HDR-847-2	5.25-inch hard 5.25-inch soft 8-inch soft	SID/ZSID is a debugging utility that enables you to display and change portions of an assembly language program by accessing assembly mnemonics in source files or hexadecimal code in object files.
Macro Assembler	HDR-817-1 HDR-837-1 HDR-847-1	5.25-inch hard 5.25-inch soft 8-inch soft	A Macro Assembler is an ad vanced assembler utility that makes program development and assembly easier, It uses the assembly language designed for the ASM utility and includes many useful macro utilities.
MACRO-80	HMS-817-52 HMS-837-52 HMS-847-52	5.25-inch hard 5.25-inch soft 8-inch soft	MACRO-80 is a fast and versatile utility for assembling 8080 or Z80 building libraries of source code, relocatable modules, linking modules from several languages into executable object code, and cross referencing variable names and line numbers.
CBASIC®	HCM-817-1 HCM-837-1 HCM-847-1	5.25-inch hard 5.25-inch soft 8-inch soft	CBASIC is a noninteractive BASIC programming tool that in cludes a pseudo-code compiler and a run-time interpreter. It includes programs to convert source files into executable object files and a program to list all variables used in a source file.

'Table J-1 (continued): Convertible CP/M-80 Software

PROGRAM NAME	MODEL	DISK FORMAT	DESCRIPTION
Pearl III	HCP-837-1 HCP-849-1	5.25-inch soft 8-inch soft	Pearl III is a menu-driven pro gram generator that enables users without programming experience to design and produce custom application programs that can manipulate up to three files at one time. Prompts the user to specify what the program should do, and converts these specifications into a CBASIC source file.

Magic Wand Function Key Guide

Some of the features of the Magic Wand word processor are performed on the Z-89 by pressing keys that do not exist in the same form on the Z-100 keyboard. This guide will help you to determine which keys are available for these functions on the Z-1 00.

Table J-2 shows the Z-100 keys you can press to duplicate the Magic Wand functions you performed on the Z-89 computer.

Table J-2: Magic Wand Z-89 to Z-100 Function Key Guide

Z-89 KEY	Z-100 KEY	FUNCTION
f1	F1	Backward line scroll.
f2	F2	Forward line scroll.
f3	F3	Backward page scroll.
f4	F4	Forward page scroll.
f5	F5	Page feed.
blue	F6	Search and replace.
red	F7	Repeat search.
white	F8	Set block marker.
IC/7	I CHR	Toggle the character insertion on or off.
DC/9	D CHR	Delete the current word.
IL/1	INS LINE	Toggle the full insert on or off.
DL/3	DEL LINE	Delete the current line.
↑	↑	Move the cursor up one line.
↓	↓	Move the cursor down one line.
→	→	Move the cursor one character to the left.
←	←	Move the cursor one character to the right.
HOME	HOME	Move the cursor to the home position.

Interactive Business Graphics

Introduction

This appendix contains the additional instructions for using your demonstration disk programs. In particular, these instructions deal with the Interactive Business Graphics programs (selection F2).

After you are familiar with BASIC, you are invited to "take the programs apart" and examine the various routines contained in them. If you have purchased GW-BASIC, instead of Z-BASIC, you will need to convert the programs, using the TOKEN program that is distributed with GW-BASIC. Refer to the GW-BASIC documentation for instructions.

The Interactive
Business Graphics Program

The business graphics charts are produced in a three-step process: first, create and/or modify data file(s); second, create a graphic design; and third, draw the display. The data may be kept (stored on disk) for as long as you need it. A data file that is used with one type of chart may be used with any of the other six types of charts.

NOTE: Do not use a write-protected disk.

To use the program, proceed with the following.

At the master menu, press the **F2** key. After a few moments, the screen will clear and display four options and three "windows."

The left window shows you typical data information. This represents option 1, the data management routines. The routines allow you to create, change, or print out a data file that you may later use to create one or more business graphs. Press the **F1** key to proceed to the data management routines.

- The right window tells you what kind of display is being used in the center window. This represents option 2, the graphic design section. It allows you to specify the format of the display. In addition, you will specify the title, data labels, and the data file(s) that are to be used. Press the F2 key to proceed to the graphic design routines.

- The center window shows a miniature version of a display created from the information that you see in the left and right windows. This represents option 3, the graphic display. It creates the display that you have specified. Press the F3 key to display the graph you have selected.

- The continuous demonstration will display a series of charts that have been created using the same three steps that you can use to create your own charts. Each of the seven types of charts is shown during this demonstration.

NOTE: If your computer does not have the color video option, you will only see five of the charts; the program detects the presence or absence of the color option and displays a message in place of the graph.

To design your own chart, proceed with the following steps and enter the data as instructed. Later, after you get a feel for this program, you will be able to proceed without specific instructions. The program has been designed with prompts to lead you through the process. After this first session, you will be able to use your own data.

The Data Management Routines

☐ From the demonstration disk's main menu, press the F2 key to proceed to the interactive business graphics menu.

☐ To set up, modify, or print a data file, press the F1 key. The screen will clear and display the following menu.

> Data Management Routines
>
> Enter Your Choice:
>
> <Fl> Create a New Data File
>
> <F2> Modify existing Data File
>
> <F3> Print a Data File
>
> <HOME> EXIT
>
> Press Function key indicating your choice >

This menu gives you several options. When you press the F1 key, you will be able to create a new data file and enter data into it. If you have an existing file on the disk, you can modify or change the data in it by selecting the F2 option. To print the information stored in a data file, you would press the F3 key. If you want to return to the interactive business graphics menu, press the HOME key.

Create New Data File

☐ Press the **F1** key. The screen will clear and display the following.

> Create New Data File
>
> Enter name for new file or EXIT   >********

To return to the main menu enter the word "exit" in either all uppercase letters or all lowercase letters and press the **RETURN** key. If you use a combination of upper- and lowercase letters, the program will not recognize the word and will treat it as the name of a data file. Do not use a combination of capital and lowercase letters.

Data file names follow a set of rules. More detail is provided in the "Disk Operating System" chapter of this manual.   For now, remember that you may use only eight characters.   The first character must always be a letter. Do not use punctuation (even though some are allowed, there aren't many, so for now, do not use any).

The file name is controlled by the program (it will not allow you to enter amore than eight characters); therefore, do not attempt to enter an extension. The interactive business graphics programs assign specific extensions to your files.

⌐ Enter a name for your file. For the first time through these instructions, enter the following name.

    TEST

⌐ Press the **RETURN** key.

If you use a name that has previously been assigned to a file, the program will display a message which will inform you that recreating the file will erase the old data. The program will then ask you if this is what you want to do. If you press the Y key in response to this prompt, then the program will continue. Otherwise, the program will prompt you to enter a new file name.

The computer will now display the following.

    Number of data items (maximum=20)   >**

Before you enter the actual data into a file, you must tell the program how many items you are about to enter. The data files for this program are limited to twenty items. Your own programs may use more, but only if the program and graphic displays are adjusted for the larger number of items. The lower limit is set to two items, since this is the minimum necessary to create a meaningful chart.

If you enter a number less than 2 or greater than 20, a message will be displayed that tells you that your number is out of range and that you must enter a valid number.

⌐ Enter any number between 2 and 20, depending upon the number of items you have. For the first time through the program, enter 2 and press the **RETURN** key. The screen will clear and the following will be displayed.

> Data Descriptions and values will now be entered.
>
> Press RETURN after each line to continue with the next item.
>
> Errors can be corrected after all items have been entered.
>
> Enter Description for item #1   > ** *

⌐ For the first time through the program, enter the following description.

> January

⌐ Press the **RETURN** key. The display will now show:

> Enter value for January   >********

⌐ For this prompt, enter 3 and press the **RETURN** key. The display will show:

> Enter Description for item #2   >**************

⌐ Enter February and press the **RETURN** key. The display will show:

> Enter value for February   >********

⌐ Enter 2 and press the **RETURN** key. This completes the second entry. Since you told the program you had only two items, you are now done with this section. You will now be automatically transferred to the second of the data management routines, the modify existing data file routine.

Modify Existing Data File

⌐ Press the **F2** key from the data management routines menu to start this part of the routines. Note that if you just created a new data file with the F1 key from the data management routines menu, you will automatically be sent to this routine after you enter your last data item.

⌐ If you are entering this routine from the menu and not the create new data file routine, you will be asked for the data file to be modified. If the file cannot be found, a message will be displayed which tells you that the data file was not found. You may then enter the correct data file name or the word EXIT in all uppercase or all lowercase letters to get back to the menu.

After the data has been read from disk (if needed), the screen will clear and the data will be displayed in a manner similar to the following.

<div align="center">Modify Data</div>

1) Description > January   Value> 3 (60. 0%)
2) Description > February   Value> 2 (40.0%)

Enter item number to change (99) if done)   >**

The data shown in this example was entered by following the steps in creating a new data file. Here, each item is identified by a number (1, 2 and etc.). To modify any particular line, enter the line number that identifies rat line.

⌐ To change the data displayed in line two, enter the number 2 and press the **RETURN** key. The screen will display the following.

Description (Default =February)   >**************

⌐ Since you don't want to change the description, press the **RETURN** key. Otherwise, you may modify the description by entering the correct information. The screen will flash the default and display the following line.

Enter new value or <RETURN> (Default=2)   >********

⌐ To change this value, enter a new number (enter 3) and press the **RETURN** key. After correct a line, the new values will be displayed and the percentages recomputed. You may correct another line using the same procedure, or you may exit this routine. To exit the routine, enter 99 and press the **RETURN** key. The screen will now display the following line.

Shall I save changes (Y/N)?

⌐ Press the Y key. The screen will display the following.

** Saving file>   TEST.DAT**

2

Data Output Completed.

The file is stored on the disk. The program will then return to the data management routines menu.

If you press the N key instead of the Y key, the screen would display the following line.

File not saved. Returning to menu...

The program will return to the data management routines menu.

Print Existing Data File

⌐ To print the contents of a data file on a printer, press the F3 key at the data management routines menu.

⌐ When you are prompted to enter the name of a data file, enter the name of the file you want printed. Do not enter any file extension name. Press the **RETURN** key. If you do not want to print a file, enter either EXIT or exit and press the **RETURN** key. The program will return to the data management routines menu.)

⌐ If you entered the wrong name for a file, you will see an error message and then you will be given the opportunity to enter the correct name or return to the data management routines menu.

⌐ You will be asked to press the RETURN key if your printer is ready. Before you do, check to make sure the printer is on and set up properly. Then press the **RETURN** key.

⌐ After your file has been printed, you will be asked to enter the name of another file. This gives you the opportunity to print the data in another file or return to the data management routines menu. To exit this routine, enter either EXIT or exit and press the **RETURN** key.

Graphic Design Routine

The graphic design option of this demonstration is the second step you use to create a business graph. The first step was the entry of data into a file, which was stored for use in producing one or more graphs. Your next step is to provide the "visual" information needed to produce the graph. This information includes the following.

- The type of graph.
- The data file or files to be used to create the graph.
- The title of the graph.
- The X-axis label when needed.
- The Y-axis label when needed.

- The X-axis descriptions or pie chart labels.
- The Y-axis minimum, maximum and increment values.
- The legends.
- The bar types.
- The pie pieces to be offset from the chart.

To enter the specifications for the graph, press the F2 function key from the interactive business graphics menu. The screen will clear and a sample of each of the seven types of displays will be shown on the screen. Above each sample will be the name of the display and the respective function key. Table K-1 is a complete list of the function key and corresponding chart.

Table K-1: Graph Display Types

FUNCTION KEY	TYPE OF GRAPH
F1	Vertical bar chart.
F2	Single pie chart.
F3	Horizontal bar chart.
F4	Point-to-point line chart.
F5	Multiple pie chart.
F6	Trend-line analysis chart.
F7	Three-dimensional bar chart.

Press the function key that corresponds to the chart you want to display. If you wish to return to the interactive business graphics menu, press the **HOME** key.

Enter the specification requested for the type of chart you have selected. Table K-2 contains the information requested for each type of chart. The heading across the top of the chart contains the function key number that corresponds to the charts as described in Table K-1.

Table K-2: Chart Specifications

	F1	F2	F3	F4	F5	F6	F7	NOTES
Number of files	1-4	1	1-4	1-4	2-8	1	1-2	1
File names	1-4	1	1-4	1-4	2-8	1	1-2	2
Chart title	x	x	x	x	x	x	x	3
X-axis labe	x	n/a	x	x	n/a	x	x	4
Y-axis label	x	n/a	x	x	n/a	x	x	5
X-axis descriptions	x	n/a	x	x	n/a	x	x	6
Y-axis values	x	n/a	x	x	n/a	x	x	7
Legends	x	n/a	x	x	x	n/a	x	8
Bar layout	x	n/a	n/a	n/a	n/a	n/a	n/a	9
Bar spacing	x	n/a	n/a	n/a	n/a	n/a	n/a	10
Piece description	n/a	x	n/a	n/a	x	n/a	n/a	11
Piece offset	n/a	x	n/a	n/a	n/a	n/a	n/a	12

Notes:

1. The number of files that can be used for any chart can range from 1 to 8, depending upon the chart. The range is provided.

2. The file name is that of the data file. The number of names requested will depend upon the number of files you specified for the first question (unless the chart type only requires one file). Please note that if multiple files are specified, they all must have the same number of data items. Also not that pie charts and the three-dimensional bar chart do not allow for negative values within the data file.

3. The chart title is limited to 70 alphanumeric characters, including spaces.

4. The X-axis label is limited to 15 alphanumeric characters, including spaces.

5. The Y-axis label is also limited to 15 characters.

6. The default x-axis descriptions will be those you entered when you set up the data files.

7. The Y-axis values are the minimum and maximum values that have been calculated (along with the increment value) from your data file or files. If you override these defaults with new values, the relationship between these values is calculated according to the following formula.

$$\text{Increment} = \frac{\text{maximum} - \text{minimum}}{16}$$

8. The default legends will be the names of the data file or files.

Table K-2 (continued): Chart Specifications

9. The bar layout may be specified as either normal (no overlap) or overlapping.

10. The bar spacing may be specified as either stepped or spaced with gaps.

11. The default piece descriptions are the data descriptions you entered when you set up the data files.

12. The piece offset gives you the choice of several options including which piece to offset.

13. If a data file is altered so that the data no longer fits within the minimum/maximum values specified during this procedure, then all designs that use the modified file must be respecified. Otherwise, an error may occur when the display is placed on the screen.

14. If a data file that is used in a chart is not on the disk when that chart is displayed, an error will occur. The missing data file should be supplied by either copying it from another disk or entering the data with the Create Data File routine.

15. Multiple pie displays are limited to a maximum of eight pies (files) of no more than eight data items per file (slices per pie).

16. Bar and line charts are limited to fur files of twenty data items per file.

Once you have finished specifying the design, you will be asked if you want to save the design. If you have made errors or have decided not to use the design, press the N key. The specifications will be ignored (not stored) and the program will return to the interactive business graphics menu.

If you are satisfied with your specifications, press the Y key. The program will then prompt you for a file name under which the information will be stored. Enter a name without an extension and press the **RETURN** key. The program will store the data under the file name you entered and by the type of chart you specified. The program will return to the interactive business graphics menu.

Displaying the Graph

When you have created the data file or files and specified the graph, ou are ready to display the results.

⌐ To display a design, press the F3 key from the interactive business graphics menu. The screen will clear and you will see the seven type of designs that can be created by this program.

⌐ Press the function key that corresponds to the design you wish to display. The names of the design files that are stored on the disk will be displayed.

⌐ Enter the name of the display that you wish to see. Do not enter the extension.

⌐ Press the **RETURN** key. The screen will clear and the chart will be created from the specifications you provided earlier. To return to the interactive business graphics menu, press the **HOME** key.

This completes the instructions for using the demonstration disk that is included with your system. While these instructions have been brief, we hope you will have gained some insight into the power and strength of the Z-1 00 Series Computers from Zenith Data Systems Corporation.

Backups

This appendix will show you how to make backups of your important disks using two different methods. You will also be shown a way to make a suggested copy of MS-DOS to use as a basis for all your bootable software that use this operating system.

Using the DISKCOPY Utility
to Make Backups

The DISKCOPY utility of MS-DOS can be used to duplicate or make backups of identical disks. if you wish to backup a disk to a different format (for instance, from 5.25-inch disks to 8-inch disks or from a Winchester partition to 5.25-inch disks or 8-inch disks) you must use the FORMAT and COPY procedure that is explained later in this appendix.

Likewise, if you want to backup only certain files, you would use the COPY command, formatting new disks as needed.

When you use the DISKCOPY utility, it does not have to be on the source disk. In the following example, you will use DISKCOPY to duplicate the second MS-DOS working disk. You will need a blank disk and the MS-DOS disk #1 working disk.

⌐
   Boot your computer from the MS-DOS disk #1 working disk.

⌐
   Enter the following command line.

       DISKCOPY/V

⌐
   Press the **RETURN** key. The computer will locate the DISKCOPY file, load
   it and display a message similar to the following.

                   DISKCOPY version 2. 20
           Copyright(C) 1984 Zenith Data Systems Corporation

           Source drive name? (A-H) _:

⌐ Remove the disk in drive A and place the MS-DOS disk #2 working disk in drive A and close the door or latch.

⌐ You will notice that the cursor is to the left of the colon. It is prompting you to enter the name of the disk drive in which the source disk is located. Press the A key. The computer will now show:

Destination drive name (A-H) _:

NOTE: This backup procedure does not check to see if your destination disk has data on it. Any information previously recorded on the disk will he erased and blank (empty) tracks will be placed on the disk, making it ready to receive new data. Be sure you are using a blank disk (or one that you wish to erase).

Insert a blank disk in drive B and close the door or latch. Press the B key. The computer will display:

Place the source disk in A and the destination disk in B.
Press RETURN when ready.

You have a chance to check that you have the correct disks in the proper drives. The source disk, MS-DOS disk #2 working copy, should be in drive A. The destination disk, a blank disk, should be in drive B. If you are not sure that they are correct, check them now.

You also may stop the duplication process now if you wish. To stop (or abort) the backup procedure, you would press *both* the **CTRL** and **C** keys at the same time. The computer would end the program and display ↑C on the screen, followed by the MS-DOS prompt. However, you *need* to make working copies of your distribution disks, so continue with the following procedure.

⌐ With MS-DOS disk #2 working copy in drive A and a blank disk in drive B, press the **RETURN** key. The light in drive A will come on momentarily and then the light in drive B will come on. You will see the following on the screen.

Formatting destination...

When the light came on for drive A, the computer was checking the type of disk in drive A and the way the tracks were organized on the source disk. Next, it checked the type of disk in drive B. When it was satisfied that the disks were of an identical type (both soft-sectored, in this case), it displayed the message and began formatting, or organizing, the tracks and sectors so they matched those of the disk in drive A. After the destination has been formatted, the display will show:

> Copying...

Now you will see the disk access indicators in drive A and drive B alternately come on. While the indicator in drive A is on, the computer is reading information from the disk into memory. Then while the indicator in drive B is on, the computer is writing that same information onto the tracks and sectors in drive B. When this process has been completed, the computer will show:

> Verifying...

Again, the disk access indicators in drive A and drive B will alternately come on. This time, the computer reads the information from each respective disk and then compares the data to make sure it matches. This process verifies that the destination disk is an exact copy of the source disk. When this process has been completed, the computer will show:

> Do you wish to copy another disk (Y/N)? <N>

⌐ If you have another disk to duplicate, press the Y key, followed by the **RETURN** key. You will again be asked to enter the name of the drives being used.

⌐ If you do not have any other disks to copy, press the **RETURN** key. The character inside the angle brackets indicates the default value (the character used if you do not enter anything form the keyboard). In this case, the letter N is used as the default value; you could have pressed the N key and then the RETURN key instead.

The computer will display the MS-DOS prompt.

Using the FORMAT and COPY Procedure to Make Backups

The external FORMAT command is used to organize the surface of a new, unformatted disk and place a copy of the operating system on it to create a bootable disk. The internal COPY command is used to copy or backup your original files.

You must always format new disks, since the COPY command does not automatically format blank disks. It is also necessary to format any disk that was used on a different computer (other than a Z-100 or Z-100 PC under MS-DOS version 2), under a different operating system, or that had been partially or completely erased by a magnetic field. Different computers and operating systems may use a different, incompatible format the disk.

FORMAT

Turn on the computer and boot the MS-DOS disk #1 working copy. The display will show the MS-DOS prompt:

        A>

┌ If you want to produce a bootable disk, enter the following command line.

        FORMAT B:/S/V

┌ If you want to produce a data disk, one that is not bootable, enter the following command line.

        FORMAT B:/V

⌐
Press the **RETURN** key. The ʙ: portion of the command line tells the computer that you will use drive B to format the disk. The /S tells the format utility to place the operating system on the disk. The /V tells the utility to verify each sector on the disk and lock out any that are identified as bad. The computer will display the following information and prompt.

FORMAT version 2.20

Copyright(C) 1984, Zenith Data Systems Corporation

Insert new disk in drive B and press RETURN when ready.

NOTE: The format procedure does not check to see if your disk has data on it. Any information previously recorded on the disk will be erased and blank (empty) tracks will be placed on the disk, making it ready to receive new data. Be sure you are using a blank disk (or one that you wish to erase).

⌐
Place a blank disk in drive B and close the door or latch.

⌐
Press the **RETURN** key. The disk access indicator in drive B will light and you may be able to hear the drive making some quiet clicking sounds as the disk is formatted. When a disk has been formatted that will have the operating system on it, you will see the following message on the screen.

System transferred

After the system has been recorded on the disk or, for a data disk, after it has been formatted, you will see the following prompt on your screen.

Enter desired volume label (11 characters, RETURN for none)?

This is the only place that you can assign a volume name to your disk. Remember that the volume name is displayed by the CHKDSK and VOL commands.

Up to 11 characters, consisting of letters, numbers, spaces, underlines, and/or hyphens. All other characters are illegal and if you try to use one of them in your label, the computer will display the following error message.

Invalid characters in volume id

Enter desired volume label (11 characters, RETURN for none)?

It is a good idea to enter a volume name (label) that is similar to the label you prepare for the disk. However, be aware that 11 characters are a very limited number of characters that you can use for the name, so carefully plan what you want to enter.

Once a disk has had a name entered onto it, the only way the name can be changed is to reformat the disk.

⌐ Enter the volume name and press the **RETURN** key. The computer will display a report on the amount of disk space used and available. For a system disk formatted with 8 sectors per track, the computer will display the following.

322560 bytes total disk space

50176 bytes used by system

272384 bytes available on disk

For a data disk formatted with 9 sectors per track, the computer will display the following.

362496 bytes total disk space 362496 bytes available on disk

The computer will prompt you with the following message. It is asking you if you want to format additional disks, using the same parameters (specifications) that you specified in the original command line.

Do you wish to format another disk (Y/N)?

⌐ Press the Y key if you wish to format another disk using the same disk drive and parameters that you specified in the command line.

⌐ Otherwise, press the N key if you do not want to format another disk using the same drive or parameters.

The computer will either prompt you to insert a new disk in the specified drive or return you to the MS-DOS prompt. Note that you do not have to press the RETURN key for this prompt.

⌐ Prepare a label for the disk in drive B. For information on labeling disks, refer to Chapter 2 of this manual.

You are now ready to back up your files.

COPY

⌐ Remove the MS-DOS disk #1 working copy from drive A and put it away.

⌐ Take the disk in drive B and place it in drive A.

⌐ Place the disk from which you wish to copy (backup) files in drive B.

⌐ Enter the following command line.

COPY B:*.*/V

⌐ Press the **RETURN** key. The disk access indicators of each drive will alternately come on and the name of each file will be displayed as it is read into memory from the disk in drive B and then written onto the disk in drive A. When all the files have been copied, the computer will display a message similar to the following.

xx File(s) copied

A>

The xx in the display will indicate the number of files that were transferred to the disk (in this case, all of them).

The COPY command is used to copy one or more files from one disk to another. It is a widely used command that can be used to make backups or system disks from software that is distributed on nonsystem disks. The message displayed at the end of the operation tells you how many files were involved in any particular COPY procedure.

Likewise, the COPY command can be used to transfer files from one type of disk to another. For instance, you can copy files from a 5.25-inch distribution disk to either a Winchester partition or an 8-inch floppy disk with the COPY command.

In the next section of this appendix, you will use the FORMAT and COPY commands to create a special operating system disk, one that can be used as the basis for most of your bootable system disks.

Creating Bootable MS-DOS Disks for Your Applications Packages

If you read through chapter two of this manual or have attempted to read the directory of MS-DOS disk #1, you know that it has a branch directory on it that contains the majority of the useful MS-DOS utility programs. However, it is not always convenient to use branch directories on 5.25-inch disks. You may use the following procedure to create a minimum system MS-DOS disk that can be used as a root bootable disk for many of your application programs.

A number of application programs require one or more MS-DOS files and utilities for proper or convenient operation. The files and utilities include ALTCHAR.SYS, CONFIG.SYS, CHKDSK.COM, FORMAT.COM, CONFIGUR.COM, DISKCOPY.COM, PRINT.COM, RDCPM.COM, MAP.COM, and ZDIR.COM. You may not need some of these files; you will be given the opportunity as you create this new MS-DOS disk to select the files you think are necessary to your computer operation.

⌐ Prepare a label for a new disk. Label it "MS-DOS minimum system disk."

⌐ Boot your computer from MS-DOS disk #1 working copy.

⌐ Place a blank disk in drive B and enter the following command line.

FORMAT B:/V/S

⌐ Press the **RETURN** key. The computer will load the FORMAT utility from drive A and display a message similar to the following:

FORMAT version 2.20

Copyright(C) 1984, Zenith Data Systems Corporation

Insert new disk in drive B and press RETURN when ready.

⌐ Insert the new disk in drive B and close the door or latch.

⌐ Press the **RETURN** key. The computer will format the disk in drive B and lock out any bad sectors. Then it will display the following messages.

System transferred

Enter desired volume label (11 characters, RETURN for none)?

⌐ Enter the following volume label.

MS-DOS

⌐ Press the **RETURN** key. The computer should display the following information.

322560 bytes total disk space
50176 bytes used by system
272384 bytes available on disk

Do you wish to format another disk (Y/N)?

⌐ Examine the disk allocation information. If you see any disk
space allocated to bad sectors, remove the disk and format a
new disk. *Do not use a disk with bad sectors for this procedure.*

⌐ If the disk does not have bad sectors, press the N key, followed
by the **RETURN** key. The MS-DOS prompt will be displayed.

⌐ Transfer control to drive B by entering the following command line.

        B:

⌐ Press the **RETURN** key. The system prompt should now be B>.

Now you will copy files from the MS-DOS disk #1 working copy in
drive A to drive B. For each file, you must choose to copy or not to
copy the tile to the new MS-DOS minimum system disk.

The first two files that you will copy are the system files,
CONFIG.SYS and ALTCHAR.SYS. These files are loaded
automatically into memory it they are on the disk when you boot the
system. Since they carry important information, such as the
graphics characters, it is suggested that you always place these
files on your bootable system disks, since they do not occupy much
space (less than 1 kilobyte).

⌐ To copy the two system files, enter the following command line.

        COPY *. SYS B:

⌐ Press the **RETURN** key. The computer will display the following
lines as the files are copied.

        ALTCHAR.SYS
        CONFIG.SYS
        2 File(s) copied

⌐ The following files will be copied from the branch directory, BIN. To change the directory of the disk in drive A, enter the following command line.

      CD A: BIN

⌐ Press the **RETURN** key.

The file CHKDSK.COM is used to check and correct any problems with the directory. It is also used to report free disk space. It can be used by some programs to report this information without leaving the program. Therefore, it should be placed on your system disks.

⌐ To copy CHKDSK.COM, enter the following command line.

      COPY A:CHKDSK.COM

⌐ Press the **RETURN** key. The file will be copied and the computer will report:

      1 File(s) copied

You should be familiar with FORMAT.COM. It is the format utility and is used to format new, blank disks. Since very few application programs have this capability, you should place FORMAT on most of your system disks.

⌐ To copy FORMAT.COM, enter the following command line.

      COPY A: FORMAT.COM

⌐ Press the **RETURN** key.

The CONFIGUR utility is used to configure the operating system on your disks to the characteristics of your computer system. Although this utility may be left off the minimum system disk, it occasionally is needed if you have more than one Z-100 system, frequently change peripherals in the system you do have, or expect to make changes in the near future.

☐ To copy CONFIGUR.COM, enter the following command line.

    COPY A:CONFIGUR.COM

☐ Press the **RETURN** key.

The DISKCOPY utility can be used to make exact duplicates of your disks. If you have two 5.25-inch or two 8-inch floppy disk drives, you will want this utility on your minimum system disk. If you have a Winchester system and a single floppy disk drive, then do not copy this file.

☐ To copy DISKCOPY.COM, enter the following command line.

    COPY A:DISKCOPY.COM

☐ Press the **RETURN** key.

The PRINT utility is used to print files in the background mode. This means that you can use the computer to print files at the same time you are using it to do other tasks. Copy this file only if you expect to need this function. Most word processing programs, including MicroPro's WordStar® and Microsoft's Word, have this capability.

☐ To copy PRINT.COM, enter the following command line.

    COPY A:PRINT.COM

☐ Press the **RETURN** key.

The RDCPM utility is used to copy files from CP/M disks. If you do not have CP/M disks to copy, do not include this file. If you will be using CP/M-85 or CP/M-86 on your Z-100, you may need to occasionally use this utility.

⌐ To copy RDCPM.COM, enter the following command line.

     COPY A:RDCPM.COM

⌐ Press the **RETURN** key.

The MAP utility is required by some application programs to properly map the drive names when the Winchester or 8-inch disk drives are used. Copy this file to your minimum system disk only if you have a Winchester disk drive or 8-inch floppy disk drives.

⌐ To copy MAP.COM, enter the following command line.

     COPY A:MAP.COM

⌐ Press the **RETURN** key.

The ZDIR utility is a modified directory utility that displays the directory entries in alphabetical order. You use this directory command most often when you have disks that have a large number of files.

⌐ To copy ZDIR.COM, enter the following command line.

     COPY A:ZDIR.COM

⌐ Press the **RETURN** key.

You have copied all of the files that are needed on a regular basis with MS-DOS. You may find others equally important to your particular system. Copy those files at this time, using the same procedure.

If you plan to use the screen dump facility, refer to your MS-DOS documentation and copy the appropriate file from the PSC branch directory of MS-DOS disk #2.

If you copied the files suggested in this section, taking a directory of drive B should produce a display similar to the following.

Volume in drive B is MS-DOS Directory of B:\

COMMAND	COM	16421	11-12-84	11:03a
ALTCHAR	SYS	432	4-04-84	3:18p
CONFIG SYS		12	9-06-84	2:36p
CHKDSK	COM	6468	4-04-84	1:47p
FORMAT	COM	13674	11-12-84	11:42a
CONFIGUR	COM	12031	11-12-84	11:47a
DISKCOPY	COM	15738	11-12-84	11:35a
PRINT	COM	6288	10-31-84	12:52p
RDCPM	COM	3818	11-12-84	11:33a
MAP	COM	3743	10-26-84	1:23p
ZDIR	COM	3372	6-01-84	2:58p

    11 File(s)   200704 bytes free

An absolute minimum MS-DOS disk would produce a directory similar to the following.

Volume in drive B is MS-DOS Directory of B:\

COMMAND	COM	16421	11-12-84	11:03a
ALTCHAR	SYS	432	4-04-84	3:18p
CONFIG	SYS	12	9-06-84	2:36p
CHKDSK	COM	6468	4-04-84	1:47p
FORMAT	COM	13674	11-12-84	11:42a

    5 File(s)   2xxxxx bytes free

The advantage to keeping the number of files to an absolute minimum is that your system disk can hold more application programs. One alternative to obtaining slightly more disk space is to format the system disk with the /9 switch, thus recording 9 sectors per track instead of 8. This higher density will sometimes reduce the reliability of a system operated under adverse conditions and makes the system somewhat more sensitive to rapid variations of temperature and/or humidity. If your system will be operated in a

location where the temperature and humidity are relatively stable (such as in an air conditioned office), then you should experience no problems using disks that are formatted to the higher density.

⌐ Use DISKCOPY to produce two copies of the minimum system disk to use as working copies. Label them appropriately.

⌐ Whenever you want to produce a system disk for an application program, use DISKCOPY to produce a new copy of the minimum system disk. Then copy your application files to the new minimum system disk and label it accordingly.

If you plan to go through the exercises in Chapter 3 of this manual, you will want to place a copy of the BASIC interpreter on a bootable disk. Use DISKCOPY to produce a copy of the minimum system disk and then follow the directions provided in Chapter 3 to produce a bootable BASIC disk.