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**Z-150**  
**Personal Computer**  
**Desktop System**

**User's Guide**

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## REGULATORY AND REGISTRATION INFORMATION

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

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

- Move the computing device away from the receiver being interfered with.
- Relocate (turn) the computing device with respect to the receiver.
- Reorient the receiver's antenna.
- Plug the computing device into a different AC outlet so that the computing device and receiver are on different branch circuits.
- Disconnect and remove any I/O cables that are not being used. (*Unterminated* I/O cables are a potential source of high RF emission levels.)
- Unplug and remove any circuit boards that are not being used. (Here again, *unterminated* cards can be a source of potential interference.)
- Be certain that the computing device is plugged into grounded outlet receptacles. (Avoid using A/C cheater plugs. Lifting of the power cord ground may increase RF emission levels and may also present a lethal shock hazard to the user.)

If you need additional help, consult your dealer or ask for assistance from the manufacturer. Customer service information may be found in the In Case of Difficulty section of the Operations Manual. 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, D.C. 20402 — Stock No. 004-000-000345-4.

### 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 Corporation regarding this equipment.

Model \_\_\_\_\_ Serial # \_\_\_\_\_

Series \_\_\_\_\_ Date Purchased \_\_\_\_\_

Any attempt to alter or modify the design, or to use this device in a manner other than described in the User's and Operations Manuals, will void the Warranty and release the manufacturer from any responsibility for its operation.

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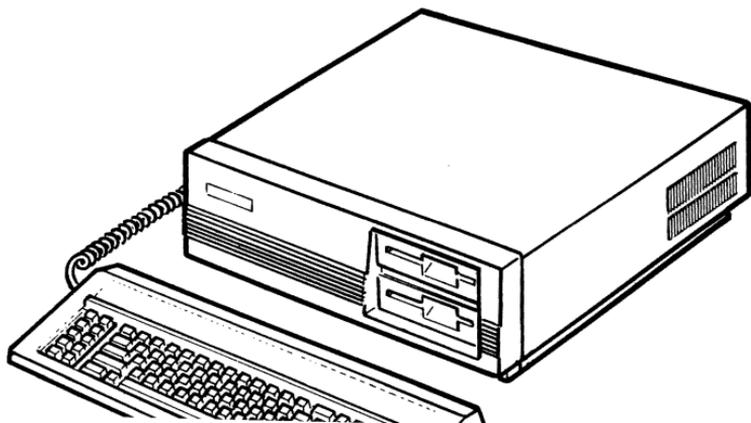
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# Welcome

Congratulations on your purchase of a new Z-150 Personal Computer Desktop System. The Z-150 PC represents a state-of-the-art design capable of satisfying both business and personal needs.

With Zenith, the future is here today. Your new computer can act as a stand-alone tool or function as the heart of a powerful and expandable business automation package. Combined with Zenith Data Systems software, the desktop computer can easily provide practical and affordable solutions to many of your business problems. It can satisfy a variety of business applications, including data processing, telecommunications, networking, and financial analysis.

This User's Guide has been prepared for you, the new computer owner and user. Welcome to personal computing at its very best, and accept Zenith's pledge and commitment that the quality goes in before the name goes on.



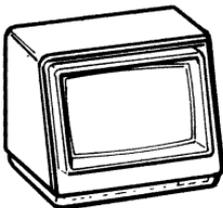
# Chapter 1

## Introduction

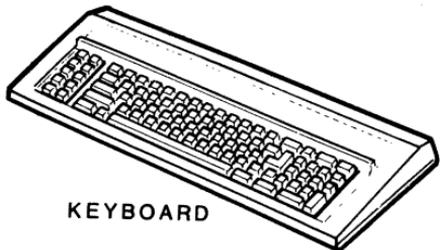
### Introduction to Computers

A computer is a tool much like a typewriter or calculator. It can be used in a wide number of engineering, business, and personal applications, such as computer-aided design, word processing, general accounting, inventory, payroll, mailing lists, and many other similar applications. It also is an excellent educational tool that can make the learning process fun and challenging for the student, while providing management aids for the instructor and school.

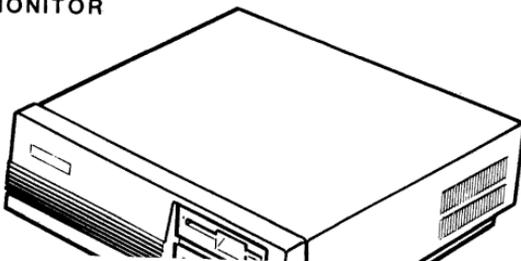
As shown in Figure 2, a typical desktop computer system consists of three or more individual hardware components, including the computing unit, the keyboard, and the video monitor.



VIDEO MONITOR



KEYBOARD



## Introduction

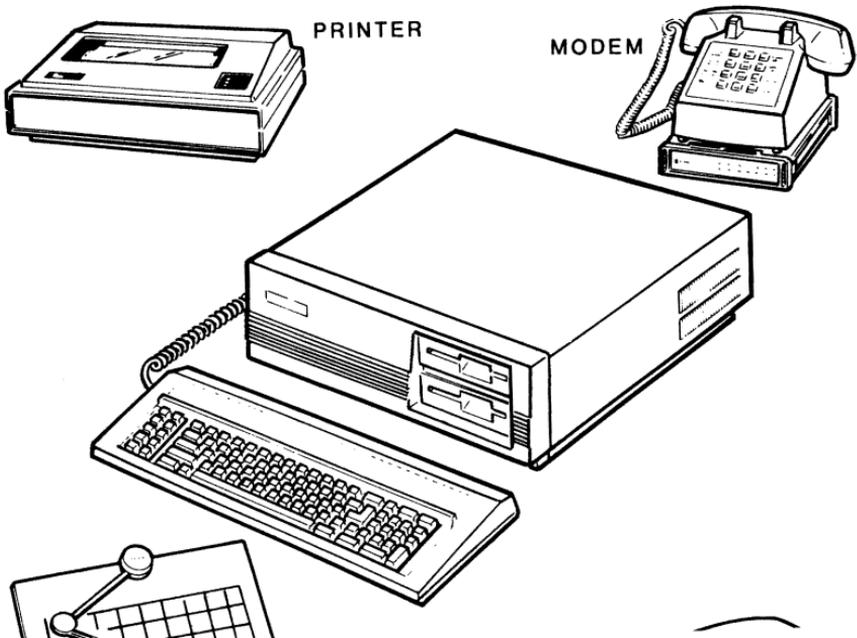
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In addition, options (“peripherals”) are available that will increase the versatility of your computer system. These peripherals include any piece of equipment that is attached to the computer. Several are illustrated in Figure 3.

### The Basic Computer System

The computing unit contains the “brains” of your computer system: a Central Processing Unit (CPU), Read-Only Memory (ROM), Random Access Memory (RAM), and control circuits for peripherals. The computer also contains the disk drives which act as mass storage devices for information in your applications.

The video monitor — also called the video display, Cathode-Ray Tube (CRT), or screen — is like a television set. It is where you see and work with the programs used in the computer system.



The keyboard is used to enter information into the computer. It has all the keys contained on a standard typewriter keyboard plus additional special function keys. There also is a calculator-style keypad on the right side of the keyboard that allows you to make faster numeric entries.

Information also can be entered into your computer from disks, special signals over telephone lines, and through other optional devices.

The floppy disk drive(s) built into the desktop computer allow(s) you to store large amounts of information on removable 5.25-inch floppy disks. Each of these disks is capable of holding up to 180 pages of typewritten text. Even more storage is available on a special, high-capacity Winchester disk drive.

## **Optional Peripherals**

Adding a printer greatly enhances the operation of your computer system by making it possible to produce professional copies of letters, accounting records, or any other material prepared by the computer.

Another computer system enhancement is computer-to-computer communications capabilities via a telephone “modem”. This capability makes it possible for the computer to send and receive information to and from other computers, and gain access to a growing number of computer services.

You also may choose to use an auxiliary device such as a “mouse” or graphics tablet to enter graphics information into the computer system.

## How to Use this Manual

This User's Guide is part of your Operations Manual set and will provide an introduction to your Zenith Data Systems Desktop Computer. It describes the keyboard and controls of your system, how to set up the desktop computer and turn it on for the first time, the proper use and care of disks, and how to load and run the demonstration disk.

This manual has four chapters and an index:

- **Introduction** — Serves as a general introduction to typical desktop computer systems and lets you know how to use your manual. You are reading the Introduction now.
- **Setup and Initial Operation** — Describes the back panel of the desktop computer and interconnecting the various parts of a basic computer system: the computing unit, keyboard, and video monitor. Power connections, turning on your computer for the first time, disk drives, software, and the demonstration disk also are discussed.
- **Operation** — Describes the functions of the keyboard keys, keyboard tilt adjustment, and normal power-up procedures.
- **Maintenance** — Discusses the self-tests used during powerup, and provides procedures for proper care of disks and the desktop computer system. In the event that you have difficulty, you are shown how to solve some of the basic problems that can confront first-time users.

**NOTE:** The manual covers the connections for a basic system only; the remaining peripheral connections are covered in the Operations Manual.

Even if you have used computers before, you will want to become familiar with this manual to truly appreciate the many features of the Z-150 Personal Computer Desktop System.

## Chapter 2

# Setup and Initial Operation

The following pages describe the setup, configuration, and interconnection of the various parts of your desktop computer. In addition, this section discusses the keyboard, those switches you must adjust to operate the computer in your particular application, and the typical operating characteristics of the computer.

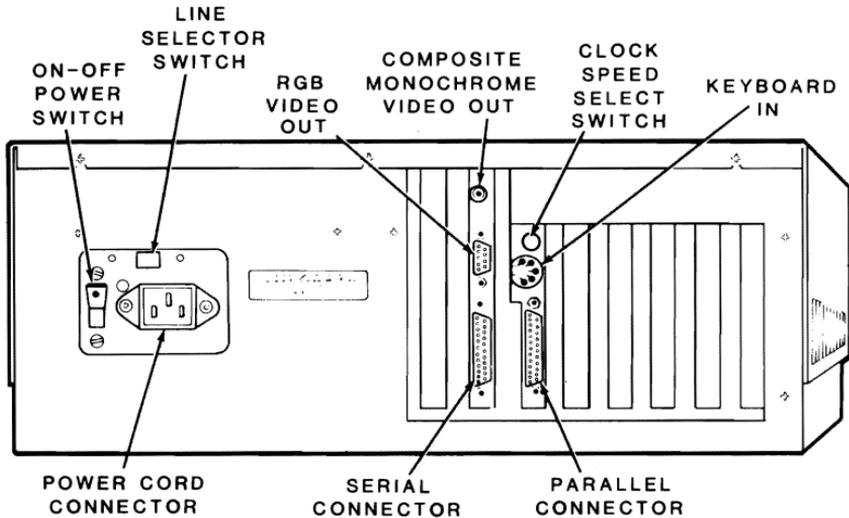
You will find your computer system easiest to use if all of the components are located in the same general area. A good, solid work surface (like you would use for an office typewriter) that is near a power source and a telephone will prove best. The environmental range is 60 to 90° F (16 to 32°C) and 10 to 80% relative humidity.

## The Back Panel

Refer to the unpacking instructions on the inside top flap of the shipping carton and unpack the computer. Place it on the work surface selected and position it so you are looking at the back panel. Refer to Figure 4 for the following discussion.

**NOTE:** Use care when unpacking a computer which has a Winchester drive assembly. Do not drop or jar the unit. The Winchester system is extremely fragile and can be easily damaged. Refer to the Operations Manual for proper handling procedures in moving a computer with a Winchester assembly installed.

## Setup and Initial Operation



**Figure 4. The Computer Unit Back Panel**

The center of the back panel contains the following:

- **Serial Connector** — Provides the necessary EIA-standard RS-232 signals for connection to a serial printer or other device. This connector is most commonly used for a serial printer.
- **Composite Monochrome Video Out** — This “phono-jack” connector provides the proper video signal for a monochrome (sometimes called black and white) video monitor. A standard television receiver **cannot** be used for this purpose, since it is not designed to display all of the information needed for word processing or accounting applications.
- **RGB Video Out** — A 9-pin “D” connector that provides the necessary signals for a high-resolution color monitor which uses RGB (Red, Green, Blue) color signals.

● **Clock speed select switch** — This switch selects the clock speed of the computer. It is set to 1.5 MHz.

## Setup and Initial Operation

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- **Parallel Connector** — Provides the necessary parallel signals for connection to a Centronics-type parallel printer or other parallel input/output device.

In addition to these connectors, there are six unfilled positions on the back panel for future expansion. The necessary connectors will be provided with the expansion units.

The following features are located on the left side of the back panel:

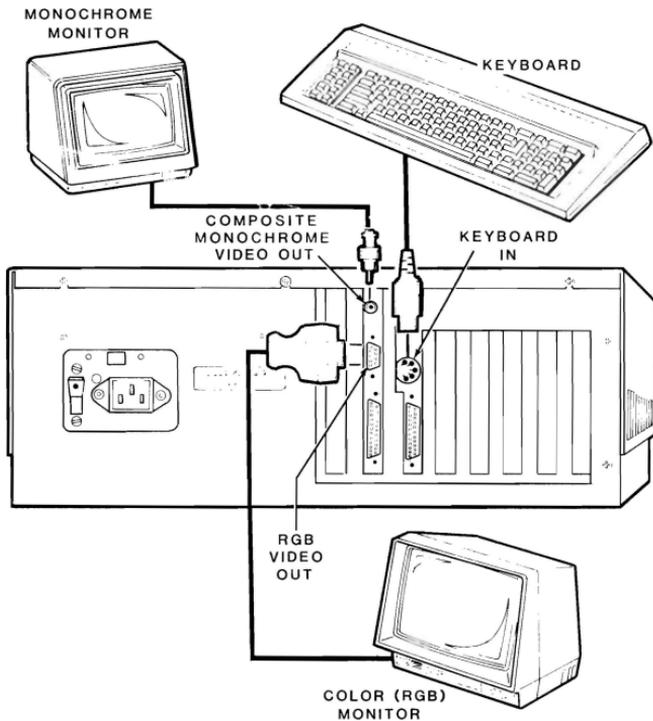
- **ON/OFF Power Switch** — This is the main power switch to the desktop computer. Make sure the switch is in the OFF position before you plug in your computer if you are going to be using it for the first time.
- **Line Select Switch** — Used to select between 115 VAC and 230 VAC. Normally, you will never use this switch unless (during initial setup) you are in an area serviced by a 230 VAC power source. Changing the setting on this switch should be done only by qualified service individuals. When the line voltage is changed, i.e., 115 to 230 VAC, the line cord plug must be changed to the proper type and voltage rating. Check local electrical codes.
- **Power Cord Connector** — Used with the AC power cord to supply power to the desktop computer.

The left and right sides of the computer have a number of openings that are used for ventilation by a small fan in the power supply. Never block these openings or restrict air movement while your computer is turned on.

## Internal Configuration

**NOTE:** If you are using a non-Zenith Data Systems monitor, you will need to set or check jumpers on the video/floppy controller card inside

## Connecting the Keyboard and Monitor



**Figure 5. Connecting the Keyboard and Monitor**

If you have not placed your computer where it normally will be operated, place it there now. Position it so you can get to the back panel to make the following connections. Refer to Figure 5 for the following discussion.

- Unpack and place the keyboard next to the computer; connect the cable as shown in Figure 5.
- Unpack your color or monochrome (black and white) monitor and

## Setup and Initial Operation

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- For RGB monitors: Connect one end of the cable to the RGB connector on the back of the computer. Connect the other end to the appropriate connector on your monitor (refer to your monitor's documentation for the location).
- For monochrome monitors: Connect one end of the cable to the composite monochrome video out jack on the back of the computer. Connect the other end to the video input jack of your monochrome monitor (refer to your monitor's documentation for the location).

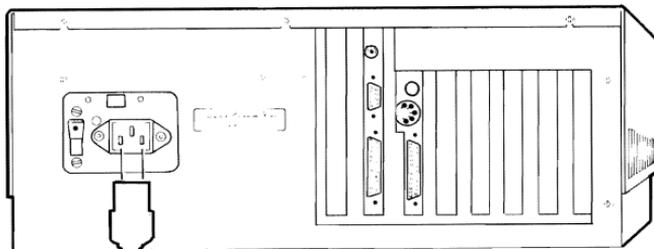
## Final Connections

If your system components are not in their normal operating positions, move them to their final positions now. Reconnect any cables.

Up to this point, you should not have made any power connections.

**CAUTION:** Make sure that the line select switch is properly set for your power source.

- Before you connect any of your computer's components to an AC power source, turn all power on/off switches off.
- The computer has a detachable power cord. Refer to Figure 6 and plug the appropriate end of the power cord into the computer. Do not attach the other end at this time.



## Setup and Initial Operation

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**NOTE:** With the multiple power cords involved, you may want to use a switched multiple outlet box or power strip to turn on (or off) all system components at the same time. If you do use a switched outlet box or power strip, make sure it is properly rated for your system's power needs (for 115 volt systems, 10 amperes; for 230 volts, 5 amperes).

**Do not** use an extension cord unless it is a heavy-duty three-wire type. Smaller cords tend to reduce the amount of voltage available and can cause unsatisfactory performance from your computer.

- If you have not done so, position the computer so that the front of it is clear and you can insert or remove disks as needed. You also should be able to easily reach the power ON/OFF switch (on the back panel next to the power cord receptacle). Plug the power cord into an AC power source.
- The monitor may be placed on the computer or anywhere that is convenient. Plug its power cord into an AC power source.
- Place the keyboard where you normally will use it. It receives its power directly from the computer and does not have a separate power connection.

## Initial Powerup and Adjustments

**CAUTION:** Before you turn on your system, be sure the cardboard shipping inserts have been removed from the disk drives.

You are now ready to turn on power to your desktop computer. Before you do, make sure:

- The power cord is plugged into both the computer and an AC power source (if you are using a multiple power outlet box or strip, make

## Setup and Initial Operation

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- The keyboard is attached to the computer.
- The monitor is connected to the computer and plugged in.
- There is no disk in the disk drive.

Now turn on the monitor and then the computer. You should observe a number of things while the system is testing itself: a small, cooling fan will start up; a green Light-Emitting Diode (LED) on the computer's front panel will glow; lights on the disk drives will alternately come on and the drives will make some sound as they move their "read/write heads" back and forth. Factory assembled computers are set to "autoboot" (automatically load a disk operating system from a disk) when they are shipped. One of the lights in the disk drives will come on and remain on in a computer set for autoboot. After about 20 seconds (or 35 seconds in Winchester systems), your monitor will display the following message:

```
+++DISK ERROR: DRIVE NOT READY!+++
```

This message indicates that there is no disk in the disk drive (or the Winchester has not been properly prepared — see your Operations Manual), and is the normal system response at this time.

If the computer is **not** set for autoboot, a message appears in the upper left-hand corner of the screen about 10 seconds after the unit is turned on.

Refer to your monitor's documentation and adjust the screen display for the best contrast and brightness.

## Setup and Initial Operation

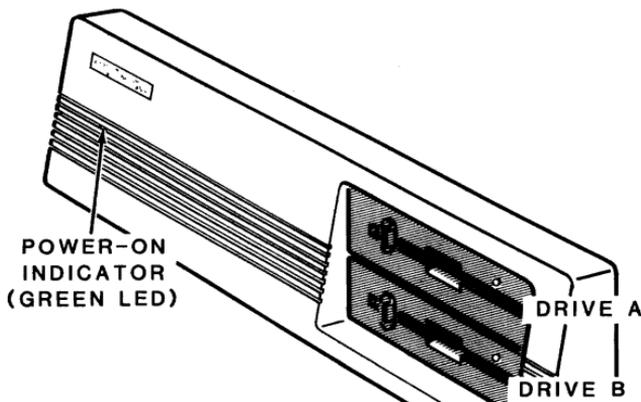
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# Disk Drives

Next, look at the disk drives (refer to Figure 7). They are mass storage devices designed to transfer information into and out of computer memory.

- **Disk Drives** — One or two floppy disk drives are included with your desktop computer. Your computer also may include a Winchester hard disk system.
- **Disk Drive Positions** — For dual floppy disk drive systems, the top disk drive is referred to as drive A and the bottom one is drive B. If your computer has only one floppy disk drive, it will be known as drive A. The optional Winchester system may be divided in up to four parts, called partitions. These are identified as drive C, drive D, drive E, and drive F. If the Winchester system is not “partitioned,” it is referred to as drive C.

**NOTE:** The drive names are arbitrary with the disk operating system. Most systems that run on your desktop computer use the names illustrated here. Other operating systems may refer to the drives by other means. Consult the documentation supplied with your operating system for the names of the drives (drive A will be the first named drive; drive B, the next; and so on).



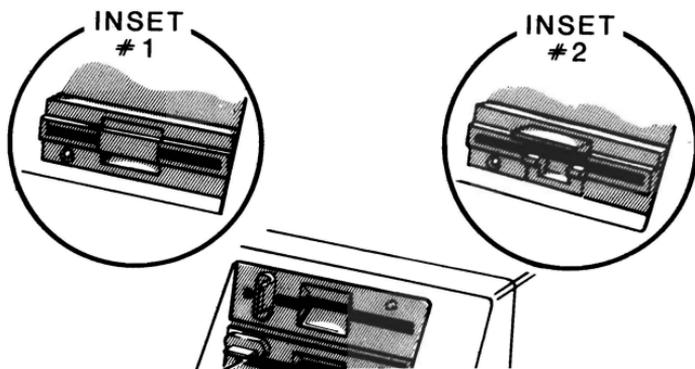
## Setup and Initial Operation

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Refer to Figure 8 for the following discussion.

- **Disk Load Slot** — Insert a floppy disk in this slot with the label up and toward you. If the disk is not oriented as shown, the unit will not operate properly and you may damage the floppy disk and/or the disk drive. If the disk meets resistance while you are inserting it into the drive, check to make sure there is no disk already in the drive. The disk should slide smoothly into the drive.
- **Disk Drive Latch** — Your floppy disk drive may contain a latch, door, or handle, which is used to secure the floppy disk in the proper position in the 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 rim of the center hole for damage, check for proper floppy disk orientation (see the previous discussion), and try again.
- **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.

**NOTE:** Winchester disk drives do not have removable disks. Instead, all you will see is the LED disk access indicator on the front panel, below the disk drive.



## **Introduction to Software**

### **Programs**

Computers need instructions to operate. A program is a set of detailed instructions a computer can follow. Without instructions, a computer only consumes electricity and will not calculate, display, or print anything.

You will make use of several different types of programs as you learn to operate your new computer. A brief synopsis of the programs your computer uses is contained in the Operations Manual.

### **Connecting Other Peripherals**

Refer to the Operations Manual for instructions on connecting other peripherals, such as printers, modems, and graphics tablets, to your system.

## Chapter 3

# Operation

This chapter of the User's Guide contains detailed descriptions of the various controls of your computer, including the keyboard. There also is a brief discussion about normal power-up procedures.

## Computer Controls

### Keyboard

The keyboard of your desktop computer contains 84 keys, which are discussed by groups in the following pages.

Whenever you hold down any key except the SHIFT, CTRL, ALT, CAPS LOCK, or NUM LCK for more than a moment, it will automatically start repeating. The rate of the repeated entry is equal to pressing the same key about eleven times a second. If you continue to hold the same key down, the rate at which it repeats will gradually increase.

## Operation

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### Alphabetic Keys

Refer to Figure 9.

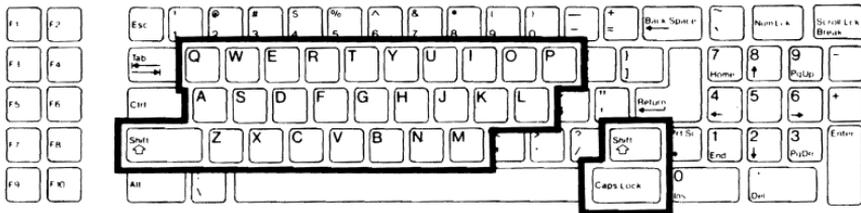
- The desktop computer has the standard 26 letters of the alphabet arranged as they are on a typewriter. These keys allow you to enter either upper- or lowercase letters; hold down either SHIFT key or press the CAPS LOCK key to obtain uppercase letters.
- The CAPS LOCK key turns the caps lock feature on or off. A small red indicating light in the CAPS LOCK key glows when the caps lock feature is on. If the light is out, the caps lock feature is off.

**NOTE:** The caps lock feature shifts all the alphabetic keys to uppercase. **Only the alphabetic keys are affected.**

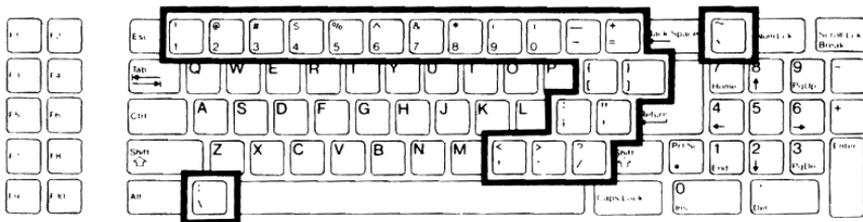
### Nonalphabetic Keys

Refer to Figure 10.

- The nonalphabetic keys include the numbers 0 through 9, punctuation marks, and special characters. The lower marking on each key is generated when both 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 9. Alphabetic Keys**



**Figure 10. Nonalphabetic Keys**

## Operation

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### Other Keys

Refer to Figure 11 for the following discussions, which describe the most common function for each key. However, software may direct any key to cause some other function to take place. Any key that has a special function usually is described in the documentation that accompanies the software.

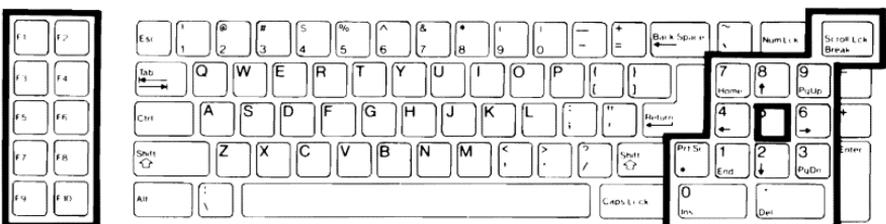
- **Space Bar** — Functions just as it does on a typewriter. Enter a blank character (space) by pressing this bar.
- **BACK SPACE** — Functions just as it does on a typewriter, by moving the cursor (an indicator on your display that lets you know where the next key entry will appear) one position to the left.
- **TAB** — Causes the position of the cursor to move to the next tab column.
- **RETURN** — Returns the cursor to the left side of the display (software usually adds a line feed as well). RETURN also tells the computer that data or instructions have been entered and may be processed.



Figure 11. Common Control Keys

Figure 12 illustrates those keys used for special purposes by some programs. Instructions describing their use appear with the programs which use their functions.

- **Special Function Keys (F1 through F10)** — Used for special purposes by some programs.
- **1/END, 2/(down arrow), 3/PG DN, 4/(left arrow), 6/(right arrow), 7/HOME, 8/(up arrow), and 9/PG UP** — When none of the SHIFT or NUM LCK keys are pressed, these cursor control keys are used to control cursor movement and screen presentation by some programs.
- **0/INS and .DEL** — When none of the SHIFT or NUM LCK keys are pressed, these two keys are used in applications which require special insertion and deletion operations. The DEL (Delete) key often duplicates the BACK SPACE key, but may be used for other purposes.
- **SCROLL LCK/BREAK** — Used to control screen scrolling or interrupt program execution (not always active).
- **PRT SC/\*** — Used to enter the asterisk (the same as on the main keyboard) or, when used with the SHIFT key, sends the contents of the screen to a printer.



**Figure 12. Special Function Keys**

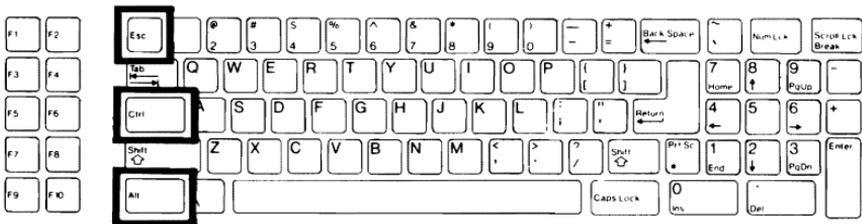
## Operation

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Refer to Figure 13 for the following discussion of the control keys used in combination with other keys to perform a function.

- **ESC** — The Escape key. Used to stop the execution of a program/function or to perform special functions when you press it and another key in sequence. For instance, if you want to enter ESC-E, press the **ESC** key, release it, and then press the **E** key.
- **CTRL** — The Control key. Use it to perform special functions by pressing it and another key at the same time. For instance, if you want to enter the CTRL-C combination, press and hold the **CTRL** key and then press the **C** key.
- **ALT** — The Alternate key. Use it to enter special commands by pressing it and another key at the same time. For instance, if you want to enter the ALT-A combination, press and hold the **ALT** key and then press the **A** key.

**NOTE:** The CTRL, ALT, and DEL keys are used in combination to reset your computer. All three keys must be pressed at the same time.



**Figure 13. Control Keys**

## Calculator Keyboard Operation

Figure 14 shows those keys which are used to speed up the entry of data.

- NUM LCK** — This key, when pressed, shifts the normal functions of the cursor control keys and the INS and DEL keys to that of a calculator keypad. A small red light in the NUMLCK key indicates whether the feature is on (light glows, calculator number keys are active) or off (light is out, cursor control keys are active).
- 0–9, ., -, +, ENTER** — This group of keys, located to the right of the main keyboard, is organized somewhat like a calculator and includes: the numbers 0 through 9 and a period for entry of decimal points; a plus for entry of positive numbers (optional in most cases); a minus for entry of negative numbers; and an ENTER key for signaling the computer that the entry has been completed. Some software may use the plus and minus keys to indicate the type of entry and that the entry has been completed.

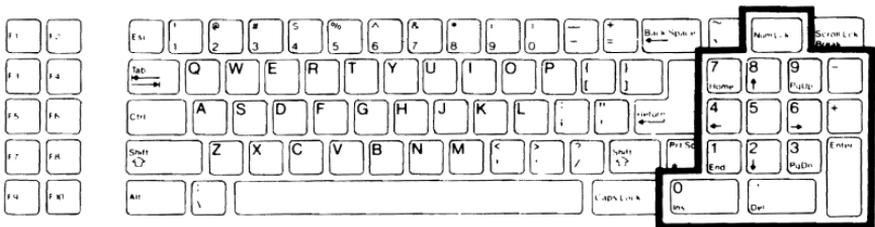
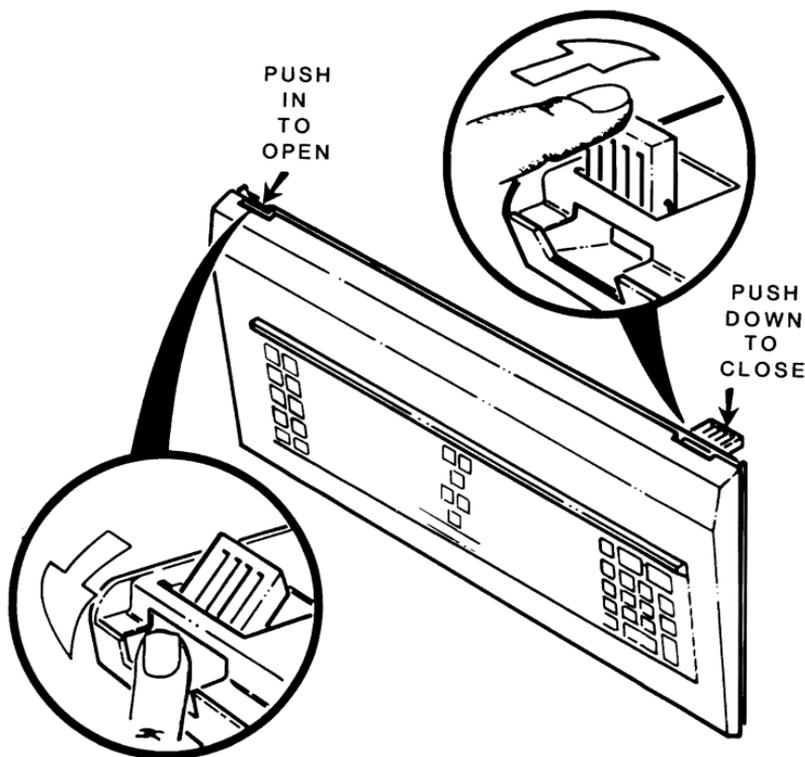


Figure 14. Calculator Keyboard

## Keyboard Adjustment

The keyboard of the desktop computer has an adjustment that allows you to select one of two positions of tilt. A leg is located under each back corner of the keyboard. Refer to Figure 15 and select the position that best fits your needs.

- To increase the tilt of the keyboard, refer to the inset in the figure and press on the spot indicated.
- To select the closed position, move the leg back into its closed position.



## Normal Powerup

Be sure to complete the setup procedures described in Chapter 2 **before** beginning this section on powerup.

The computer system power may be turned on in any sequence you prefer. However, **never** turn your system power on or off with a disk in the floppy disk drive; remove the disk first.

There are two suggested sequences for turning on your system:

- One switch operation through a switched multiple outlet power box or strip. The one switch on the box or strip will control the entire computer system simultaneously.
- For most applications, apply power to your monitor first, then the computer. Finally, turn on any other peripherals attached to your computer system. The keyboard is powered from the computer.

## Resetting the Computer

There are two ways to reset your computer. One is through the keyboard, and the other is by turning system power off and then on again.

Refer to Figure 16. There are times you will want to reset your computer. To do so, press the **CTRL** and **ALT** keys and while holding them down, press the **DEL** key; then release all three keys. Your computer should reset to the power-up point.

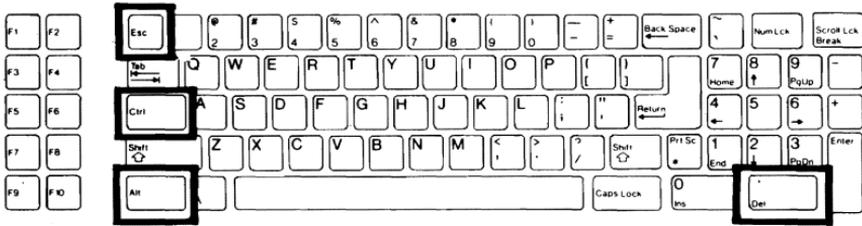
If you want to reset your computer by turning the power off and then on again, move the computer power switch to the **OFF** position (the rest of the system may remain on), wait at least five seconds, and then move it back to **ON**.

## Operation

---

### Defeating the Autoboot Feature

Refer to Figure 16. When you do not want your system to autoboot a disk, press the **ESC** key during autoboot (while the disk light is on). The system prompt and message will appear in the upper left corner of your video monitor's screen.



**Figure 16. Special Use Keys**

## Chapter 4

# Maintenance

This chapter of your User's Guide contains a discussion of the tests performed during the power-up sequence, a section on disk care and backups, cleaning instructions for the system, and service information in case you experience any difficulty operating your system.

## Self-Tests

When you turn on your desktop computer, it executes a series of internal tests to check that everything is working correctly. While these tests do take a moment, they serve several important functions. First, they make sure that all of the circuits are in the starting configuration. Second, the tests check various functions of the desktop computer so that it will operate properly.

Finally, when the tests are finished, the computer will let you know that it is truly ready to run by starting the automatic boot procedure (autoboot). When autoboot is started, a disk must be placed in the drive and the door shut within about 20 seconds (about 35 seconds in Winchester systems if the Winchester disk has not been prepared with an operating system). If no disk is inserted promptly, an error message, reading:

```
+++DISK ERROR: DRIVE NOT READY!+++
```

is displayed. Your desktop computer does not have to warm up before it can be operated.

Should some portion of the equipment fail to operate correctly, the desktop

## Disk Care

Both floppy disks and Winchester systems can be damaged, so keep the following precautions in mind when using or handling either system.

### Winchester System Precautions

If you own a Winchester system, never drop it or subject it to any kind of physical shock. If the computer is accidentally dropped, even from only two or three inches, the Winchester drive may fail to operate. If this occurs, contact your local Zenith Data Systems representative for service.

The built-in disk of your Winchester drive cannot be physically removed from the drive. However, information can be removed, stored, and then replaced with other data. Refer to your Disk Operating System (DOS) manual for instructions on how to do this.

### Floppy Disk Precautions

When preparing a label for a floppy disk, write on it **before** you place it on the disk; or, if you must write on a label that is already on a disk, use a felt-tip pen. Ballpoint pens and pencils may exert enough force on the disk to crease it, thus destroying its usefulness; do not use them to mark labels once they are on a floppy disk.

Handle the floppy disk much the same as you would an audio record. It should be stored in its protective envelope in an upright position, away from heat or direct sunlight when not in use. Don't bend the disk 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 disks, and X-rays also may destroy the data on a disk. By keeping your disks and equipment away from these sources of trouble, you can

## Backups

A backup might easily be called an insurance copy. It is a duplicate of a disk. During the course of normal operation, accidents do happen and a disk can be ruined. By having a backup, you will reduce the chance of accidentally losing vital information.

By making disk backups at regular intervals, you can minimize the amount of work necessary to bring your computer records up-to-date if information is lost through mishandling of a disk or the equipment.

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

Refer to the DOS documentation for more information about backing up information stored on floppy disks and in the Winchester system.

## Cleaning the System

The desktop computer is well-designed and does not require a lot of maintenance. Occasionally you may want to wipe dust and fingerprints off the cabinets and monitor screen. Use the following suggestions to clean your equipment.

- Before cleaning the equipment, make sure the power is off.
- Use only a cloth that has been slightly dampened with water or a nondetergent cleaning solution.
- Do not use spray liquids or a soaking-wet cloth.
- After wiping the computer with a damp cloth, make sure you thi

## Maintenance

---

- Do not attempt to clean floppy disks.
- Any other portions of the system that cannot be cleaned in this manner should be left to qualified service individuals.

The most common problem experienced by customers with equipment of any kind is dust that builds up over a long period of time. Keep your computer and keyboard covered when they are not in use.

## In Case of Difficulty

All ZDS computer hardware and software products are designed to work together as a complete system. Proper operation can be assured 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 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 or 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 1-800-842-9000 for the name and location of one nearest you.

## General Troubleshooting

The following list of conditions and possible causes will provide you with information concerning possible solutions to common problems.

CONDITION	POSSIBLE CAUSES
Nothing happens at power on and the green light on the computer is not lit.	<ol style="list-style-type: none"> <li>1. Line cord not plugged in (check both ends). If you are using a multiple outlet box, check its plug.</li> <li>2. Power not on at AC power source (wall outlet). Check the power source with a different electric device.</li> <li>3. Power switch not on (either the computer unit or the multiple outlet box).</li> <li>4. Line select switch incorrect for your power source.</li> </ol>
No video (blank screen) on the monitor.	<ol style="list-style-type: none"> <li>1. Monitor not turned on.</li> <li>2. Monitor not plugged in.</li> <li>3. Monitor not properly connected to computer.</li> <li>4. Brightness control turned down on monitor.</li> <li>5. Computer not transmitting a signal (screen was blanked or cleared by a program). <b>NOTE:</b> This will not be the case when you first turn on the unit, or the computer is waiting for you to do something).</li> <li>6. Computer failure during initial tests (see the diagnostics discussion in the Operations Manual).</li> </ol>
Insufficient brightness on	<ol style="list-style-type: none"> <li>1. Brightness control turned down on</li> </ol>

## Maintenance

---

CONDITION	POSSIBLE CAUSES
System won't boot from monitor program.	<ol style="list-style-type: none"> <li>1. Haven't pressed the RETURN key.</li> <li>2. Wrong disk (you are trying to boot from an unformatted disk or data disk).</li> <li>3. Disk inserted wrong.</li> <li>4. Disk drive latch not closed.</li> <li>5. Pressed wrong key.</li> </ol>
System won't boot automatically.	<ol style="list-style-type: none"> <li>1. Wrong disk (you must use a system disk).</li> <li>2. Disk inserted wrong.</li> <li>3. Disk drive latch not closed.</li> <li>4. Boot from floppy/Winchester switch in wrong position.</li> </ol>
System resets to power on point or disk keeps rebooting. Error message displayed right after power on.	<ol style="list-style-type: none"> <li>1. Loose line cord.</li> <li>2. Bad disk.</li> </ol> <ol style="list-style-type: none"> <li>1. See the diagnostics discussion in the Operations Manual.</li> </ol>

## Service Information

In the extreme case you are unable to resolve a difficulty, you may want to contact your local Zenith Data Systems dealer or authorized repair facility.

The desktop computer has built-in diagnostic routines which may assist the service representative in correcting any difficulties. Refer to the diagnostics information in the Operations Manual.

## When You Call for Help

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

1. The problem you are having. If you ran the diagnostics, supply him with the tests you ran and the messages, if any, that were displayed.
2. The name, model number, and series number of your computer system.
3. System configuration (including any peripherals being used).
4. Any additional information that will help describe your system and the difficulty you are experiencing.

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## DEMONSTRATION DISK INSTRUCTIONS

The following procedure describes how to run your demonstration disk. If you have a computer system without a hard disk, start the procedure at step 1. If your system contains a hard disk, start the procedure at step 2.

1. The demonstration disk is bootable. Insert the disk in the default floppy drive and turn on your computer. Refer to your computer's *MS-DOS* manual for details on the default drive. Skip to step 3.
2. Insert the demonstration disk in the default floppy drive and turn on your computer. Refer to your computer's *MS-DOS* manual for details on the default drive. Perform the manual boot up procedure by pressing CTRL-ALT-INSERT (press all three keys at once and release them). An identification message and monitor prompt appears similar to the following:

```
MFM-Monitor, Version x.x  
Memory Size: nnnK bytes  
Enter "?" for help.  
—>
```

At the —> prompt, type

**BF**

and press RETURN.

3. The demonstration disk contains a file called AUTOEXEC.BAT. This file automatically loads the demonstration program and begins execution. Once the program is running, select the desired menu item to view a part of the demonstration.

# **Z-150 PC Series Computers**

**Operations Manual**

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# Preface

This Operations Manual is intended to be used as a reference guide whenever you wish to set up, add to, or understand more about your Z-150 PC Series Computer System. There are five parts.

- **User's Guide** — This separately bound manual guides you through the setup and cabling of your basic computer system. It includes instructions on the use of the keyboard, those self-tests the computer will run when the power is turned on, and basic maintenance procedures.
- **Hardware** — This part describes devices associated with your computer and includes information about optional equipment and how peripherals such as a printer and other external devices are added to your system.
- **Operations** — This part describes the fundamental operation of your system software: how to duplicate disks, copy files, and perform other day-to-day functions.
- **General Service** — This part provides disassembly and assembly instructions, installation of accessory cards, system diagnostics, and general troubleshooting information.
- **Software Summaries** — This part provides you with summaries of the operating system, languages, and other information relevant to programming your computer system.

A glossary of commonly used computer terms and an index also are included in this manual.

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**NOTE:** The User's Guide, which comprises Chapter 1 of this manual, is a separately bound manual. Included here is list of the major parts of that manual. Consult the Table of Contents and Index in that volume for a complete list of its contents.

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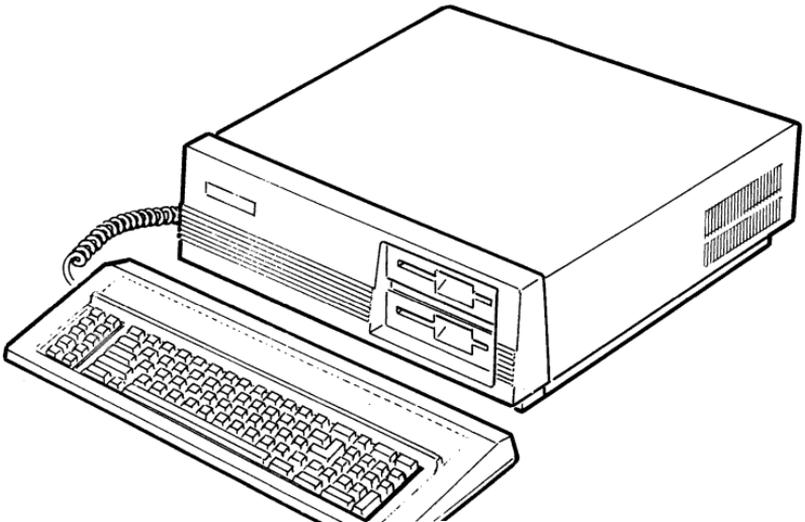
# Hardware

## Hardware Overview

Your system is a flexible, reliable, and powerful personal computer. It is designed to provide you with years of trouble-free performance.

The heart of your system is the Central Processing Unit (CPU). The CPU processes information, performs arithmetic functions, and provides control for the rest of the system.

With a 168-watt power supply distributed through an eight-slot backplane board, the Z-150 PC Series Computer can support many different options. The basic system includes video, memory, disk storage, and input/output functions.



## Hardware

---

Refer to Figure 2.2 for the following discussion.

### Power Supply

The switching power supply provides 168 watts of power for your computer. It can support many peripherals including the popular Winchester disk system.

Do not attempt to service your power supply. It has no user-replaceable parts.

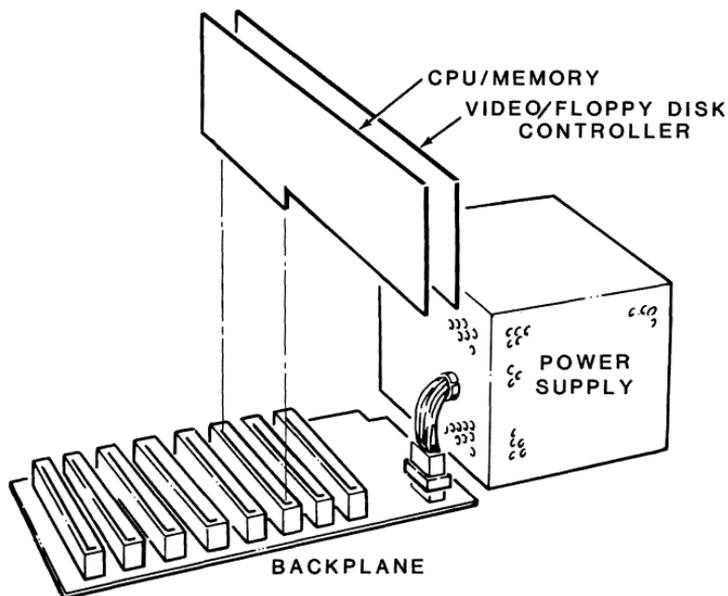


Figure 2.2. Hardware Configuration

## Backplane

The backplane is a board that acts as the computer's central nervous system. It is securely mounted to the computer chassis and has slots for eight cards. When a card is plugged into the backplane, it becomes part of your computer.

The basic computer includes two cards: a CPU/memory card and a video/floppy disk controller card. The six remaining slots on the backplane are for expansion, such as a Winchester controller card.

There also are five Light-Emitting Diodes (LEDs) for monitoring the power supply. Information about these LEDs is in "General Service," Chapter 4 of this manual.

## CPU/Memory Card

The CPU/memory card contains an Intel 8088 16-bit Microprocessor. A socket is provided for an optional numeric data coprocessor. The CPU/memory card contains a tone generator, which provides signals from 37 to 32,000 hertz to a speaker mounted on the chassis.

The memory portion of this card holds information, programs, and data temporarily, and acts as a work space. The standard memory can be expanded to 640 kilobytes (one Kilobyte (K) is approximately 1,000 characters of information). This card also contains a parallel output port with connector, the keyboard connector, and the clock speed selection switch.

Other features on the CPU card include the Direct Memory Access (DMA) controllers, the interrupt structure, and the clock generator.

## Video/Floppy Disk Controller Card

The video portion of the video/floppy disk controller card supplies signals for either a monochrome composite monitor, or a Red, Green, Blue (RGB) color monitor. It supports both medium and high resolution text and graphics.

The floppy disk controller portion of this card provides two functions: access to mass storage on floppy disks, and a serial input/output port with connector.

Each floppy disk drive built into your system can store up to 360K of information on double-sided, double-density, soft-sectored, 5.25-inch floppy disks.

The serial port is RS-232 compatible and can be used with a number of different serial input/output devices. Such devices include a serial printer/plotter, a modem for asynchronous communications, a graphics tablet, and a mouse.

## Winchester Disk Controller Card (optional)

This optional card supports one Winchester hard disk system for mass storage of information and programs.

## Specifications

<b>Backplane</b>	62-pin, 8-slot, .825-inch separation, IBM PC XT compatible
<b>Keyboard</b>	84 keys with extended function capabilities, 8048 keyboard processor
<b>Power Supply</b>	168 watts DC output: +5V +12V -12V

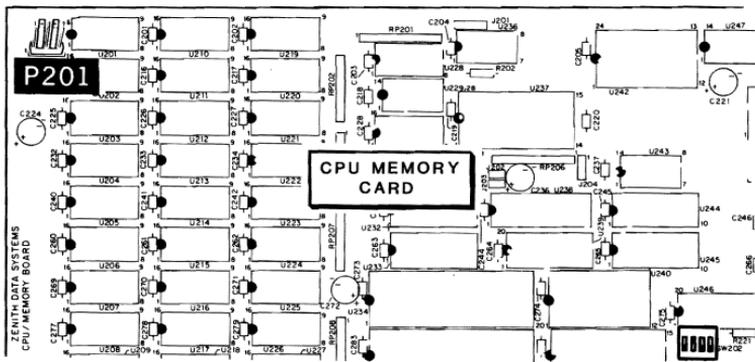
<b>Processors</b>	Intel 8088 16-bit Microprocessor Optional Intel 8087 Numeric Data Coprocessor 4.77 MHz/8 MHz selectable Clock
<b>Memory</b>	Up to 640K RAM
<b>Video</b>	Color/Graphics Graphics and Text modes available  Graphics (all points addressable) Suitable for composite or RGB monitors Available in two resolutions: High 640 × 200 pixels, or Medium 320 × 200 pixels  Text (Alpha/Numeric) 40 or 80 character lines 25 lines/screen  Two video outputs available Monochromatic composite and 9-pin RGB “D” type
<b>Audio</b>	One 8-ohm, 2-inch speaker
<b>Mass Storage</b>	One or two floppy disk drives Double-sided, double-density, soft-sectored 360K formatted capacity (MS-DOS Version 2 or higher), or One floppy disk drive and a Winchester hard disk system
<b>Input/Output Ports</b>	One parallel printer port One RS-232 serial input/output port

# Hardware

## CPU/Memory Card

### Features

- 8088 microprocessor, socket for 8087 coprocessor
- Read-Only Memory (ROM)
  - Contain boot, monitor and diagnostic programs in ROM
- Connectors
  - Keyboard connector
  - Power-on indicator and speaker connection (P201)
- Switches
  - SW202 used to set system parameters  
Table 2.1 defines the settings of the switches
  - 4.77 MHz/8 MHz selectable clock speed
- 640K single card capacity, expandable in 64K or 256K increments
- 128K standard in factory wired units with one disk drive,  
256K standard in factory wired units with two disk drives



- Parallel output port
- Parity checking for accuracy
- Jumpers
  - All jumpers are factory set and do not require operator adjustment.

## 8088 Microprocessor

The heart of your computer is the Intel 8088 Microprocessor. It consists of three sections — an Arithmetic Logic Unit (ALU), memory, and a control section.

The ALU performs all of the calculations for the computer.

The microprocessor's memory holds information that the ALU or the control section may use. This memory, while small, is the quickest in the machine.

The control section keeps all of the information coming and going in the proper order, making sure that information arrives at the proper place at the proper time.

## 8087 Numeric Data Coprocessor

On your CPU/memory card is a socket for an optional Intel 8087 Numeric Data Coprocessor.

This device can, with the proper software, take over some of the arithmetic processing from the 8088 microprocessor and speed up the calculating of certain kinds of data.

Not all programs will benefit from the coprocessor. Only programs that are specifically meant for, or programs that check for its presence will benefit from the 8087.

## Hardware

---

### Read-Only Memory

Read-Only Memory (ROM) retains the information stored in it even after the computer is turned off. It contains information which is vital to your computer's operation. The CPU/memory card has one ROM chip which contains:

- Power-up diagnostics;
- Facilities that enable programmers to enter, examine, change, or run machine language programs;
- The boot (or bootstrap loader) program which enables your computer to load the operating system into system memory from disk;
- Extensive menu-selectable diagnostics, covered in "General Service," Chapter 4 of this manual;
- Video mode and scroll mode set commands, used to select the screen characteristics for the video display.

### Keyboard

The keyboard connector is located on the CPU/memory card and extends through the rear of the computer.

The keyboard functions as an input device for your computer. See the separately bound User's Guide for information concerning special keys.

### Speaker

Your computer has a 2-inch speaker.

GW-BASIC supports various tones and durations that enable your computer to play a full range of music. Consult the GW-BASIC manual for specific programming information.

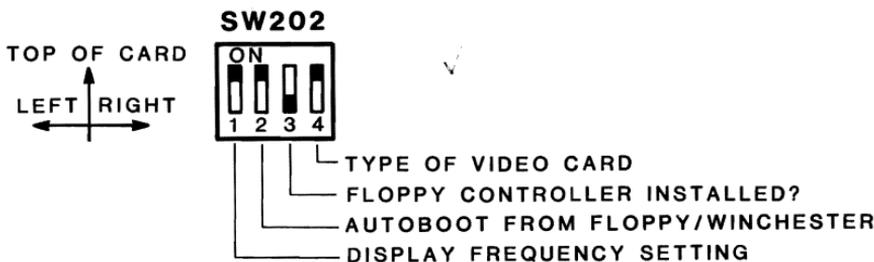
## CPU/Memory Card DIP Switch Settings

There is one Dual Inline Package (DIP) switch on the CPU/memory card. The location of this switch is shown in Figure 2.3.

This switch is set to reflect the current hardware configuration of your Z-150 PC Series Computer. If you change configurations — for example, if you add a monochrome card — you will have to adjust this DIP switch.

Adjust these switches with a small tool by moving them to the ON or OFF position. The following table shows possible orientations. The illustration that accompanies the table shows the proper configuration for a system with the display frequency set at 60 Hz, that will autoboot from the floppy disk drive when turned on, using a color card.

**Table 2.1. DIP Switch Settings**



## Hardware

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**Table 2.1 (continued). DIP Switch Settings**

POSITION	FUNCTION	CONFIGURATION	SETTING
1	Display Frequency Setting	60Hz 50Hz	ON OFF
2	Autoboot	Floppy Drive Winchester	ON OFF
3	Floppy Controller	Not Installed Installed	ON OFF
4	Video Card	Color Adapter Monochrome	ON OFF

**NOTE:**

The first section, section 1, controls the display frequency setting. This should remain set at 60Hz.

The second section, section 2, controls the autoboot or the automatic loading of the operating system. Autoboot may be set to load the operating system from a floppy disk drive or a Winchester.

The third section, section 3, tells your computer whether or not there is a floppy controller card installed. This switch should be set in the OFF position if you are using one or more floppy disk drives.

The last section should be set for the type of video display card you have in the computer. This switch should be set in the ON position for standard video cards. If you are using an IBM monochrome display adapter or compatible card, the switch should be set in the OFF position.

---

## Memory Options

There are several options you may select by changing some of the jumpers on the CPU/memory card. These jumpers tell the computer whether or not the parallel printer port is enabled (functioning), the address at which the parallel port is located, and how many banks of memory are populated by 256K chips.

**NOTE:** You may have one of three versions of the CPU/memory circuit card. All three versions of the card **function the same**. However, the jumper locations and designations may vary, depending on the version you have.

Tables 2.2A, 2.2B, and 2.2C define the jumper settings for the various versions of the CPU/memory card.

**Table 2.2A. Jumper Settings (Board 85-3118-24)**

JUMPER	CONFIGURATION	ADDRESS
J204		
Pins 1 and 2	Parallel Port 1	378H
Pins 2 and 3	Parallel Port 2	278H
J205		
Installed	Parallel Port Enabled	—
Not Installed	Parallel Port Disabled	—
J206	Should have no jumper installed.	

## Hardware

---

**Table 2.2B. Jumper Settings (Board 85-3162-1)**

JUMPER	CONFIGURATION	ADDRESS
J208		
Pins 1 and 2	Parallel Port 1	378H
Pins 2 and 3	Parallel Port 2	278H
J209		
Installed	Parallel Port Enabled	—
Not Installed	Parallel Port Disabled	—

**Table 2.2C. Jumper Settings (Board 85-3200-1)**

JUMPER	CONFIGURATION	ADDRESS
J208		
Pins 1 and 2	Parallel Port 1	378H
Pins 2 and 3	Parallel Port 2	278H
J209		
Installed	Parallel Port Enabled	—
Not Installed	Parallel Port Disabled	—
J211		
Pins 1 and 2	Parallel Port 1 — Interrupt Request 7	
Pins 2 and 3	Parallel Port 2 — Interrupt Request 5	

## Random Access Memory

Random Access Memory (RAM) is used to temporarily store information, programs, and data, and to act as a work space for the CPU. Naturally, the larger the work space the more work that can be done.

The 16-bit processor of your computer can utilize up to one Megabyte (M) of main memory. This is a substantial advance over the 64K of information that an 8-bit computer can address.

## Measuring RAM

The smallest unit of information is called a bit. The next largest unit of information is a byte, which is composed of eight (8) bits. Each byte can represent one (keystroke) character.

## Standard Memory

Each Zenith Data Systems Personal Computer comes standard with a CPU/memory card containing 512K of memory.

Again, depending on which CPU/memory card you have, the jumper designations may vary. Tables 2.3A, 2.3B, and 2.3C discuss the various jumper settings for different versions of the card.

Your nearest Zenith Data Systems dealer has memory expansion kits.

**Table 2.3A. Jumper Settings for Memory Configurations  
(Board 85-3118-24)**

BANKS WITH 256K CHIPS	J202 SETTING
0	Jumper is installed
0, 1, and 2	Jumper is not installed

## Hardware

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**Table 2.3B. Jumper Settings for Memory Configurations  
(Board 85-3162-1)**

BANKS WITH 256K CHIPS	J206 SETTING
0	Jumper is installed
0, 1, and 2	Jumper is not installed

**Table 2.3C. Jumper Settings for Memory Configurations  
(Board 85-3200-1)**

BANKS WITH 256K CHIPS	J206 SETTING
0	Jumper is installed
0, 1, and 2	Jumper is not installed

## Parallel Printer Output Port

The parallel printer port is located on the CPU/memory card. Its DB-25 connector is accessible through the rear panel of your computer.

The printer port is used to drive Centronics<sup>1</sup>-type print devices (printers or plotters). This standard has been adopted by a large number of manufacturers.

Note that the port is brought out of the machine to a DB-25 connector rather than an edge connector as Centronics uses. If you intend to use this connector, be sure to have the proper cable.

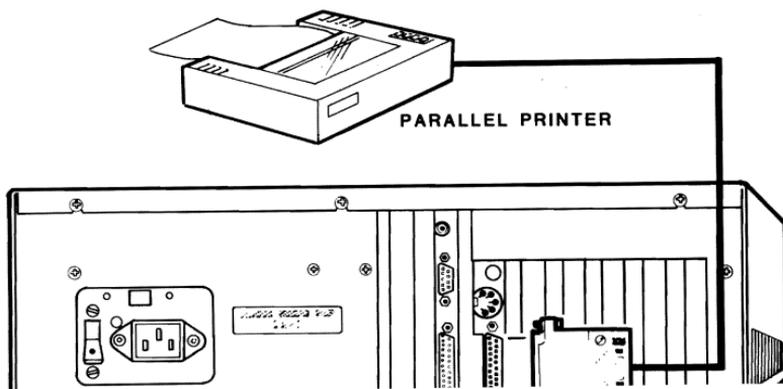
The operating system, MS-DOS Version 2 or higher, is configured to use this port as a standard printer port as it is supplied by Zenith Data Systems.

Table 2.4 defines the parallel printer port.

**Table 2.4. Parallel Port Definitions**

SIGNAL NAME	PIN NUMBER
<u>Strobe</u>	1
Data Bit 0	2
Data Bit 1	3
Data Bit 2	4
Data Bit 3	5
Data Bit 4	6
Data Bit 5	7
Data Bit 6	8
Data Bit 7	9
<u>Acknowledge</u>	10
Busy	11
Page End	12
Select	13
<u>Auto Feed</u>	14
<u>Error</u>	15
<u>Initialize Printer</u>	16
Select Input	17
Ground	18-25

A typical parallel printer will be connected as shown in Figure 2.4. Be sure to use the proper cable.



## Video/Floppy Disk Controller Card

### Features

- IBM PC color/graphics compatible
- Monochrome composite and/or RGB color output
- 40- or 80-character lines
- Eight available display modes, including five text modes and three graphics modes
- Supports up to two internal floppy disk drives
- One RS-232 input/output port
  - Serial printer support
  - Supports other serial devices at baud rates up to 9600 baud such as: asynchronous modems, graphics tablets, plotters, or a mouse

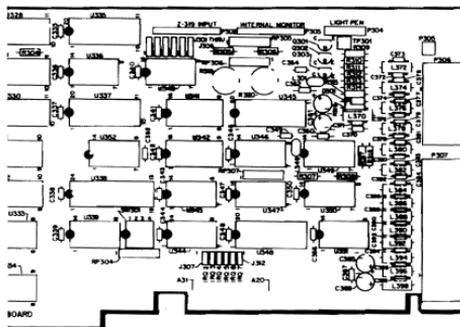


Figure 2.5. Video/Floppy Disk Controller Card

## Video Options

Your computer has been factory set to use Zenith Data Systems monitors. If you use another brand, it may be necessary to select some of the video options outlined in Tables 2.5A and 2.5B. Consult the documentation supplied with your monitor for the correct settings.

Your computer uses the same character font as the IBM PC to display characters that look the same as the IBM PC characters. This font can be changed by adjusting switch SW301 and adding a custom character ROM. The necessary adjustments are outlined in Tables 2.6A and 2.6B.

**NOTE:** You may have one of two versions of the video/floppy disk controller card. Use the tables that reflect your card.

**Table 2.5A. Video/Floppy Disk Controller Card Jumper Settings (Board 85-3012-11)**

POSITIONS			
1	2	3	4
–	J301	+	Light pen polarity

This jumper allows the light pen polarity to respond to a positive (+) or negative (–) going light pen pulse.

V	J302	C	Vertical/composite sync select for external monitor
---	------	---	-----------------------------------------------------

This jumper allows you to select either a composite (vertical and horizontal together) sync signal, or a separate (horizontal and vertical separate) signal. If your monitor requires a separate signal, set the jumper to V. If it requires a composite signal, set the jumper to C.

+	J303	–	Vertical sync polarity for external monitor
---	------	---	---------------------------------------------

Select either a positive (+) or a negative (–) signal, depending upon what is required by your monitor.

J304	and	J306	Select the vertical and horizontal sync polarity for an
------	-----	------	---------------------------------------------------------

## Hardware

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**Table 2.5A (continued). Video/Floppy Disk Controller Card Jumper Settings (Board 85-3012-11)**

---

POSITIONS			
1	2	3	
+	J305	-	Horizontal sync polarity for external monitor

---

This jumper may be set for either positive (+) or negative (-) horizontal sync signal polarity, depending upon what is required by your monitor.

---

J307	not installed	Interrupt 2
J308	not installed	Interrupt (COM2) 3
J309	installed	Interrupt (COM1) 4
J310	not installed	Interrupt 5
J311	not installed	Interrupt 6
J312	not installed	Interrupt 7

---

**NOTE:** Only one jumper from J307-J312 should be in place at any one time.

---

**Table 2.5B. Video/Floppy Disk Controller Card Jumper Settings (Board 85-3057-1)**

---

POSITIONS			
1	2	3	
-	J301	+	Light pen polarity

---

This jumper allows the light pen polarity to respond to a positive (+) or negative (-) going light pen pulse.

---

V	J302	C	Vertical/composite sync select for external monitor
---	------	---	-----------------------------------------------------

---

This jumper allows you to select either a composite (vertical and horizontal together) sync signal, or a separate (horizontal and vertical separate) signal. If your monitor requires a separate signal, set the jumper to V. If it requires a composite signal, set the jumper to C.

**Table 2.5B (continued). Video/Floppy Disk Controller Card Jumper Settings (Board 85-3057-1)**

POSITIONS		
1 2	2 3	
+	J303	- Vertical sync polarity for external monitor
Select either a positive (+) or a negative (-) signal, depending upon what is required by your monitor.		
J304	and J306	Select the vertical and horizontal sync polarity for an internal monitor. Operation with an external monitor is not affected by this jumper.
+	J305	- Horizontal sync polarity for external monitor
This jumper may be set for either positive (+) or negative (-) horizontal sync signal polarity, depending upon what is required by your monitor.		

**Table 2.6A. Switch SW301 Settings (Board 85-3012-11)**

SWITCH POSITION	POSITION	FUNCTION
1	ON	Custom video font
	OFF ✓	Standard video font
2	ON ✓	Serial port is addressed as COM1 (IRQ4)
	OFF	Serial port is addressed as COM2 (IRQ3)
3	ON ✓	Serial port enabled
	OFF	Serial port disabled
	ON ✓	Video enabled
	OFF	Video disabled

## Hardware

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**Table 2.6B. Switch SW301 Settings (Board 85-3057-1)**

---

SWITCH POSITION	POSITION	FUNCTION
1	ON	Floppy enable
	OFF	Floppy disable
2	ON	Serial port is addressed as COM1 (IRQ4)
	OFF	Serial port is addressed as COM2 (IRQ3)
3	ON	Serial port enabled
	OFF	Serial port disabled
4	ON	Video enabled
	OFF	Video disabled

---

## Video Modes

Computers display information on video monitors in various ways or modes. The resolution (sharpness) of the display varies from mode to mode, as does the number of characters per line and the ability to display colors.

Your computer can display information in one of eight video modes or environments. The modes are listed in Table 2.7.

**Table 2.7. Video Modes**

MODE	NUMBER	DESCRIPTION
Text	0	40 characters/line, 25 lines/screen, monochromatic at the RGB output
Text	1	40 characters/line, 25 lines/screen, color at the RGB output
Text	2	80 characters/line, 25 lines/screen, monochromatic at the RGB output
Text	3	80 characters/line, 25 lines/screen, color at the RGB output
Graphics	4	Medium resolution graphics, color, text displayed as 40 characters/25 lines at the RGB output
Graphics	5	Medium resolution graphics, monochromatic, text displayed as 40 characters/25 lines at the RGB output
Graphics	6	High resolution graphics, monochromatic, text displayed as 80 characters/25 lines at the RGB output
Text	7	80 characters/line, 25 lines/screen using a video board compatible with the IBM monochrome display

## Hardware

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### Text Modes

Text modes display information on a 25-line screen. They are capable of displaying the entire 256-character set stored in the ROM character generator.

Characters are formed from a ROM character generator. The character generator contains dot patterns for 256 characters per font, two fonts, which are hardware and software selectable.

The fonts contain characters for game support; word processing editing functions; the standard 96 ASCII character set; business block graphics allowing drawing of charts, boxes, and tables using single or double lines; some of the most often used Greek characters; characters to support foreign languages; and some of the most often used scientific notation characters.

Standard characters are displayed on a  $7 \times 7$  grid within an  $8 \times 8$  grid box.

In text modes, sixteen (16) colors are available. Blinking is available on a per-character basis. In order to display all sixteen colors, a monitor must have provisions for an intensity signal, as well as for RGB signals. Monitors without provision for the intensity signal can display eight (8) colors.

**Table 2.8. Available Colors**

NUMBER	COLOR	NUMBER	COLOR
0	Black	8	Dark Gray
1	Blue	9	Light Blue
2	Green	10	Light Green
3	Cyan	11	Light Cyan
4	Red	12	Light Red
5	Magenta	13	Light Magenta
6	Brown	14	Yellow
7	Light Gray	15	White

In the monochromatic text modes, reverse video, blinking, and highlighting all are available.

The 16K video memory located on the video card can store a number of screen images called pages. It holds up to eight pages of 40 characters per line information, or up to four pages of 80 characters per line information.

## Graphics Modes

Modes 4, 5, and 6 all are graphics modes. Modes 4 and 5 are identical except that mode 4 can display color and mode 5 is monochromatic. Mode 6 is a high resolution monochromatic mode.

The resolution of your computer is measured in pixels, or picture elements. Each picture element represents a position on the video screen.

Medium resolution graphics mode has a resolution of  $320 \times 200$  pixels. Four colors are available at any one time in this mode. They consist of the colors in either Set 1 or Set 2 listed in Table 2.9, and any one of the 16 colors in Table 2.8 as the background.

**Table 2.9. Available Medium Resolution Graphics Colors**

---

SET 1	SET 2
Cyan	Green
Magenta	Red
White	Brown

Medium resolution foreground colors.

---

## Hardware

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### High Resolution Graphics Mode

Mode 6 has a resolution of  $640 \times 200$  pixels. Color is not available in this mode.

### Mass Storage

Floppy disk drives provide your computer with a transportable mass storage capability. Mass storage is important for several reasons which are explained in the following paragraphs.

Mass storage provides a place to store programs, data, and other information that needs to be kept for use some time in the future. Remember, information in RAM memory disappears each time the computer is turned off.

Mass storage also provides the computer with a place to store information that isn't being used at that very instant. For example, in word processing, long documents can reside on a disk. As sections need to be modified, they can be moved from the disk into RAM memory where they can be edited quickly.

Mass storage is a reusable storage space. Once information is no longer needed, it may be erased and the space used for more current information. Mass storage provides a convenient method for transporting programs and data between computers.

### Floppy Disk Drive Features

- 5.25-inch industry standard
- Double-sided, double-density, soft-sectored
- Format and capacity, software controlled
  - MS-DOS Version 2 or higher supports 360K per drive

## Floppy Disks

The floppy disk is a precision storage medium which requires care and attention to ensure a long, trouble-free life. A floppy disk consists of three parts: the plastic disk, the disk liner, and the disk jacket.

The disk itself is made out of a thin flexible plastic material coated with a magnetic oxide similar to that used in magnetic recording tape. It can be stretched or bent easily, leaving distortions in its surface that will destroy its usefulness.

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 disk jacket has three openings and a notch along one side. The large center opening is used by the disk drive to grip the disk and rotate it. The small circular hole to one side is used for timing purposes. The long slot is used for access to the disk itself by the read/write head which records and “reads” information to and from the surface of the disk.

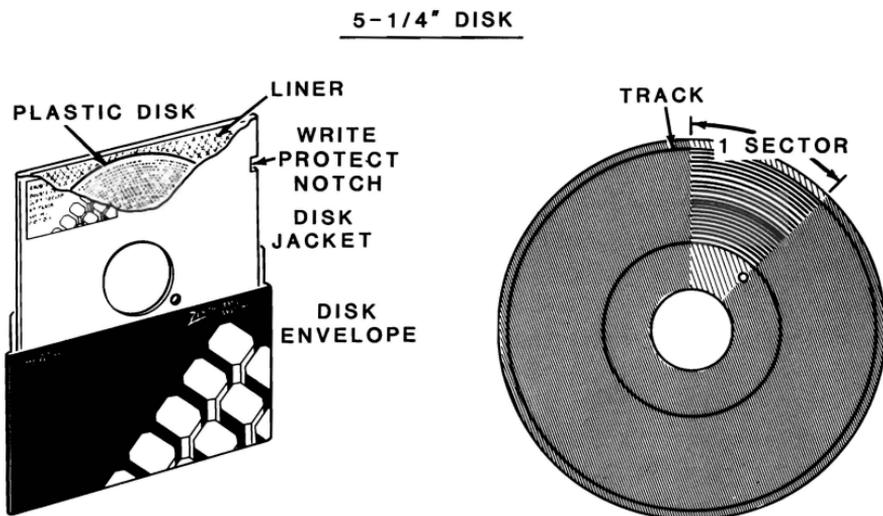
The notch, on 5.25-inch disks, is called a write protect notch and is located near the label. Whenever you have important information on a disk that you do not want to write over, place an opaque tab over this notch. The computer will sense its presence and will not record on this disk.

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 may cause the disk to lose contact with the head, interrupting the read/write process.

## Hardware

You can compare a new disk to a file cabinet that is full of files. When the disk is new, it is like a new, empty file drawer. You have to organize (format) the disk so that it can hold your files of information. This information may take the form of data, programs, and the Disk Operating System (DOS). "Operations," Chapter 3, tells you how to organize, or format, your disks.

Refer to Figure 2.6. 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-sectored disk. When software determines the sectoring, the disk is a soft-sectored disk. The two types of disks cannot be used interchangeably in the same disk system.



**Figure 2.6. The Floppy Disk**

The amount of information each sector can hold determines the disk density. 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

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 in your computer.

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 write on only one side of the disk. Your Z-100 PC Series Computer has double-sided disk drives to provide for full business application usage.

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

## Disk Care

Because the disks can be damaged, keep these precautions in mind when handling them.

When preparing a label for a disk, write on it **before** you place it on the disk. If you must write on a label already on a disk, use a felt-tip pen. Ball point pens and pencils may exert enough force on the disk to crease the plastic, 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 upright in its protective envelope away from heat or direct sunlight. 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 the disk. By keeping your disks away from these sources of trouble, you can help to ensure trouble-free operation of your computer.

## Disk Drive Identifiers

Refer to Figure 2.7. One or two floppy disk drives are included with your personal computer system. Your computer also may include a Winchester hard disk system.

For dual floppy disk systems, the top disk is referred to as drive A and the bottom one is drive B. If your computer has only one floppy disk drive, it will be known as drive A.

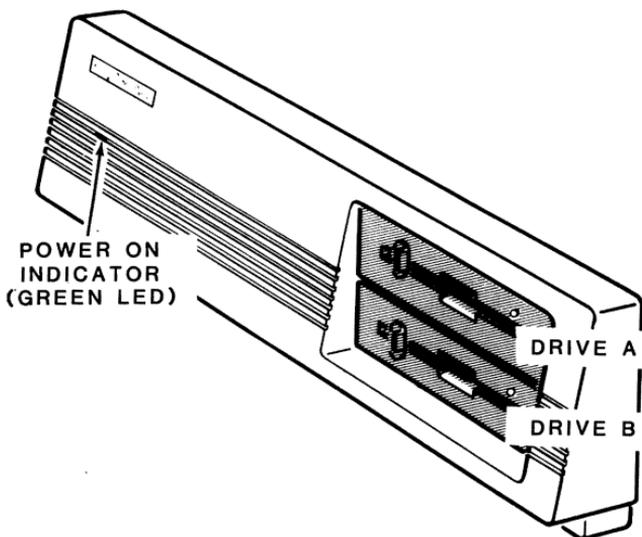
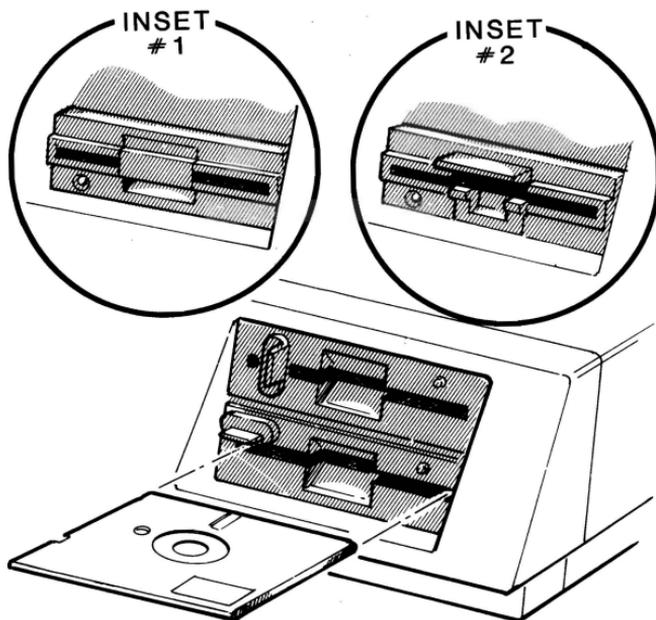


Figure 2.7. Disk Drive Identification

The optional Winchester system may be divided into up to four parts, called partitions. These can be identified as drives C through F.

**NOTE:** The drive names A, B, C, and D are arbitrary. Most systems that run on your computer use the names illustrated here. Other operating systems may refer to the drives by other means. Consult the documentation supplied with your operating system for the names of the drives (drive A will be the lowest named drive; drive B, the next; and so on).

Refer to Figure 2.8 for the following discussion.



**Figure 2.8. Disk Drive Features**

## Hardware

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### Disk Load Slot

Insert floppy disks in this slot with the label up and toward you. If the disk is not positioned as shown, the unit will not operate properly and you may damage the floppy disk and/or the disk drive. If the disk meets resistance while you are inserting it into the drive, check to see if there is a disk already in the drive. The disk should slide smoothly into the drive.

### Disk Drive Latch

Your floppy disk drive may contain a latch, door, or handle as illustrated in the insets of Figure 2.8. 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 center hole for damage, check for proper disk orientation, and try again.

### LED Disk Access Indicator

This LED, 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.

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

### Serial Input/Output Port

Mounted on the video/floppy disk controller card of your personal computer is one RS-232 serial port that extends through the rear of the cabinet.

This input/output port is software controlled, and may be used with a wide variety of equipment, including a serial printer, asynchronous

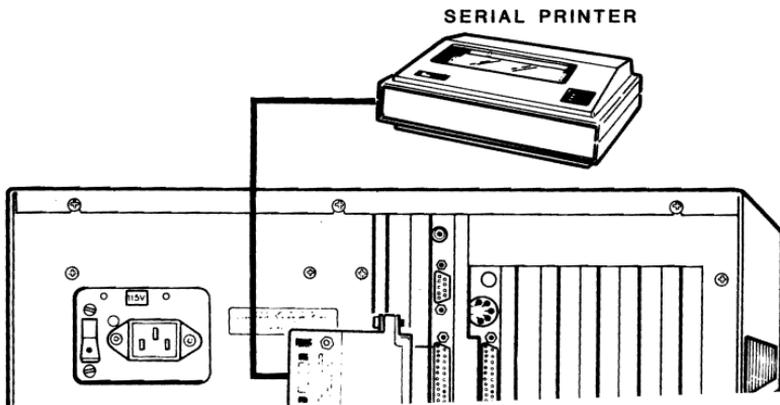
**Table 2.10. RS-232 Pin Definitions**

SIGNAL	PIN NUMBER
Ground	1
Transmit data	2
Receive data	3
Request to send	4
Clear to send	5
Data set ready	6
Signal ground	7
Carrier detect	8
Data terminal ready	20
Ring indicate	22

## Connecting a Serial Printer

If you have a serial printer, connect one end of your cable to the serial connector on the back of the computer and the other end to your printer. Refer to Figure 2.9 and the printer's documentation for specific instructions.

Before you can use the printer, you must run the configuration program supplied with your operating system to properly configure the signals going to your printer. Refer to "Operations," Chapter 3, for specific instructions.



## Connecting a Modem

There are two types of modems: acoustic-coupled and direct-connect. Although connection to the computer is the same for either modem, the direct-connect type must be connected directly to the telephone line. Refer to Figure 2.10 and your modem's documentation for specific instructions.

To connect your modem to the computer, connect one end of the modem cable to the serial connector on the back of your computer. Connect the other end to the modem. Refer to your modem's documentation for specific instructions. Also, refer to "Operations," Chapter 3, for information concerning the CONFIGUR program.

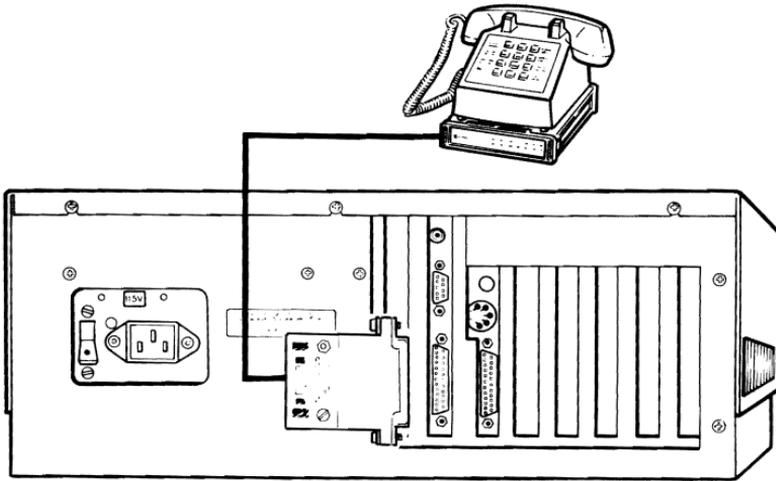


Figure 2.10. Modem Connection

## Winchester Disk

With the addition of the optional Winchester drive, your Z-100 PC Series Computer from Zenith Data Systems achieves a level of performance seldom achieved in personal computers.

The Winchester drive is an option that will allow you to store the equivalent of several dozen floppy disks inside your computer ready for immediate access in your daily business needs. Besides additional on-line capacity of stored records, the speed at which that information may be accessed is increased by a factor of ten to twenty.

The Winchester disk drive replaces one of the two floppy disk drives in your system. In place of the disk load slot, disk drive door, and LED disk access indicator, you will see only an LED disk access indicator.

## Winchester Disk Drives

A Winchester disk drive system, such as the one in your personal computer, is only one of a family of disk systems generally called hard disks.

The disk itself is a carefully machined and polished nonmagnetic metal platter coated with a magnetic material, similar to that used by floppy disks and audio or video tape. Hard disks come in a variety of sizes, capacities, and configurations. Many have multiple disks and some even are removable, being enclosed in "disk packs," or "cartridges."

The read/write head (which records and reads information to and from the surface of the disk) floats on a cushion of air above the disk as it turns. The distance between the head and the surface is so small that even a tiny smoke particle could cause irreparable damage to the disk. For this reason, most disks, including your Winchester disk system, are sealed against contamination.

## Hardware

The organization of the individual hard disk is similar to a floppy disk. However, a hard disk system may have more than one platter (disk), and the system may use each side of each platter. Therefore, each side will have its own read/write head. Each head is in alignment with the heads for the other platters or sides, and all are moved together. Refer to Figure 2.11.

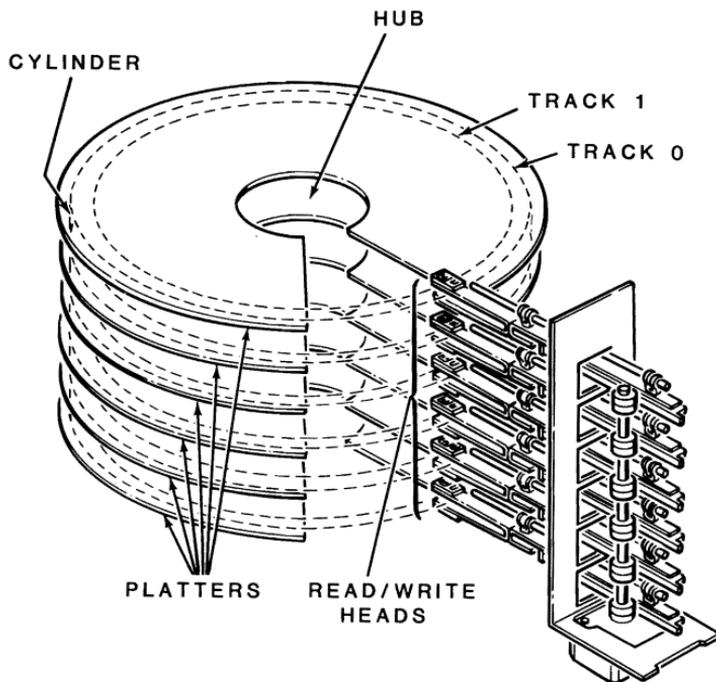


Figure 2.11. The Elements of a Hard Disk

A track is that portion of the disk that passes under a read/write head. If you have four read/write heads on four different platter sides, you will have four tracks that are passing under the heads at one time. These four tracks make up a cylinder. A cylinder has as many tracks as there are heads in any particular hard disk system.

In addition to being divided into cylinders, tracks, and sectors, a hard disk may be "partitioned." A partition is a group of tracks or cylinders used as a "logical" drive for a particular application or operating system.

A logical drive acts like a floppy disk. Because a partition is considered to be a logical drive, it is treated the same as any individual floppy disk drive. It is uniquely identified with a drive name, such as A or B. It may contain an operating system such as MS-DOS, or may be used strictly for data storage.

The Winchester design in your personal computer uses a single head per platter side, and is sealed against contamination from the outside. Before you can use it, the disk surfaces must be prepared (formatted like a floppy disk) and partitioned. Your operating system from Zenith Data Systems contains four utility programs — PART, PREP, SHIP, and DETECT — to prepare and partition your system. These programs are discussed in "Operations," Chapter 3.

## Chapter 3

# Operations

This chapter of your Operations Manual introduces you to the fundamental operation of MS-DOS, a disk operating system designed for your computer. Instructions are included for making backups, copying files, and performing other day-to-day tasks with the operating system.

## The Disk Operating System

A Disk Operating System (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 date and time (**DATE** and **TIME** commands), and load other programs.

MS-DOS was prepared for the Zenith Data Systems Z-100 PC Series Computers by Microsoft. It is compatible with Z-DOS, the operating system for the Zenith Data Systems Z-100 Desktop Computers, and PC-DOS, the operating system of the IBM Personal Computer. It is supplied on disks 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, check out certain features, and serve as a system supervisor. Loading MS-DOS and using it to organize and duplicate disks is discussed later in this chapter.

If you are using your computer for the first time, be sure to read the separately bound User's Guide and the contents of "Hardware," Chapter 2, in this manual; they both contain important information for new users. Even if you are familiar with computers, it's a good idea to read the discussion on controls in the User's Guide before using your computer.

## The Monitor Program

Your computer contains a special program, called a monitor, designed to help you get started. One of its functions is to load (or boot) the disk operating system from disk into memory. Wired computers are set at the factory to automatically boot the DOS when they are turned on.

There will be no display during powerup until a certain amount of time passes, the ESC key is pressed, or a disk with the DOS on it is inserted into drive A. Some Winchester systems may attempt to boot from the Winchester system; if the DOS has not been placed on the Winchester disk, an error message eventually will be displayed.

When you press the ESC key during powerup, the screen will show something similar to the following messages.

```
MFM-150 Monitor, Version 2.2  
Memory Size: 128K  
Enter "?" for help.  
->
```

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 version and given a number (Version 1.0, Version 1.1, etc). The version of your monitor program is shown in the first line of the message.

The second line of the message tells you how many thousands (K) of bytes of memory are installed in your computer. In this case, the computer illustrated has the standard 128K bytes (or characters) of memory. Your computer may contain more, typically 320K, for some systems. Your computer's memory can be expanded to 640K of memory, more than enough for almost any conceivable application.

When your system attempts to boot a disk and none are placed in the drives, the following message will be displayed after about 15 seconds:

```
+++ DISK ERROR: Drive not ready! +++
```

The disk access light will remain on. In order to use your computer, press the **ESC** key and the opening messages will be displayed, erasing the error message.

Your computer is now in the manual mode and you can use the monitor commands. A complete summary of the monitor commands is included in "Software Summaries," Chapter 5.

The **B** command is the monitor command used most often if a disk is not autobooted after powerup, 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 and the video monitor are on and the prompt is showing.
- Insert the MS-DOS disk (or any disk with a Z-150 PC Series disk operating system on it) into drive A.
- Close the disk door or latch.
- Press the **B** key. The computer will display the letter **B** (or **b**).
- Press the **RETURN** key.

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

## Loading MS-DOS

With the MS-DOS manual, you will receive two MS-DOS disks titled: Distribution Disk I and Distribution Disk II. The following steps show you how to load the DOS for the first time and then create backups, or working copies, of the distribution disks.

To load MS-DOS:

- Turn on the computer. If the computer is already on, press the **CTRL**, **ALT**, and **DEL** keys in sequence while holding down each of the previous keys.
- Insert MS-DOS Distribution Disk I into drive A.
- Close the disk drive door or latch.
- If you are booting the computer manually, press in sequence the **B**, **F**, and **0** (zero) keys. The computer will display:  
  
bf0
- Press the **RETURN** key.

The disk access light will come on, indicating that the disk is being read by the computer. You may hear a buzz or two from your drive, which is the normal sound of the disk drive motors.

As MS-DOS is read into the computer, your display will show messages similar to the following:

```
MS-DOS Version 2.01
Copyright (C) 1981, 82, 83 Microsoft Corp.
Current date is Tue 1-01-1980
Enter new date: _
```

The date actually shown by your computer will probably differ from this display. 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 the year if you are entering a year from 2000 to 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

12-31-2082                        Thu 12-31-2082

1-1-80                              Tue 1-01-1980

8/12/82                            Thu 8-12-1982

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

Current time is 0:03:20.20

Enter new time: \_

The time actually shown by your computer will probably differ from this display. 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 seconds (0 to 59), and C is hundredths of a second (0 to 99). 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: \_

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Note that your computer's clock is a 24-hour clock. Some examples of valid entries and how they are stored in your computer are:

<u>Your entry:</u>	<u>Will be stored as:</u>
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:

A>

You can see by this sample display that the arrow has been replaced by A>, which is the prompt used by MS-DOS. This display also tells you which drive is currently being used by the system, 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.

## Backups

**NOTE:** The procedure described here is for a two-drive system. If you have a single-drive system, read MS-DOS for Single-Drive Systems in Chapter 5 before proceeding.

A backup is an insurance copy. It is a duplicate of important data. During the course of normal operation, accidents do happen and a disk can be 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.

Making backups at regular intervals minimizes the amount of work neces-

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

The following discussion will take you through a step-by-step method of making backups. This procedure involves formatting a new disk and then copying every track from the original (source) disk to the new (destination) disk. This program can be used to duplicate and produce identical disks; however, you cannot use it to produce nonidentical disks. Another method of making backups using the `FORMAT` and `COPY` commands is discussed later in this chapter.

- Before you start, prepare two labels, one for each disk.

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 (summary or title only). An example would be:

Formatted:7-15-84      PAYROLL DATA

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

For your new copy of Distribution Disk I, prepare a label with the following information on it:

Number:1

Date: (today's date—the format date)

Title: MS-DOS Disk I—Working Copy

This disk is called a working copy because it is one you will use on a continuing basis. Prepare a label for your new copy of Distribution Disk II in a similar manner.

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**NOTE:** Do not affix the labels to the disks until you are instructed to do so.

- Make sure your system is on and the MS-DOS prompt, `A>`, is on the display.
- Insert MS-DOS Distribution Disk I in drive A (if it is not already there).
- Type:

```
DISKCOPY/V
```

- Press the **RETURN** key. When you pressed the RETURN key, you told the computer to execute the command. The computer will display something similar to :

```
DISKCOPY version 2.00
Copyright (C) 1984, Zenith Data Systems Corporation
```

```
Source drive name? (A-B) _:
```

Diskcopy is a utility; the version number illustrated may not necessarily match yours. There are several operator prompts, the first of which is now on the screen.

- Press the **A** key. This is your source drive, the one that contains MS-DOS Distribution Disk I. The computer will display:

```
Destination drive name? (A-B) _:
```

- Press the **B** key. This is your destination drive, where you will place a blank disk. The computer will display:

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

If your source disk is not in drive A, replace the disk in drive A

- Place a blank disk in drive B. Any information previously recorded on this disk will be erased and replaced with a copy of the information contained on the disk in drive A.
- Press the **RETURN** key. Your computer will display:

Formatting destination...

The disk in drive B will be formatted. Formatting is the process of organizing the surface of the disk so that it can receive information. This takes about a minute, then your computer will display:

Copying...

You will see the disk access lights of the drives alternately glow as the information is copied from the disk in drive A to the disk in drive B. When all the information has been copied, your computer will display:

Verifying...

The DISKCOPY command normally will not verify a disk (that is, check to make sure that the material just recorded is identical to the source). However, we had you place a “switch” at the end of the command. This and other switches are shown in the MS-DOS Command Summary in Chapter 5.

Again, you will see the disk access lights of the drives alternately glow as the information from one disk is compared against the other. If the two do not agree, an error message<sup>1</sup> will be shown on the screen. Otherwise, you will see:

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

---

<sup>1</sup>If the disk placed in drive B contains flaws on the surface of the disk or in the magnetic coating, an imperfect copy was made and the following error message will be displayed:

Read error on destination drive  
Disk verify failure

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This message also will appear after any error messages regarding a bad copy. If you see no error messages, the information has been successfully copied from the source to the destination disk.

- Remove the disk from drive A (Distribution Disk I) and put it in its disk envelope.
- Remove the disk from drive B (the new working copy of Distribution Disk I) and put it in its envelope.
- Place the label prepared earlier on this disk.
- Respond by pressing the Y key and then the RETURN key to the Do you wish to copy another disk (Y/N)? <N> prompt. The computer will display:

Source drive name? (A-B) \_:

Return to the beginning of this section and use another disk as the destination disk for Distribution Disk I.

- Press the **A** key. The computer will display:

Destination drive name? (A-B) \_:

- Press the **B** key. The computer will display:

Place the source disk in A and the destination disk in B.

Press RETURN when ready.

- Place MS-DOS Distribution Disk II in drive A and close the door or latch.
- Place a blank disk in drive B and close the door or latch.
- Press the **RETURN** key. The computer will format, copy, and verify the disk as it did before. The following will be displayed during this procedure:

```
Formatting destination...
```

```
Copying...
```

```
Verifying...
```

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

- Press the **RETURN** key.<sup>2</sup> The computer will display:

```
A>
```

which is the default MS-DOS prompt.

- Remove the disk from drive A and put it in its envelope.
- Remove the disk from drive B and put it in its envelope. Place the label on it that you prepared earlier.

You have now completed the first backup of the distribution disks. Place the originals in a safe place, away from the computer.

Now make at least one copy of your working disks by using the same procedure just completed, or, by using the **FORMAT** and **COPY** procedures described later in this chapter.

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<sup>2</sup>In the prompt, you will see an N enclosed between less than and greater than symbols.

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# MS-DOS Preview

This section of this Operations Manual is an introduction to the most rudimentary operations performed while using MS-DOS. Complete documentation is included with your operating system software.

## MS-DOS Commands

An MS-DOS command is an instruction to the system that is typed on the keyboard. Some of the commands, called internal commands (referred to as resident commands in the MS-DOS manual), are an integral part of the operating system. Other commands, referred to as external commands (called transient commands in the MS-DOS manual), are actually separate programs (called utilities) on the disk and must be loaded into the computer before the functions are performed.

The FORMAT 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 the MS-DOS operating system. In order to use an external command, the command file must exist on the disk. If the file is not present, the commands will not work.

## MS-DOS Prompts

The prompt is a signal that your system is ready to accept a command. While using MS-DOS, you will see the prompt displayed as the letter representing the drive being used. The letter is followed by a symbol, usually a greater than sign (>), and a blinking underline. The underline is called the cursor and it lets you know where the next character will be displayed.

If you selected drive A, the normal default drive on powerup, the MS-DOS prompt would look like this:

You can change the prompt and the default drive by typing the new drive name, a colon, and pressing the RETURN key. For instance, 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 system will display an error message when something is wrong. The message itself often tells 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 system. 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 your MS-DOS manual.

## Files, Programs, and File Names

A file may contain either data or a program. Some programs actually may consist of several different files, such as MS-DOS. There are three programs (files) critical to the operation of MS-DOS: MSDOS.SYS, IO.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.

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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 F and must be followed by a colon. The use of these letters is limited by the configuration of your system. For instance, if your 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, A1PROG, and 333-1.
- **Extension** — 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 manual for further information.

Examples of valid and invalid file names are:

Valid file names:

MYPROG.BAS  
COMMAND.COM  
MSDOS.SYS

Invalid file names:

WE,3.BAS (comma)  
B:MYP:2.BAS (second colon)  
MS.OS.SYS (first period)

## Internal Commands

Some of the commands that are internal to MS-DOS are listed in the following chart:

<u>The command:</u>	<u>Tells the computer to:</u>
COPY	Copy files.
DATE	Display the current system date and prompt for a new entry.
DEL	Delete a file from the disk (same as ERASE).
DIR	List directory entries.
ERASE	Delete a file from the disk.
REN	Rename a file (same as RENAME).
RENAME	Rename a file.
TIME	Display the current system time and prompt for a new entry.
TYPE	Display the contents of a file.

This is not a complete list of the internal MS-DOS commands. A summary of all MS-DOS commands is found in "Software Summaries," Chapter 5. For a full discussion of all the internal commands, consult your MS-DOS manual.

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### 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 name allows 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 used.

There are several options and limitations in the format of the COPY command. These are fully explained in the MS-DOS manual. However, one 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 system.

- To execute the command, type:

**DATE**

- Press the **RETURN** key. The computer will display the current date and prompt you for a new entry. If you press the RETURN key, the computer will not make any changes 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 the year if you are entering a year from 2000 to 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:

<u>Your entry:</u>	<u>Will be stored as:</u>
6-9-82	Wed 6-09-1982
12-31-2082	Thu 12-31-2082
1-1-80	Tue 1-01-1980
8/12/82	Thu 8-12-1982

## DIR

Each disk, when it has been formatted, is organized to accept files. The names of these files are stored on the disk in an area called the directory. The DIR command allows you to look at the files which are on the default drive.

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- Press the **RETURN** key. You will see a listing similar to the following partial listing of MS-DOS Distribution Disk 1:

```
Volume in drive A has no label
Directory of A: /
```

```
COMMAND  COM   18160  12-13-83  11:20a
FORMAT    COM   12656   1-06-84   2:43p
CONFIGUR  COM   19724  12-13-83   8:14a
CHKDSK    COM    6468  11-21-83   3:24p
.
.
.
PSCMX80   COM    1456  11-08-83   2:00p
PSCMPI    COM    1394  11-08-83   3:45p
        26 Files(s) 129024 bytes free
```

While your distribution disk will probably differ in the information displayed, you will see the same five columns of information representing, in order: (1) the name of each file, (2) the extension name, (3) 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 (4) the date and (5) time that file was created, last edited, or changed.

At the top of the listing you will see the label of the disk (your distribution disks are unlabeled) and the path name(s) of this directory. At the bottom of the directory list, you will see a total count of the number of displayed files and the number of bytes still free for your use on the disk. Complete information on directories, paths, files, and disk space can be found in the MS-DOS documentation.

You can list the directory of a drive other than the default drive by adding the drive name. For example, to get a directory listing of the disk in drive B:

- Type:

```
DIR B:
```

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

DIR FORMAT.COM

or,

DIR B:FORMAT.COM

**NOTE:** You must use the entire file name. The inclusion of the drive name tells the computer to look on the disk in that disk drive.

### **Wild Cards**

Two additional characters that you may use with a file's name are called wild cards. The term means "anything" and they are represented by the question mark (?) and the asterisk (\*).

You can use the question mark whenever you want a match to any letter in the position the wild card appears. For instance, if you type:

DIR AB?DE.EXT

the computer will display any files with five letter names that begin with AB, end with DE, and have the extension of .EXT that appear in the directory of the default drive's disk.

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The other wild card is the asterisk (\*). This is used as a multiple question mark and will cause the computer to match with all characters found in those positions. For instance, when you type:

```
DIR AB*.EXT
```

the computer will display any files with names that begin with AB and have the extension of .EXT. Likewise, if you type:

```
DIR F*
```

the computer will list all files starting with the letter F, regardless of the rest of the file name or extension.<sup>3</sup> If you type:

```
DIR C*
```

for the directory sample we showed you earlier, the computer will display:

```
Volume in drive A has no label
Directory of A:/

COMMAND COM   18160  12-31-83  11:20a
CONFIGUR COM   19724  12-13-83   8:14a
CHKDSK  COM    6768  11-21-83   3:24p
    3 Files(s) 129024 bytes free
```

To get a feel for how this works, place one or more of your disks in the computer and experiment with the directory command.

---

<sup>3</sup> Normally, you would have to also repeat the wild card \* (asterisk) after the period as well, as shown in the following:

```
DIR F:*. *
DIR C:*. *
```

However, DIR is the one command that will accept a single wild card for both the file name and the extension.

## 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 could delete it by:

- Typing:

```
ERASE BADFILE.EXT
```

- Press the **RETURN** key. Or, you could type:

```
ERASE B:BADFILE.EXT
```

- Press the **RETURN** key. You must use the drive name if the file you want to remove is not on the default drive.

The command DEL may be used in place of the ERASE command. The following are equivalent to the previous examples:

```
DEL BADFILE.EXT  
DEL B:BADFILE.EXT
```

## RENAME (REN)

Occasionally, you will want to rename a file. To do this, you would type, for example:

```
RENAME NAMEONE.EXT NAMETWO.EXT
```

or,

```
RENAME B:NAMEONE.EXT = NAMETWO.EXT
```

These files don't exist on the MS-DOS disk shipped from the factory, but if they did, the computer would take the file named NAMEONE.EXT

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

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

## TIME

The TIME command allows you to change the time that is currently stored in your computer. The command will be executed when you type 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, 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 seconds (0 to 59), and C is hundredths of a second (0 to 99). 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:

<u>Your entry</u>	<u>Will be stored as:</u>
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 for a quick view. By using the CTRL-P function (refer to your MS-DOS manual), you also may make a permanent hard copy on your printer.

If you would want to look at the file TEXTFILE.TXT, you would enter:

```
TYPE TEXTFILE.TXT
```

The computer will now present the contents of the file on the display. If you want to temporarily stop the display, you can use the CTRL-S key as described in your MS-DOS manual.

## Other Internal Commands

You will find more complete instructions on how to use the options of the internal MS-DOS commands in your MS-DOS manual. The internal commands not discussed here also are discussed in that manual.

## External Commands

External MS-DOS commands are actually separate programs. They are called commands because you can 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.

All external commands will appear on the directory listing of a disk. These programs are known as utilities and are used for common tasks, such as the FORMAT command.

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Some of the external commands included with MS-DOS are summarized as follows:

<u>The command:</u>	<u>Tells the computer to:</u>
CHKDSK	Check the directory, report free space, and repair the directory, if necessary.
CONFIGUR	Configure the system for a specific printer, or with use of some other serial or parallel device.
DEBUG	Load, change, or display the contents of any file.
DISKCOMP	Compare the contents of two disks to see if they are identical.
DISKCOPY	Duplicate the contents of one disk onto another disk.
EDLIN	Create, edit, display, or delete ASCII files.
FC	Compare the contents of two files to see if they are identical.
FORMAT	Format a disk.
LIB	A library manager used with object code files.
LINK	Creates an executable file (.EXE) from object code files.
SYS	Transfer the operating system.

## CHKDSK

This command lets you check your disks to make sure they are still usable and do not contain any bad areas. Use this 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 error messages are discussed fully in your MS-DOS documentation.

After the error messages are displayed (if any), CHKDSK will display a status report consisting of the number of files on the disk, the total disk space, the amount of unused space remaining on the disk, the internal memory space in the system, and the amount of unused memory by the system.

A typical status report of any empty formatted disk (no label) would read:

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

131072 bytes total memory
105328 bytes free
```

The amount of total memory is for a system with 128K of memory.

A CHKDSK report for a disk (no label) that contains files on the disk would be similar to:

```
362496 bytes total disk space
 22528 bytes in 2 hidden files
171008 bytes in 26 user files
168960 bytes available on disk

131072 bytes total memory
105328 bytes free
```

The two hidden files are IO.SYS and MSDOS.SYS, which are present but are not displayed during a listing of the directory

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### FORMAT

The **FORMAT** command is used to organize your disk so that it can receive files of data or programs.

This command also puts information in the area of the disk which normally holds the operating system. If you try to boot your system with a disk which only has 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 reset your system by pressing the **CTRL**, **ALT**, and **DEL** keys at the same time. Then you can place a system disk in drive A and properly boot the system. The term "system disk" refers to any disk that has the operating system on it.

You can use the **FORMAT** command during the backup procedure and place the operating system on the new disk with a "switch." The disk also can be checked during the **FORMAT** procedure and verified. The two switches are: **/S** (for System) and **/V** (for Verify). If you want to make a data disk which will not contain the operating system, use the following instructions:

- With the system on and your **MS-DOS** working disk 1 on drive A, type:

```
FORMAT B: /V
```

- Press the **RETURN** key. The computer will display:

```
FORMAT version 2.00
```

```
Copyright (C) 1984, Zenith Data Systems Corporation
```

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

- Place a blank disk in drive B.

- Press the **RETURN** key. The disk in drive B will be formatted. Then the computer will display:

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

- You may use up to 11 continuous characters (excluding the period) for a name. Most computer users will use the underscore to join words. Press the **RETURN** key when you have finished typing your label the computer will display:

362496 bytes total disk space  
362496 bytes available on disk

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

If the **FORMAT** program discovered any flawed areas on the disk, it will "lock them out" so they will not be used. We suggest that disks with bad areas be discarded. The computer will display a message similar to the following for a disk with bad areas.

362496 bytes total disk space  
10240 bytes in bad sectors  
352256 bytes available on disk

Likewise, **CHKDSK** will display similar information.

## **SYS**

From time to time, improvements and/or enhancements will be made to the operating system included with the Z-100 PC Series Computer. When this happens, use the **SYS** command to copy the new system onto existing disks. Refer to the MS-DOS documentation when you need to use **SYS**.

## DISKCOPY

DISKCOPY.COM is a disk duplication program that, once loaded into your system, allows you to duplicate disks. You used DISKCOPY earlier to back up your MS-DOS distribution disks.

DISKCOPY contains its own formatting routines, so the destination disks do not have to have been previously formatted. However, no check is made to see if the destination disk contains data, so be sure the disk does not contain vital information before you proceed with DISKCOPY.

- To use DISKCOPY, type:

```
DISKCOPY
```

- Press the **RETURN** key. The computer will display a message similar to:

```
DISKCOPY version 2.00  
Copyright (C) 1984, Zenith Data Systems Corporation
```

```
Source drive name? (A-B) _:
```

- Press the key that corresponds to the drive which will contain your source disk. The next prompt will show:

```
Destination drive name? (A-B) _:
```

- Press the key that corresponds to the drive which will contain your destination disk. For instance, if you pressed the A key for the source and the B key for the destination, your computer would display:

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

- Now place your source and destination disks in their respective drives and press the **RETURN** key. The display will show:

The destination disk will be formatted. This takes about a minute. After the formatting is completed, the display will show:

Copying...

Now the drive access indicators will alternately glow as the information is copied from the source disk to the destination disk. When all of the information has been copied, the display will show:

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 again will 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 computer will return to the MS-DOS prompt.
- An alternate method to use the DISKCOPY command is to type:

DISKCOPY A: B:

Here is what you are telling the computer:

DISKCOPY Duplicate the disk

A: in drive A

B: onto the disk in drive B

- Press the **RETURN** key. The following prompt will be displayed:

DISKCOPY version 2.00

Copyright (C) 1984, Zenith Data Systems Corporation

Place the source disk in A and the destination disk in B.

Press **RETURN** when ready.

## Operations

---

### DISKCOMP

The DISKCOMP command is a companion to the DISKCOPY command. Disks that have been duplicated with the DISKCOPY command can be checked against the originals with DISKCOMP. Also, if you have two disks and suspect that they are not identical, DISKCOMP is a quick method to check them out.

- To use DISKCOMP, type:

```
DISKCOMP
```

- Press the **RETURN** key. The computer will display:

```
DISKCOMP version 2.00  
Copyright (C) 1984, Zenith Data Systems Corporation
```

- Press the letter that corresponds to the drive you will use for one of the disks. The computer will now display:

```
Source2 drive name? (A-B) _:
```

- Press the letter that corresponds to the drive you will use for the other disk. If you used A for one drive and B for the other, the computer will now display:

```
Place the source1 disk in A and the 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 display will show:

```
Disk verify failure
```

If the two disks are identical, then the display will simply ask:

```
Do you wish to compare more disks (Y/N)? <N>
```

## Other External MS-DOS Commands

You will use the CONFIGUR command to set up your system if you have a printer. It is explained fully later in this chapter.

The other external commands are explained in detail in your MS-DOS documentation.

## Manual Backups

MS-DOS offers the option of making manual backups of disks. While this process is not as simple as using DISKCOPY, it does permit you to make copies of files on different media (for instance, backup material on the Winchester to a floppy disk). This process also allows you to create working copies of application software that may be distributed without an operating system.

## System Disks

This section shows you how to use the FORMAT command to organize a disk (to store files of data or programs), and put the operating system on it. Then you will use the COPY command to make a duplicate of original files.

You must always use the FORMAT procedure with new disks. It also is necessary to format any disk was used on a different computer, under a different operating system (other than MS-DOS), or that had been partially or completely erased by a magnetic field. Different computers and operating systems may use a different and incompatible format on the disk surface.

## Operations

---

### FORMAT

- Turn on the computer system and load (boot) MS-DOS. The computer will display:

A>

- Type:

FORMAT B: /S/V

- Press the **RETURN** key. The "B:" portion of the FORMAT command tells the computer that you want to use drive B to format your disk. The "/S" portion tells the system to place a copy of the operating system onto the disk in drive B. The "/V" portion tells the system to check and lock out (verify) any bad sectors (areas of the disk surface) that it finds. The computer will display:

FORMAT version 2.00

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 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 **RETURN** key. Drive B's disk access indicator will glow, and the drive will make some clicking sounds as the disk is formatted. After approximately one minute, the computer will display:

System transferred

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

- Enter an appropriate title (limited to 11 characters with no spaces or punctuation), and press the **RETURN** key. The computer will display:

```
362496 bytes total disk space
 40960 bytes used by system
321536 bytes available on disk
```

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

- Press the **N** key for “no.” The display will show the MS-DOS prompt.

The disk has been successfully formatted and the operating system placed on it. Even though you used drive B to format the disk, drive A stayed in control and is still the “default” drive. You know this by the **A>** prompt which is now on the screen, telling you the computer is ready for the next command.

## COPY

- Place the disk you want to copy in drive A. Leave the disk in drive B alone.
- Type the following:

```
COPY A:*. *:=B:
```

Here is what each part of this command tells your computer:

COPY	Copy
A:	from drive A (the source drive)
*.*	all the files (the asterisks are “wild cards” and mean all)
=	to (a space also will work here)

## Operations

---

- Press the **RETURN** key. The disk access indicators alternately glow as each disk drive is accessed by the operating system. The name of each file will be displayed as it is copied from drive A to drive B. When all files have been copied, a message is displayed that tells you how many files were transferred (copied) to the destination disk (in this case, all of them). Such a message might read:

26 File(s) copied

## Nonsystem Disks

To prepare a disk that does not contain the operating system, the procedure is slightly different.

### FORMAT

- Place your MS-DOS disk in drive A.
- Type:

**FORMAT B: /V**

- Press the **RETURN** key. The disk will not have the operating system placed on it for the **FORMAT** procedure, but it will be checked for bad sectors. Your computer will display:

FORMAT version 2.00

Copyright (C) 1984, Zenith Data Systems Corporation

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

- Insert a blank disk in drive B and close the door or latch.
- Press the **RETURN** key. Drive B's disk access indicator will glow, and the drive will make some clicking sounds as the disk is formatted. After approximately one minute, the computer will display:

- Enter an appropriate title (limited to 11 characters with no spaces or punctuation), and press the **RETURN** key. The computer will display:

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

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

- Press the **N** key for “no.” The display will show the MS-DOS prompt. The disk has been successfully formatted, but the operating system has not been placed on it.

## **COPY**

- Place the disk you want to copy in drive A. Leave the disk in drive B alone.
- Type the following:

```
COPY A: *.* =B:
```

- Press the **RETURN** key. The disk access indicators will alternately glow as each disk drive is accessed by the operating system. The name of each file will be displayed as it is copied from drive A to drive B. When all the files have been copied, a message is displayed that tells you how many files were transferred (copied) to the destination disk (in this case, all of them). Such a message might read:

```
26 File(s) copied
```

The **COPY** command is used to copy one or more files from one disk to another. It is a widely used command and, as you can see, 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** operation.

## Configuring the System

The Z-100 PC Series Computers may be connected to many different types of printers, modems, and other devices which make use of either a Centronics parallel signal or RS-232 serial signals. This section will show you how to use the CONFIGUR utility of MS-DOS to customize your operating system for use with different devices.

CONFIGUR will guide you through each phase of selecting the necessary conditions to hook up your printer and telephone modem (or other peripheral).

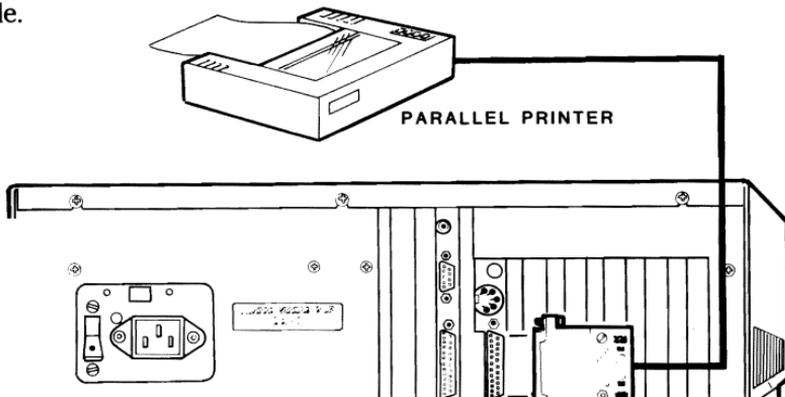
**NOTE:** Some peripherals, not sold by Zenith Data Systems, may require the fabrication of custom cables for proper operation.

### CONFIGUR

#### Parallel Printers

As your personal computer is delivered, it is ready to be connected and used with a parallel printer.

If you are going to use a parallel printer, all you need to do is plug it into the parallel port as shown in Figure 3.1. Be sure to use the proper cable.



## Serial Printers

Serial printers (as well as modems and other serial devices) use the serial RS-232 input/output port in a variety of ways.

If you are going to use a serial printer, you must first set up (configure) your computer system by running the CONFIGUR program.

CONFIGUR is an MS-DOS utility program which allows you to change the communications protocol of your computer to match that of your printer. A protocol is a set of parameters used in the process of exchanging information between computers and/or other devices such as printers. There is no one best protocol; however, in order to communicate successfully, both your computer system and printer must use the same protocol.

If your printer (or other serial device) is listed on Table 3.1, or is compatible with a device that is listed, the necessary protocol parameters are already in MS-DOS.

Example 3.1 shows how to set up your personal computer for use with any of these devices.

**Table 3.1. List of Serial Devices**

DEVICE	COMMENTS
MX-80	4800 baud, DTR pos. (pin 20)
H/Z-25	4800 baud, RTS pos. (pin 20)
H-14/WH-24	4800 baud, RTS neg. (pin 4)
Diablo 630/1640	1200 baud, ETX/ACK
WH-23/WH-33/WH-43 modem	300 baud, no handshake
WH-12 Votrax	
Type-N-Talk	4800 baud, RTS pos. (pin 4)

Some protocol parameters are listed in the comments section of Table

## Operations

---

It is, of course, possible to set up your computer for almost any protocol. If your printer (or other serial device) is not listed in Table 3.1, skip Example 3.1 and proceed to the User-Defined Serial Configuration section.

### Example 3.1 Configuring a Listed Serial Printer

This example configures a serial Diablo 1640. The same steps should be followed for any device listed in Table 3.1. If you are configuring a listed device other than a Diablo 1640, follow the example and substitute your device name in the step where the device type is specified.

Before you begin the configuration process, be sure you have the proper cable. You must use a null-modem, RS-232 cable with a suitable DB-25 connector. Check your Zenith distributor for the proper cable.

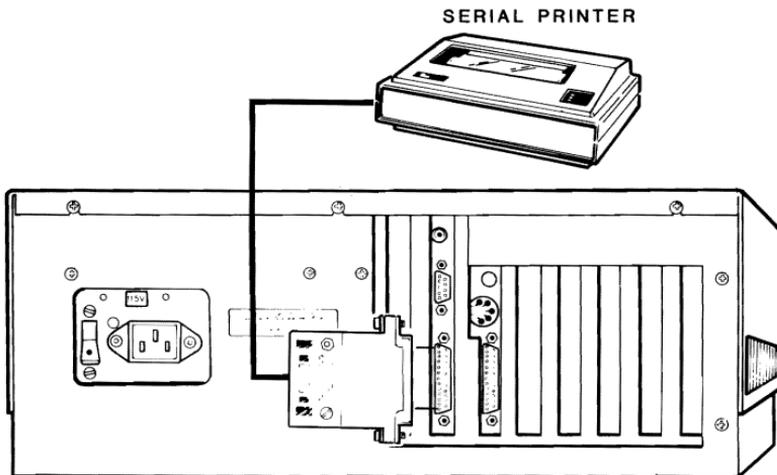


Figure 3.2. Serial Port

This configuration example does three things:

1. It tells your computer system you will be using a serial printer.
2. It tells your computer system which serial printer you will be using.
3. It saves configuration information on your operating system's disk so your computer system will remember the serial printer being used.

Now turn on your computer. If your computer is set for autoboot, it automatically loads (boots) MS-DOS and you see the MS-DOS prompt:

```
A>
```

When you see this prompt, you are ready to begin the configuration process.

If you don't see this prompt, boot the MS-DOS operating system manually. Refer to the Loading MS-DOS section of this chapter for information concerning boot procedures.

Now type:

```
Configur
```

and press the **RETURN** key.

```
CONFIGUR Version 2.00
```

```
Copyright (C) 1984, Zenith Data Systems Inc.
```

```
Use one of the following options to configure a device
```

- A. Configure LPT device
- B. Configure COM device
- C. Exit with no changes

## Operations

---

This screen or a very similar screen (the actual screen depends upon the version of MS-DOS you are using) appears on your monitor. This is the configuration main menu. Look at it closely; you will see it three times in this example.

Remember, configuration accomplishes three things.

1. It tells the system that you are using a serial printer.
2. It tells the system specifically which printer you are using.
3. It stores the configuration information on the operating system disk.

First, you need to tell the computer you will be using a serial printer, and then which specific serial printer you will be using. And finally, you will have the computer save the information.

Press A

The following screen appears:

```
Use one of the following options to select the type of
configuration
```

- A. Map parallel output to serial output
- B. Configure parallel device
- C. Exit

```
Enter selection (A-C):_
```

Now tell the computer that you want to "Map parallel output to serial output." In effect, this tells the computer that you are going to use a serial printer.

Press A

This screen then appears:

Select the parallel port to be mapped.

- A. LPT1
- B. LPT2
- C. LPT3
  
- D. Exit

Enter selection (A-D):

LPT refers to logical devices, which are beyond the scope of this example but are discussed in the MS-DOS manual. In response to this prompt:

Press A

Use one of the following to select a mapping for LPT1

- A. No mapping
- B. Map to COM1

Enter one of the mapping values:

In response to this screen:

Press B

Use one of the following options to select the type of configuration

- A. Map parallel output to serial output
- B. Configure parallel device
  
- C. Exit

## Operations

---

This is the same screen you saw when you began this operation. Since you have already told the computer that you will be using a serial device, you should:

Press **C**

CONFIGUR Version2.00

Copyright (C) 1984, Zenith Data Systems Inc.

Use one of the following options to configure a device

- A. Configure LPT device
- B. Configure COM device

Use one of the following to modify an existing system

- C. Exit program
- D. Make changes to disk
- E. Make changes to memory
- F. Make changes to both disk and memory

Enter selection (A-F):\_

You are now back to the main menu. Notice that it is larger than before. You now have more alternatives. Alternatives D, E, and F all deal with making changes to the computer system and will be explained later.

Since you have just told the computer you are using a serial printer, you now need to tell it specifically which serial printer.

Press **B**

Select the serial port to be configured

- A. COM1
- B. Exit

Press A

This screen appears:

Use one of the following options to select the appropriate configuration

- A. Compatibility mode (2400 baud, DTR and RTS pos.)
- B. MX-80 (4800 baud, DTR pos. (pin 20))
- C. H/Z-25 (4800 baud, RTS pos. (pin 4))
- D. H-14/WH-24 (4800 baud, RTS pos. (pin 4))
- E. Diablo 630/1640 (1200 baud, ETX/ACK)
- F. WH-23/WH-33/WH-43 modem (300 baud, No handshake)
- G. WH-12 Votrax Type-N-Talk (4800 baud, RTS Pos. (pin 4))
- H. User defined
- I. Exit with no changes

Enter selection (A-I):

As this example is for a Diablo 1640:

Press E

The main menu is displayed again.

CONFIGUR Version 2.00

Copyright (C) 1984, Zenith Data Systems Inc.

Use one of the following options to configure a device

- A. Configure LPT device
- B. Configure COM device

Use one of the following to modify an existing system

- C. Exit program
- D. Make changes to disk
- E. Make changes to memory
- F. Make changes to both disk and memory

## Operations

---

Now, because this example saves the configuration to both the disk and memory, take the disk out of the drive to make sure the write protect notch is not covered. Then replace the disk in the drive and:

Press F

Enter drive name with system to modify (A-B):

then appears on your monitor. Because this example uses the disk in the A drive:

Press A

Notice that the red disk access LED glows momentarily and the screen blanks out very briefly. This is configuration's way of saying you are through. Now:

Press C

to leave the configuration program and return to the MS-DOS operating system.

## User-Defined Serial Configuration

Defining a custom serial configuration for a printer, modem, or other device is not difficult, but you must know the communications protocol of the device. Likely sources of information concerning communications protocol include the documentation which comes with the device, the dealer from which the device was purchased, and the device's manufacturer.

There is no one best protocol; but, in order to successfully establish communications, both the computer and the serial device must use the same protocol.

Parameters of the communications protocol which may be adjusted using

**Parity** — A technique used by your computer system to check for communications errors. It may be set to odd parity, even parity, or no parity at all. Parity bits also may be removed on output or input.

**Case** — Some devices utilize only a subset of ASCII characters. A popular subset, ASCII 64, utilizes only uppercase letters. You have the option of mapping lowercase letters to uppercase on input and/or output.

**Baud Rate** — A measure of the speed at which information is transferred between devices. Your personal computer may be set to operate at baud rates of 110, 150, 300, 600, 1200, 2400, 4800, or 9600.

**Stop Bits** — These bits are set to tell the serial device when the data from the computer has ended. The number of stop bits transmitted with each character may be set to 1 or 2.

**Word Length** — Your personal computer may be set to operate with a 7- or 8-bit word (exclusive of stop bits and parity).

**Handshaking** — A method through which the serial device notifies the computer of its status. It can be implemented through software (ETX/ACK, DC1/DC3) or hardware (DTR and RTS positive, RTS negative or positive, DTR negative or positive). Not all serial devices use handshaking.

**Pad Character** — The option to insert pad characters is provided for slower devices which may not be able to react quickly to the signals coming from your computer.

**Timeout Value** — The timeout value is provided for reasons similar to pad characters. The timeout value is a number from 0 to 255 (the higher the number the longer the timeout) that represents the number of cycles that your computer should wait for a device to respond before it stops trying to communicate.

### Example 3.2 Configuring a User-Defined Serial Device

Conceptually, this process is the same as the previous example. The differ-

## Operations

---

Be sure you know the protocol parameters of your serial device before beginning. The separate parameters have been defined in the previous section.

If you have not already done so, turn on your computer system and load (boot) MS-DOS now.

This example begins with the MS-DOS prompt:

```
A>
```

Type:

```
Configur
```

and press the **RETURN** key.

```
CONFIGUR Version 2.00
```

```
Copyright (C) 1984, Zenith Data Systems Inc.
```

Use one of the following options to configure a device

```
A. Configure LPT device
```

```
B. Configure COM device
```

```
C. Exit with no changes
```

```
Enter selection (A-C):_
```

The above screen (or a very similar screen — the exact screen will depend upon which version of MS-DOS you are using) will appear on your monitor. This is the configuration main menu. Look at it closely; you will see it three times before this example is finished.

Remember, configuration accomplishes three things.

1. It tells the system you will be using a serial device.

Following this example, you will first tell the computer you will be using a serial device, and then you will tell it specifically each of the protocol parameters the device uses.

Press A

The following screen appears:

```
Use one of the following options to select the type of
configuration
```

- A. Map parallel output to serial output
- B. Configure parallel device
  
- C. Exit

```
Enter selections (A-C):_
```

You will now tell the computer you want to “Map parallel output to serial output.” In effect, this tells the computer you are going to be using a serial device.

Press A

This screen then appears:

```
Select the parallel port to be mapped
```

- A. LPT1
- B. LPT2
- C. LPT3
  
- D. Exit

```
Enter selection (A-D):
```

LPT refers to logical devices, which are beyond the scope of this example but are discussed in the MS-DOS manual. In response to this prompt:

## Operations

---

Use one of the following to select a mapping for LPT1

- A. No mapping
- B. Map to COM1

Enter one of the mapping values:

In response to this screen:

**Press B**

Use one of the following options to select the type of configuration

- A. Map parallel output to serial output
- B. Configure parallel device
- C. Exit

Enter selection (A-C):\_

This is the same screen you saw when you began this operation. Since you have already told the computer you will be using a serial device, you should:

**Press C**

CONFIGUR Version 2.00

Copyright (C) 1984, Zenith Data Systems Inc.

Use one of the following options to configure a device

- A. Configure LPT device
- B. Configure COM device

Use one of the following to modify an existing system

- C. Exit program

You are now back at the main menu, which has grown. You now have several more alternatives. Alternatives D, E, and F all deal with making changes to the computer system.

Since you have told the computer you are using a serial device, you have to define the protocol parameters of that device.

Of course, if you want to save this configuration, you have to tell the computer system that also. At the end of this example you will save the configuration, but for now:

**Press B**

Select the serial port to be configured

A. COM1

B. Exit

Enter selection (A-B):

**Press A**

This screen now appears:

Use one of the following options to select the appropriate configuration

- A. Compatibility mode (2400 baud, DTR and RTS pos.)
- B. MX-80 (4800 baud, DTR pos. (pin 20))
- C. H/Z-25 (4800 baud, RTS pos. (pin 4))
- D. H-14/WH-24 (4800 baud, RTS pos. (pin 4))
- E. Diablo 630/1640 (1200 baud, ETX/ACK)
- F. WH-23/WH-33/WH-43 modem (300 baud, No handshake)
- G. WH-12 Votrax Type-N-Talk (4800 baud, RTS Pos. (pin 4))
- H. User defined
- I. Exit with no changes

## Operations

---

Press H

A series of questions will appear on your screen:

Answer the following questions with a Y for Yes and a N for No

Strip parity on input? (Y/N) <N>

Strip parity on output? (Y/N) <N>

Map lower case to upper on input? (Y/N) <N>

Map lower case to upper on output? (Y/N) <N>

The selection in the brackets, < >, is called the default selection. This means that if you press RETURN, the computer will enter the response shown in the brackets (reply no).

After answering all of the above questions, the following screen appears:

Select one of the following baud rates

- A. 110
- B. 150
- C. 300
- D. 600
- E. 1200
- F. 2400
- G. 4800
- H. 9600

Enter one of the baud rate values: \_

Enter the letter of the corresponding baud rate here that matches that of your serial device.

The next screen will be:

- A. 1 Stop bits
- B. 2 Stop bits

Again, enter the letter for the value that matches the serial device. The next screen is:

Use one of the following parity selections

- A. No parity
- B. Odd parity
- C. Even parity

Enter one of the parity values: \_

Enter a value that matches your serial device. The next screen is:

Use one of the following to select the word length

Note: Word length is exclusive of stop bits and parity

- A. 7 bit words
- B. 8 bit words

Enter one of the word length values: \_

The word length refers to the size of the data communicated between your microcomputer and a peripheral.

The next screen is a menu which asks what type of handshaking is required by the serial device. The separate types of handshaking have been explained previously. The handshaking menu looks like:

Use the following to select a handshaking protocol

- A. No Handshaking
- B. ETX/ACK
- C. DC1/DC3
- D. Compatibility mode, DTR and RTS Positive
- E. RTS Positive (pin 4)
- F. RTS Negative (pin 4)
- G. DTR Positive (pin 20)
- H. DTR Negative (pin 20)

## Operations

---

If you have requested B, ETX/ACK handshaking, the computer will then ask:

Number of characters between the ETX/ACK handshake (0-255):\_

If you have entered B, D, E, F, G, or H handshake options, the following screen will appear:

If you do not wish a pad character, simply strike the RETURN key, and then enter a zero as the number of pad characters, otherwise type the actual key character you wish to pad

For example, to pad after all carriage returns, type the RETURN key.

Type the key corresponding to your desired pad character:\_

Pad characters were explained earlier. If your serial device needs a pad character, it should be entered now.

If you answer yes, the computer will ask:

Enter the number of pad character to send (0-255):

Enter the number of pad characters required by your serial device.

If you have entered option D, E, F, G, or H, the following request now appears:

The time out value is used to give slow devices time to respond to Input/Output requests. A small value is usually sufficient, but a number 0 to 255 can be entered.

Enter a time out value for COM1:\_

The timeout value is a number from 0 to 255 that represents the number of cycles your computer should wait for a device to respond before it

After you have finished responding to these questions, you will be returned to the main menu.

CONFIGUR Version 2.00

Copyright (C) 1984, Zenith Data Systems Inc.

Use one of the following options to configure a device

- A. Configure LPT device
- B. Configure COM device

Use one of the following to modify an existing system

- C. Exit program
- D. Make changes to disk
- E. Make changes to memory
- F. Make changes to both disk and memory

Enter selection (A-F):\_

Now, because this example saves the configuration to both the disk and memory, take the disk out of the drive to make sure the write protect notch is not covered. Then replace the disk in the drive and:

**Press F**

Enter drive name with system to modify (A-B):

The above message appears on your monitor. Because this example uses the disk in the A drive:

**Press A**

Notice that the red disk access LED glows momentarily and the screen blanks out very briefly. This is configuration's way of saying you are through. Now:

**Press C**

## Operations

---

# Winchester Operation

A Zenith Data System Personal Computer shipped from the factory is set up to boot from a floppy or the Winchester disk. However, the first time you use your system, the Winchester will not be ready to use because it will not yet contain an operating system. It also is possible that it may not have been prepared or partitioned, although this normally will be done before the Winchester drive is shipped from the factory. Use the following procedure to start your system for the first time, or whenever you do not want to boot from your Winchester drive.

- If your computer is set for autoboot and you do not see the operating messages described earlier when you reset or turn on the system, disable the normal power-up sequence by pressing the **ESC** key immediately. Once the screen warms up, it will display the normal opening messages and you will see the prompt. You also will see the power-on indicator light on the front panel.

You may now boot from the floppy disk drive and run the demonstration disk.

To use the demonstration disk, follow these general instructions:

- Make sure your computer is turned on and the prompt is showing. If your system is set for autoboot, remember to press the **ESC** key to disable the power-up sequence if your system tries to access the Winchester disk. If your system does not display the prompt, refer to In Case of Difficulty in Chapter 4.
- Insert the demonstration disk, with the label closest to you and facing up, into the floppy disk drive in your system.
- Close the disk drive door and press the **B** key and then the **F** key. You will see the following on the screen:

bf

- Press the **RETURN** key. The disk access light on the floppy disk

## Winchester Utilities

Four utility programs — PREP, DETECT, PART, and SHIP — are supplied with MS-DOS.

- **PREP** — This utility is supplied to initialize the surface of your Winchester disk should the need ever arise. It also will allow you to check for bad sectors and “lock out” any that are found. In addition, PREP will pre-allocate four partitions (described later), one for immediate use.
- **DETECT** — This utility is supplied to check the surface of your Winchester disk for bad sectors and lock out any that are found. Where PREP destroys the data you have stored on your disk, DETECT does not.
- **PART** — This utility is supplied so you can redefine the partitions of your Winchester disk if those that are preset do not meet your needs.
- **SHIP** — This utility is supplied so you can place the heads in your system over an unused portion of the Winchester disk. *Use this utility whenever you move your personal computer, even a short distance.*

A brief description of each utility follows.

### The PREP Utility

The surface of the Winchester disk must be initialized before you can use it in a system. This is similar to the FORMAT command and procedure discussed earlier, except that typical operating system information (headers, labels, boot code and directories) for a specific system is not written onto the disk. In addition, PREP will test the surface and set up standard partitions. Four are set up — the entire disk is allocated to the first — so it is not necessary to run the PART utility unless you want to use any

## Operations

---

You need to be aware that while PREP does test the surface of the disk for retention of data, it also will destroy any data that you have recorded on the Winchester disk system. If you do not want to destroy the data on your disk, but still want to test the disk for data retention capabilities, you may run the DETECT utility. This utility does not destroy the current data and partitions that are set up on your Winchester disk, but it does test for and flag those sectors that are bad so that they can be locked out later. See The DETECT Utility for a discussion of this process.

### Features of PREP

The PREP utility:

- initializes the surface of your Winchester disk,
- tests the data retention capabilities of your Winchester disk,
- isolates questionable disk sectors,
- divides the surface of the Winchester disk into four partitions, and
- sets up one partition with all the disk space allocated to it.

**CAUTION:** Using PREP will destroy all the files that may exist on your Winchester disk. Winchester disks supplied by Zenith Data Systems normally will be prepared with PREP at the factory. If your disk has been prepared, you will need to use PREP only if you consistently encounter an unreasonable number of disk access errors. Do not use PREP until you have backed up the information on your Winchester disk to floppy disks.

### The DETECT Utility

The DETECT utility enables you to verify the integrity of your Winchester disk. However, the tests performed by the system are not "destructive";

Several things could cause a sector to “go bad” during normal operation of your system. They include subjecting the computer system to a physical shock (most common cause of sector failure), power failure during the middle of a disk operation (unlikely), or electronic component failure (very rare). When a power failure causes a sector to go bad, you may be able to recover the use of that sector by reformatting the partition, just as you would reformat a floppy disk. However, you will want to use the BACKUP utility before you do this. See the discussion on BACKUP and RESTORE found later in this chapter.

When a bad sector is located by the DETECT utility, its location will be stored in memory. At the end of the test, those sectors that are found to be bad are added to the bad sector table that was established by the PREP utility. However, the bad sector(s) located by DETECT will not be “locked out” until you run your MS-DOS FORMAT program and reformat the partition.

One advantage of DETECT is that you can use the utility to check your disk if you suspect that you have one or more bad sectors. If none are found, the system will let you know, and you can continue to use your programs without having to go through the BACKUP and RESTORE processes described later in this chapter.

## **The PART Utility**

The PART utility enables you to change the names, number, and sizes of Winchester disk partitions. It also allows you to specify which partition you want accessed when your computer boots up.

### **Partitions**

Winchester disks distributed by Zenith Data Systems have a very large storage capacity when compared to floppy disks. To make practical use of all this storage space, partitions divide the disk space into more manageable sizes. You can use up to four partitions on your Winchester disk. Each partition will be treated like an individual disk. Therefore, you may

## Operations

---

The first of the four partitions that exists on your Winchester disk as shipped from the factory occupies the total available Winchester disk space. It has been assigned a distinct name: DOS. This can represent any of the popular operating systems that are sold by ZDS for the Z-100 PC Series. Therefore, you do not need to run PART before you can use your Winchester disk. If the one partition will meet your needs, then proceed to Installing Operating Systems in this chapter. Note that there is no requirement that you use MS-DOS on this partition, in spite of the name given to it.

**CAUTION:** If you make any changes to the number or size of the partitions on your Winchester disk with either PART or PREP, you may destroy existing data on the disk. Therefore, if you have previously used the drive for data storage, you should back up all necessary files from each partition before using the PART program.

### Features of PART

The PART utility establishes and/or changes:

- the name of each partition,
- the name of the operating system to be used with each partition,
- the amount of disk space allocated to each partition, and
- the name of the partition that is selected when you boot your computer system.

### The SHIP Utility

The SHIP utility is provided so that you may place the heads of your Winchester system over a nonvital area of the disk. Then if the system is accidentally jarred during movement, damage will be limited to an area that is not used by your computer. The floating head design of Winchester drives makes them very sensitive to physical shocks, which can damage

## Installing Operating Systems

The operating system currently available for the Z-100 PC Series from Zenith Data Systems is MS-DOS. This section explains how to install MS-DOS on your Winchester and prepare it so that you may boot directly from the Winchester disk.

For the moment, assume that you are going to use the Winchester disk as it is shipped from the factory. There are four partitions: one called DOS and three unallocated. First, you will use PART to establish the default boot partition for the operating system. Then you will install MS-DOS.

### Establishing the Default Boot Partition

- Use your MS-DOS disk and run PART as described in your MS-DOS manual.
- Press the **F1** key to establish the default boot partition.
- Press the **1** key to select DOS (for the MS-DOS operating system) as the default system to be used when booting from the Winchester disk.
- Press the **E** key to quit PART, and press the **M** to make the changes and exit to the operating system.

**NOTE:** Before you attempt to install any operating system on your Winchester disk system, you must reset and reboot your system using the operating system you wish to install. If you wish to install MS-DOS, you will have to boot your system with MS-DOS Distribution Disk I.

- Turn on your computer (if it is not already on), place your MS-DOS Distribution Disk I in the floppy disk drive, and close the door.
- If your computer is not set up to boot from the floppy disk, press the **ESC** key to stop any autoboot process. Then press the **B** key

## Operations

---

In a moment, the MS-DOS initial messages will appear and you will be asked to enter the date and time. Enter them. The MS-DOS prompt will appear.

- Type:

```
FORMAT C: /S/V
```

- Press the **RETURN** key. The C represents the first MS-DOS Winchester partition (under MS-DOS, drives A and B are assigned to the built-in floppy disk, and drives C through F are assigned to the four Winchester partitions). The /V switch will locate any bad sectors and lock them out of the system. The /S switch will establish the operating system on the disk. You will see:

```
FORMAT version 2.00
```

```
Copyright(C) 1984, Zenith Data Systems Corporation
```

```
Will format partition assigned drive C:
```

```
Press RETURN when ready._
```

- Press the **RETURN** key. You will see the Winchester disk access light come on while the disk is being formatted. When it has completed the operation, you will have created a minimum operating system on the Winchester disk. A message will be displayed informing you of the total number of bytes on the partition, the number of bytes used by the system, and the number of free bytes for your files. If any sectors were locked out, that information also will be displayed.
- Type:

```
COPY A: *.* C:
```

The C: in the command represents the first Winchester drive partition.

## Booting from the Winchester

**NOTE:** This boot procedure assumes that you have assigned the DOS partition as the default boot partition. If you have not assigned any partition as the default boot partition, read the section entitled *Booting from the Winchester — No Default Boot Partition*.

At this point, you may boot your computer from the Winchester disk. Use the same procedure to boot your computer as you would if you were using a floppy disk. The only difference is that the Winchester cannot be removed from the system; it is ready to go when you turn on or reset your computer.

If your computer is not set up to boot from the Winchester disk, you will have to press the **ESC** key to stop any autoboot process (from the floppy disk), and then press the **B** key and then the **W** key, followed by the **RETURN** key. The Winchester disk access light will come on, along with the MS-DOS opening messages. You have booted your system from the Winchester. You may now use any MS-DOS program or utility you want.

## Booting from the Winchester — No Default Boot Partition

If you attempt to boot from your Winchester disk when no default partition has been established, an error condition will be created and you will see on your screen:

```
Not a bootable partition
```

If you have selected a partition that has not been formatted, the prompt will reappear on your screen. You may attempt to boot the system as previously described.

If you have selected a partition that has been formatted, but does not contain an operating system, the operation of your personal computer

## Operations

---

### Other Operating Systems

Zenith Data Systems may release additional operating systems for use with your Winchester drive. Documentation will be included with those systems telling you how to install them on your Winchester drive.

### Backing Up the Winchester Disk

Because it is possible to store the equivalent of several dozen floppy disks on the Winchester disk, two commands, BACKUP and RESTORE, have been added to the MS-DOS operating system to aid you in backing up your Winchester MS-DOS partitions. You may elect to copy only certain files, files updated recently, or the entire partition. The basic operation of BACKUP is to create a directory of the specified files and then copy them to a single file. The single file actually may be several files that each contain a sequentially numbered extension such as BACKFILE.000, BACKFILE.001, and so on. The system backs up your files end-to-end to save floppy disk space.

The operation is further enhanced by providing an automatic FORMAT procedure for the floppy disks, protection against unwanted overwriting of existing files on the Winchester, verification, and so on. For complete details of the features and operation of BACKUP and RESTORE, refer to your software documentation.

To back up the entire MS-DOS partition, use the following instructions:

- Have a good supply of 5.25-inch floppy disks on hand that may be used for backups.
- Boot the Winchester system and at the MS-DOS prompt, type:

```
BACKUP C:*.* A:BACK1 /F/V
```

The C designates the first Winchester disk MS-DOS partition. If you want to back up a different partition, replace the C with D (or the appropriate letter representing the third or fourth partition). The wild card symbols \*. \* indicate "copy all files," and the A:BACK1 is the single file name mentioned earlier. The /F switch is used to automatically format the floppy disks. The /V switch is used to verify that the copy is valid, and is identical to the original.

The system will prompt you to put the floppy disks into the disk drives as needed. When the process is finished, the MS-DOS prompt will reappear.

Restoration of the original files to the Winchester disk is also either somewhat selective or automatic. Again, you will find full details in your MS-DOS documentation.

- To restore the single file to the Winchester drive from your master backup floppy disks, type:

```
RESTORE A:BACK1 C:*. * /O/V
```

Use the drive names as described in the BACKUP operation. The /O switch will automatically overwrite existing Winchester disk files with floppy disk files of the same name. The system will prompt you to place the floppy disks into the drives as needed. When the operation is complete, the MS-DOS prompt will reappear.

## Chapter 4

# General Service

This chapter contains general service information for your Zenith Data Systems Personal Computer. Information is included about diagnostic programs that check for errors in your computer hardware.

This chapter also contains information about how to remove the cover of your computer and install or replace any of the separate cards that constitute your computer system.

## Initial Diagnostics

Your personal computer performs a series of self-tests whenever it is turned on. The computer beeps if it encounters any hardware failures during these tests.

Should the computer fail any of the tests, it attempts to display an error message. Possible error messages, along with their likely causes, are listed in Table 4.1.

**Table 4.1. Possible Power-Up Diagnostic Messages and Explanations**

---

```
+++ERROR: CPU failure! +++  
+++ERROR: ROM checksum failure! +++
```

If either of the above two messages appear, the CPU/memory card is not functioning properly.

## General Service

---

**Table 4.1(continued). Possible Power-Up Diagnostic Messages and Explanations**

---

+++ERROR: RAM failure! Address: XXX:YYYY, Bit: N, Chip: UXXX +++  
+++ERROR: Parity hardware failure! Address XXX:YYYY, Bit:N, Chip:UXXX +++  
+++ERROR: Parity failure! Address: XXX:YYY, Chip: UXXX +++

These messages indicate that the CPU is unable to read or write to the RAM or video RAM memory.

---

+++ERROR: Timer interrupt failure! +++

If this error occurs, the interrupt control and/or timer logic on the CPU card may have failed. If cards have been added to the computer, make sure they have been set up correctly.

---

+++ERROR: Invalid/No keyboard code received! +++

Normally, the keyboard processor in your computer returns a special code at powerup to indicate that it is functioning properly. This problem is normally caused by the keyboard not being plugged in.

---

+++DISK ERROR: Drive not ready! +++  
+++DISK ERROR: Seek failure! +++

These errors are usually caused when the system attempts to boot the operating system from a disk, and no disk has been inserted into the disk drive. Be sure there is a disk in the drive, which is inserted correctly, and the drive latch is closed properly.

**Table 4.1(continued). Possible Power-Up Diagnostic Messages and Explanations**

---

+++DISK ERROR: Bad disk controller! +++  
+++DISK ERROR: DMA overrun error! +++

These errors usually indicate a faulty disk controller card, but may be caused by other cards in the personal computer (such as serial/parallel input/output cards or game cards). Remove them and run the tests again. If the problem no longer occurs, replace the cards one at a time; then run the test after each card has been inserted. When the system no longer functions, the card just placed in the system is likely to be defective.

---

+++DISK ERROR: Sector not found! +++  
+++DISK ERROR: CRC error! +++  
+++DISK ERROR: Invalid address mark detected! +++

These errors happen when booting the operating system from disk. They can result from using a disk that does not have a copy of the operating system on it, or from a faulty disk drive. Most often, this condition can be corrected by using another disk. If these errors occur often, it may be necessary to have a technician align your drives and/or adjust the disk controller card.

---

Whenever any of these error messages is displayed, be sure to write it down in full. Your service technician will need this information.

If the short suggestions listed in Table 4.1 do not correct the situation, turn to the Troubleshooting Table or the In Case of Difficulty section of this chapter for further information.

## Manual Diagnostics

In addition to the tests that run automatically when your computer is turned on, there are diagnostic tests that can be run from the keyboard.

The testing sequence is begun by typing TEST while the monitor prompt (->) is showing on the screen. This results in the following display:

CHOOSE ONE OF THE FOLLOWING

1. DISK READ TEST
2. KEYBOARD TEST
3. MEMORY TEST
4. POWERUP TEST
5. EXIT

ENTER YOUR CHOICE:

To run any of the tests, press the corresponding number key. Once any of the tests start, with the exception of the keyboard tests, it will run until it locates an error or you stop it. The keyboard test operates on a key-by-key basis.

Before beginning each test, the computer will display a screen similar to:

SAMPLE TEST

TEST COUNT = 1

TYPE <ESC> TO ABORT

## Disk Read Test

The disk read test is used to troubleshoot problems in the disk drive used to load (boot) the operating system. When this test is selected, a system disk must be in drive A. Do not use a distribution disk for this test.

Place a bootable system disk (that is, a disk with an operating system on it) in drive A and press the **1** key. The disk drive will turn on, the red disk access LED will glow, and the boot tracks will be read continuously.

Each time the initial code is read from the boot tracks, a counter will be incremented. If an error is detected:

DEVICE ERROR

will be displayed.

## Keyboard Test

The keyboard test is easy; press any printing (non-escape) key and a screen full of the respective character will be displayed. The character code of the key will be displayed in the upper right-hand portion of the screen.

## Memory Test

This memory test is more extensive than the initial power-on memory test. It can display the same set of error messages as the power-up diagnostics.

While the video RAM is being tested, patterns will appear on the screen.

## Power-Up Test

The power-up test is provided as a means to continuously run the initial tests. A message:

```
TEST COUNT = 001
```

will be displayed in the center of the screen. The number will increment by one each time the test is successfully passed.

Any error messages generated will be the same as those in the Initial Diagnostics section.

## Stopping the Diagnostic Tests

To stop any of the tests, press the **ESC** key. If you are running the keyboard test, pressing **ESC** also returns you to the diagnostic menu as seen in the Manual Diagnostics section.

To return to the menu from any test other than the keyboard test, you must first stop the test and then press **ESC** again.

## LED Diagnostic Indicators

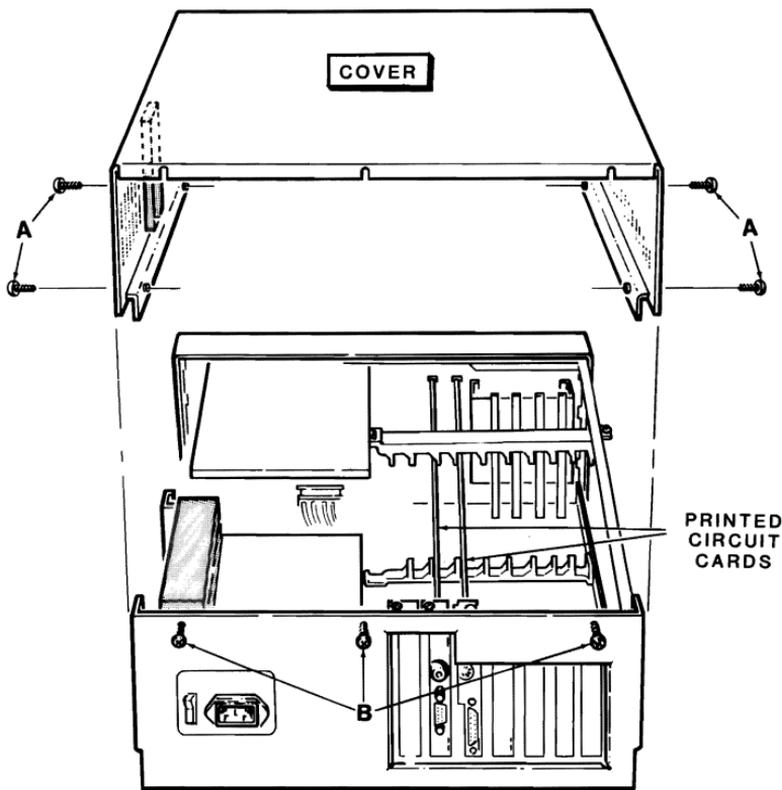
Your Zenith Data Systems Personal Computer is a reliable machine that will not need much service. However, as with all computers, there is the possibility of a major hardware failure which would prevent the screen display of diagnostic messages.

Because of this, built into your personal computer are two sets of LEDs which report diagnostics independent of the screen display. The diagnostic LEDs are located on the CPU/memory card and on the backplane board.

## Cover Removal

See Figure 4.1. To remove the cover of your desktop computer:

1. Remove the power cord from the rear of the computer (be sure that the cord is unplugged, and that the computer is turned off).
2. Remove and retain the screws at location A.
3. Remove and retain the screws at location B.
4. Lift up and remove the cover; lift from the front in an upward rolling motion. Set the cover to one side.





Viewed from the front, the five green backplane LEDs are at the right rear of the backplane. See Figure 4.3.

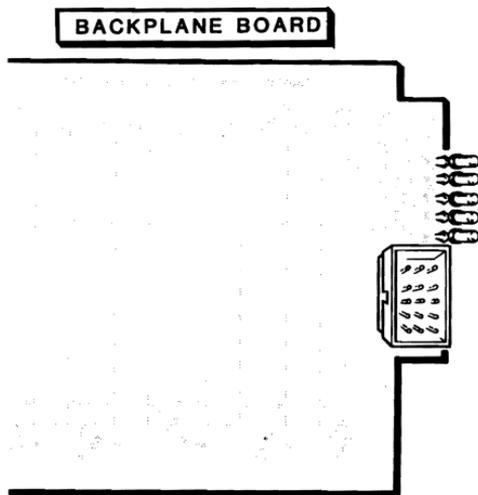


Figure 4.3 Backplane LEDs

## The LED Displays

Check to make sure that your machine is still turned off. Reconnect the power cord to the computer and plug it in. *Be careful once the machine is powered.*

Turn the machine on while observing the LEDs.

All of the LEDs on both the CPU/memory card and backplane board should light when the computer is first turned on.

The LEDs on the backplane board should remain lit whenever the computer is turned on. If any of the LEDs are not lit, call your nearest Zenith Data Systems service technician.

As the diagnostic tests are successfully completed, the CPU/memory card

## General Service

---

Because only one LED is extinguished at a time, in the event of a major hardware failure several LEDs may remain lit. The LED remaining lit nearest to the front of the machine will be the one indicating the source of failure, according to Table 4.2.

**Table 4.2. LED Diagnostic Functions**

---

LED NUMBER	FUNCTION	DIAGNOSIS
LED 1	CPU	The central processing unit.
LED 2	ROM	The program ROM in the computer is invalid.
LED 3	RAM	The random access memory is not storing information correctly.
LED 4	INT	The system clock timer, interrupts, or keyboard, is malfunctioning.
LED 5	DSK	The disk controller is not responding correctly.
LED 6	RDY	This light remains lit until an operating system is read in from the disk.

---

## Cover Replacement

Before replacing the cover, be sure that the computer is turned off and that the power cord is disconnected. Double check to make sure that all internal components are in place.

1. Fit the rear of the cover first. Make sure that the grooves along the lower part of the case are aligned properly.
2. Replace the cover and reattach the screws as shown in Figure 4.1.

## Card Removal

Before any cards may be removed, the cover must be taken off by following the previous directions. Be sure that the power cord is disconnected. With the cover removed, your computer will look similar to Figures 4.1.

Before going any further, be sure to have a level place to put the card once it is removed. Disconnect any cables that may be attached to the card. Double check to make sure you are removing the proper card.

1. Loosen and remove the locking screw at the rear of the case. Be careful not to drop the screw inside the case. Once the screw has been removed, place it in a secure area.
2. Firmly grasp the card to be removed with one hand toward the front and the other about midway down the card. Lift the card directly up firmly. Do not jerk the card. The card will release from the edge connector. You will be able to feel it releasing.

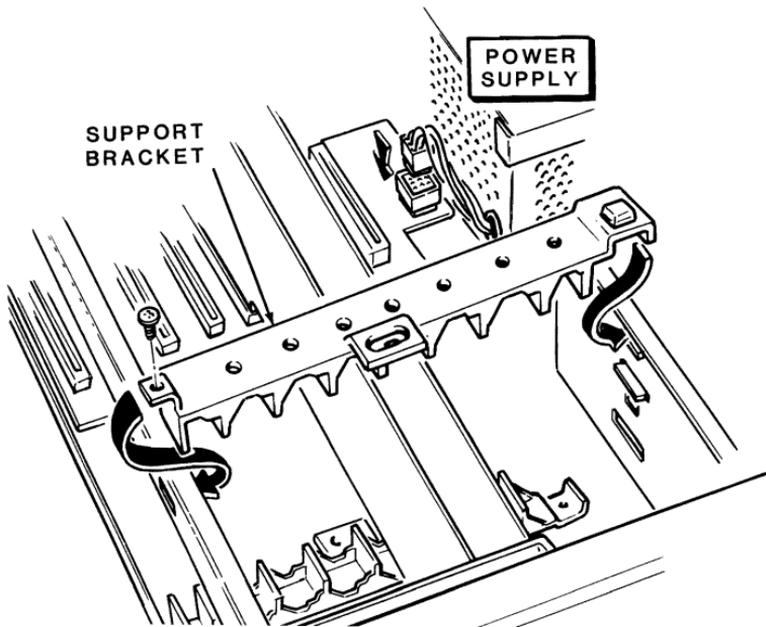
**NOTE:** If your computer includes a catch at the top of the card guide, the catch must be pulled to the side to allow the removal of the card.

3. Place the card down on a nonconducting surface with the components facing up.

## Card Replacement

See Figure 4.4. The following information may be used to install new cards as well as to replace an existing card.

1. Grasp the card and position it over the backplane. Notice the grooves at the end of the box. Be sure that the edge of the card aligns with the groove.
2. Make sure that the edge connector faces down and is aligned properly. Slowly and firmly slide the card into the edge connector.
3. Reattach the locking screw. If necessary, reattach any cables.
4. Replace the cover and screws, as detailed in Cover Replacement.
5. Reattach the power cord.



## In Case of Difficulty

All Zenith Data Systems (ZDS) computer hardware and software products are designed to work together as a complete system. Proper operation can be assured 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 repair facility to arrange for service. **Do not** attempt to service this computer 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 or authorized 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.

For the location of the nearest Zenith Data Systems dealer or repair facility, refer to the Zenith Service Center Listing which you received with your computer.

## Troubleshooting

The list below provides troubleshooting information for common problems.

### CONDITION

System won't boot automatically.

### POSSIBLE CAUSES

1. Wrong disk (you must use a system disk).

## General Service

---

### CONDITION

System won't boot from monitor ROM's opening messages.

### POSSIBLE CAUSES

1. Haven't pressed the RETURN key.
2. Wrong disk (you are trying to boot from an unformatted disk or data disk).
3. Disk inserted wrong.
4. Disk drive latch not closed.
5. Pressed wrong key.

### CONDITION

Nothing happens at poweron, and the green light on the front panel is not lit.

### POSSIBLE CAUSES

1. Line cord not plugged in (check both ends). If you are using a multiple outlet box, check its plug.
2. Power not on at AC power source (wall outlet). Check with a different appliance.
3. Power switch not on (either the CPU or the multiple outlet box).
4. Line select switch incorrect for your area.
5. Cable attaching light and speaker not attached to CPU/memory card.

**CONDITION**

System resets to power-on point or disk keeps rebooting

**POSSIBLE CAUSES**

1. Loose line cord.
2. Bad disk.

**CONDITION**

Error message displayed right after poweron.

**POSSIBLE CAUSE**

See the diagnostics discussion.

**CONDITION**

No video (blank screen) on the monitor.

**POSSIBLE CAUSES**

1. External monitor not turned on.
2. External monitor not plugged in.
3. External monitor not properly connected to computer.
4. Brightness control turned down.
5. Computer not transmitting a signal (screen was blanked or cleared by a program). NOTE: This will not be the case when you first turn on the unit or the computer is waiting for you to do something.

## General Service

---

### CONDITION

Insufficient brightness.

### POSSIBLE CAUSE

Brightness control turned down.

## Service Information

In the extreme case where you are unable to resolve a difficulty, you may want to contact your Zenith Data Systems dealer or authorized repair facility.

The personal computer has built-in diagnostic routines that may assist the service representative in correcting any difficulties. Refer to the diagnostics sections of this chapter.

## When You Call for Help

When you call for service, list the following information about your computer. It will help your dealer to diagnose and repair your unit.

1. The problem you are having. If you ran the diagnostics, supply the tests you ran and the messages, if any, that were displayed.
2. The name, model number, and series number of your computer.
3. System configuration, including any peripherals being used.
4. Any additional information that will help describe your system and

## Chapter 5

# Software Summaries

This section of your Operations Manual contains the summaries of the Operating System, MS-DOS Version 2, along with code sequences for your Z-100 PC Series Computer.

### Booting the System Manually

**B**[*disk type*][*disk unit #*][:*part*]

<b>B</b>	Monitor command for Boot.
<i>disk type</i>	F: Floppy; W: Winchester.
<i>disk unit #</i>	Hardware unit number (0 – 7).
<i>part</i>	Winchester partition number (1 – 4).

## MS-DOS Command Summary

The following is a summary of the control functions and commands that are available while you are using MS-DOS Version 2.

### Control Functions

#### Template Editing

KEY PRESSED

EVENT

F1

Copy one character.

F2 $n$

Copy  $n$  characters.

F3

Copy all characters in buffer

## Software Summaries

---

### Control Keys

<u>KEY PRESSED</u>	<u>EVENT</u>
ALT-BREAK	Empty keyboard buffer.
BACK SPACE	Backspace and delete character.
CTRL-ALT-DEL	Reset system.
CTRL-ALT-INS	Exit to monitor prompt, no system reset.
CTRL-BREAK	Exit current function immediately.
CTRL-C	Exit current function after execution of preceding entries.
CTRL-H	Backspace and delete character.
CTRL-I	Move cursor to next tab column.
CTRL-J	Insert a physical end-of-line and extend the current logical line beyond the physical limits of the display line.
CTRL-N	Cancel printer echo.
CTRL-NUM LCK	Suspend all operation. Press any key to continue.
CTRL-PRT SC	Echo all display output to printer.
CTRL-RETURN	Insert a physical end-of-line and extend the current logical line beyond the physical limits of the display line.
CTRL-S	Suspend all operation. Press any key to continue.
CTRL-X	Cancel current line.
SHIFT-PRT SC	Dump current screen display to printer.
RETURN	Execute current line.
TAB	Move cursor to next tab column.

### Syntax Notation

<u>FORM OR SYMBOL</u>	<u>DEFINITION</u>
CAPITALS	Required entry; enter the information exactly as shown.
CURTALS	Names of keys; press the key(s) indicated

<u>FORM OR SYMBOL</u>	<u>DEFINITION</u>
<i>filespec</i>	File specification: [ <i>d:</i> ][ <i>path</i> ][ <i>filename</i> ][ <i>.ext</i> ].
<i>.ext</i>	File extension.
<i>command</i>	MS-DOS command.
<i>unit</i>	Winchester hardware unit number.
<i>partition</i>	Winchester partition number.
<i>keyword</i>	Alphanumeric combination of characters.
<i>dev</i>	Any valid I/O device.
" <i>string</i> "	A string of characters (used in search/compare commands).
<i>/switch</i>	Switch parameters.
<i>comment</i>	Comments to be displayed on screen.
[ ]	Optional entry.
...	Repeated entry.

## Device Names

<u>FORM OR SYMBOL</u>	<u>DEFINITION</u>
CON	Console (keyboard and screen).
PRN	Parallel printer #1.
LPT1	Parallel printer #1.
LPT2	Parallel printer #2.
LPT3	Parallel printer #3.
AUX	Serial port #1.
COM1	Serial port #1.
COM2	Serial port #2.
CLOCK\$	Clock (on board).

## Direction Characters

<u>FORM OR SYMBOL</u>	<u>DEFINITION</u>
>	Send to specified file.
>>	Append output to specified file.

## Software Summaries

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**NOTE:** *External utilities* are external to the operating system and require specific disk files on the default or specified drive. *Internal commands* are part of the memory-resident operating system and do not require specific disk files to be present.

### Command Summary

**APPLY** [-] [d:] [path] filename "command"

**APPLY** "command" [-] [d:] [path] filename

External utility. Executes an MS-DOS command and substitutes parameters according to material contained in the file specified.

**ASSIGN** [?] [unit:] [unit:partition d:]

External utility. Assigns a Winchester drive and partition to a drive name.

**BACKUP** [?][[filespec[+filespec...]] [d:][filename][/switch...]]

External utility. Creates a single backup file on one or more disks for one or more files.

Switches:	/A[:date]	Back up files after <i>date</i> .
	/B[:date]	Back up files before <i>date</i> .
	/D	Provide directory of master backup files.
	/E	Back up all but exception files.
	/F	Format destination disks without prompt.
	/G	Global; back up subdirectories as well.
	/L	List internal backup file directory.
	/N	No formatting of destination disks.
	/Q	Query each source file.
	/R	List files to be backed up.
	/T	Back up files with today's date only.
	/V	Verify; read after write.
	/W	Back up files that have changed since last backup.

**BREAK** [ON | OFF]

Internal command. Turns on (or off) immediate response to CTRL-C or CTRL-BREAK key operations. If off, response is only during normal MS-DOS I/O operations. Turn off feature when running programs that make use of either CTRL-C or CTRL-BREAK.

**CD** [d:]*[path]*

**CHDIR** [d:]*[path]*

Internal command. Changes current directory to another directory *path*.

**CHKDSK** [d:]*[filename]* [/switch]

External utility. Scans the directory of the default or designated drive and returns a report on the status and consistency of the disk.

Switches:

/F	Fix correctable errors reported by CHKDSK.
/V	Display messages/directory during execution of command.

**CIPHER** *keyword* >*filespec*

**CIPHER** *keyword* <*filespec*

**CIPHER** *keyword* <*filespec* >*filespec2*

External utility. Encodes (encrypt) or decodes (decrypt) files for security purposes.

**CLS**

Internal command. Clears the screen.

**COMMAND** [d:]*[path]* [*iodev*] [/switch]

External utility. Loads and executes the command processor COMMAND.COM.

Switches:

/D	Do not prompt for date and time.
/P	Make COMMAND.COM permanent in memory.
/C <i>string</i>	Execute the <i>string</i> then exit.

**CONFIGUR**

External utility. Configures system I/O protocol for printers, communications, and other peripheral

Software Summaries

---

**COPY** [*d:*][*path*][*filespec*] [*d:*][*path*][*filespec*] [/switch]

Internal command. Copies file(s) specified.

Switch:            /v            Verify, read after write.

**CTTY** *dev*

Internal command. Assigns I/O device; default is console. Device routing is dependent upon user-defined configuration under CONFIGUR.

Devices:          AUX  
                  COM1  
                  COM2  
                  CON

**DATE** [*mm-dd-yy*]

Internal command. Display and/or change date.

**DEBUG** *filespec* [*parameters*]

External utility. MS-DOS debugger.

Functions:	A[ <i>addr</i> ]	Assemble.
	C <i>range</i> <i>addr</i>	Compare.
	D[ <i>addr</i> ][ <i>Lval</i> ]	Dump.
	D[ <i>range</i> ]	Dump.
	E <i>addr</i> [ <i>list</i> ]	Enter.
	F <i>range</i> <i>list</i>	Fill.
	G[ = <i>addr1</i> ] [ <i>addr2</i> ...	Go.
	H <i>addr1</i> <i>addr2</i>	Hex.
	I <i>val</i>	Input.
	L[ <i>addr</i> [ <i>drive</i> <i>rec</i> <i>rec</i> ]]	Load.
	M <i>range</i> <i>addr</i>	Move.
	N <i>filespec</i> [ <i>filespec</i> ... ]	Name.
	O <i>val</i> <i>byte</i>	Output.
	Q	Quit.
	R[ <i>reg</i> ]	Register.
	S <i>range</i> <i>list</i>	Search.
	T[ = <i>addr</i> ] [ <i>val</i> ]	Trace.
	U[ <i>addr</i> ][ <i>L val</i> ]	Disassemble.
	U[ <i>range</i> ]	Disassemble.
	W[ <i>addr</i> [ <i>drive</i> <i>rec</i> <i>rec</i> ]]	Write.

**DETECT**

External utility. Isolate bad sectors on Winchester disk system. Alters MS-DOS operating system and may destroy data on the Winchester disk system.

**DIR** [*d:*] [*path*] [*filespec*] [*/switch*]

Internal command. List requested directory entries.

Switches:        /*P*            Page mode.  
                  /*W*            Wide display mode.

**DISKCOMP** [*filespec1*] [*filespec2*]

External utility. Compare the data of two identical disks.

**DISKCOPY** [*filespec1*] [*filespec2*] [*/switch*]

External utility. Duplicate a disk.

Switches:        /*V*            Verify; read after write.

**ECHO** [*ON*] [*OFF*] [*message*]

Internal command. Control echo feature of batch processor.

**EDLIN** *filespec*

External utility. MS-DOS line editor.

Commands:	<i>nA</i>	Append <i>n</i> lines.
	[ <i>ln1</i> ] [, <i>ln2</i> ]D	Delete line(s).
	<i>ln</i>	Edit line <i>n</i> .
	E	Exit EDLIN.
	<i>lnI</i>	Insert line <i>ln</i> .
	[ <i>ln1</i> ] [, <i>ln2</i> ]L	List line(s).
	Q	Quit EDLIN.
	[ <i>ln1</i> ] [, <i>ln2</i> ] [?]R( <i>string1</i> )F6( <i>string2</i> )	Search and replace text.
	[ <i>ln1</i> ] [, <i>ln2</i> ] [?]S( <i>string</i> )	Search text.
	[ <i>n</i> ]W	Write <i>n</i> lines.
Editing:	F1    or →	Copy one character.
	F2 <i>n</i>	Copy <i>n</i> characters.
	F3	Copy all characters.
	DEL	Skip one character.
	F4 <i>n</i>	Skip <i>n</i> characters.

## Software Summaries

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### EXIT

Internal command. Exit COMMAND.COM.

### FC *filespec1 filespec2* [/switch]

External utility. Compare the data of two files.

Switches:     /B           Binary compare.  
              /C           Ignore upper- and lowercase differences.  
              /W           Compress tabs and spaces during  
                              compare.

### FIND "*string*" [*filespec...*] [/switch]

External utility. Search for string in specified file(s).

Switches:     /C           Count matches.  
              /I           Ignore upper- and lowercase differences.  
              /N           Number of lines before find to display.  
              /V           Display lines that do not contain string.

### FOR %*variable* IN *set* DO *command*

Internal command. Branch command for batch processor.

### FORMAT [*d:*] [/switch]

External utility. Format a disk to receive MS-DOS files (9 sectors/track).

Switches:     /C           Clear directory only; do not format.  
              /M           Single-sided format only.  
              /N           Suppress operator prompts.  
              /S           Include system files; make disk bootable.  
              /V           Verify; read after write; lock out bad sectors.  
              /8           Format 8 sectors/track.

### GOTO *label*

Internal command. Jump command for batch processor.

### IF [ NOT ] *condition command*

Internal command. Conditional branch for batch processor.

**LIB** [*command*,] [*listing*] [*@filename*]

External utility. MS-DOS macro library manager.

Commands: + Append object file to library.  
 - Delete module from library.  
 \* Extract a module; place in object file.  
 ; Use defaults to remaining prompts.  
 & Extend current logical line; repeat prompt.  
 CTRL-BREAK Exit library session.

**LINK** [*Objfile*,*Runfile*,*Listfile*,*Liblist*[/*switch*]] [*@filespec*]

External utility. MS-DOS linking loader.

Switches: /DSALLOCATE Load data at high end of data segment.  
 /HIGH Place runfile in high memory.  
 /LINENUMBER Include line numbers in list file.  
 /MAP List global symbols and definitions.  
 /PAUSE Halt session; press RETURN to continue.  
 /STACK: *n* Set stack size to *n*.

Commands: + Separate entries/extend current logical line.  
 ; Use defaults to remaining prompts.  
 CTRL-BREAK Exit linker session.

**MKDIR** [*d:*] *path*

**MD** [*d:*] *path*

Internal command. Create new directory path and directory.

**MORE** <*filespec*

*command filespec* | **MORE**

External utility. Display contents of file or result of command one screen at a time.

**PART**

External utility. Partition Winchester disk. Alters operating system and may destroy data on Winchester disk system.

Software Summaries

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**PAUSE** [*comment*]

Internal command. Temporarily suspend execution of batch file. *Comment* can be any text material.

**PREP**

External utility. Initialize Winchester disk system. Alters operating system and destroys all data on Winchester disk system.

**PRINT** [*filespec*[/*switch*] [*filespec*[/*switch*]]...

External utility. Print the contents of an ASCII file on a printer.

Switches:

/A	Do not print file(s) from /A to /S switches.
/C <i>n</i>	Print <i>n</i> copies.
/F	Issue form feed (top of page) at end of file.
/L <i>n</i>	Set left margin at <i>n</i> .
/P <i>n</i>	Set page length to <i>n</i> lines.
/R <i>n</i>	Set right margin at <i>n</i> .
/S	Add file(s) to print queue from /S to /A switches.
/T	Terminate printing; empty print queue.

**PROMPT** [*comment*]

Internal command. Change the MS-DOS prompt and/or material.

Comments:

\$	Specifies parameter or delimiter to follow.
t	Current time.
d	Current date.
p	Current directory path name.
v	Current MS-DOS version number.
n	Designate default drive.
g	Specify > character.
l	Specify < character.
b	Specify   character.
—	New line.
s	Leading space.
h	Backspace.
e	Escape code (01BH).

**PSCname**

External utility. Load printer drive into memory for print screen command.

Names:	<b>IDS</b>	IDS prism printers.
	<b>MPI</b>	MPI printers.
	<b>MX80</b>	Epson printers.
	<b>OKI</b>	Okidata printers.
	<b>P920</b>	Printek 920 printer.
	<b>TS315</b>	TranStar 315 color printer.

**RDCPM** [?] [DIR *d*: [*filespec*] [/switch]] [[*d*:] *filespec1* [*d*:] [*filespec2*] [/switch]]

External utility. Copy file(s) from CP/M formatted disk.

Switch:	<b>/Z</b>	Read Zenith Data Systems CP/M formatted disk.
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**RECOVER** [*d*:] *filespec*

External utility. Recover file(s) specified on damaged disks.

**REM** [*comment*]

[. [*comment*]

Internal command. Displays a comment in a batch file.

**REN** *filespec1 filespec2*

**RENAME** *filespec1 filespec2*

Internal command. Rename first file as second file.

**RESTORE** [?] [[*d*:] *filename* [*filespec* [+*filespec*...]]] [/switch]]

External utility. Restores one or more files from single backup file.

Switches:	<b>/A[: <i>date</i>]</b>	Restore files after <i>date</i> .
	<b>/B[: <i>date</i>]</b>	Restore files before <i>date</i> .
	<b>/D</b>	Provide directory of master backup files.
	<b>/E</b>	Restore all but exception files.
	<b>/F</b>	Restore all files.
	<b>/L</b>	List internal backup file directory.
	<b>/M: <i>d</i></b>	Restore files to drive <i>d</i> .
	<b>/O</b>	Overwrite existing file(s) with same name.
	<b>/Q</b>	Query each file before restoring.
	<b>/R</b>	List files to be restored.

Software Summaries

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**RMDIR** [*d:*]*path***RD** [*d:*]*path*

Internal command. Remove a directory path (must be empty).

**SEARCH** [*filespec*] [/switch]

External utility. Locate file(s) on a disk and list directory structure.

Switches:	/C	Do not search subdirectories.
	/D	List names of directories being searched.
	/T	Display directory structure.

**SET** [*string*=*string*]

Internal command. Set, change, or clear value in system environment.

**SHIFT**

Internal command. Shift batch parameters one position.

**SHIP**

External utility. Move Winchester read/write heads to shipping position.

**SORT** [/switch] [<]*filespec* [>]*filespec**command* | **SORT** [/switch]

External utility. Sorts material specified in ascending order.

Switches:	/R	Sort in descending order.
	/+ <i>n</i>	Sort material, based on column <i>n</i> .

**SYS** *d:*

External utility. Transfer the MS-DOS system to designated drive.

**TIME** [*h[:m[:s[:c]]]*]

Internal command. Display and/or change time.

**TYPE** [*d:*] [*path*]*filename*

Internal command. Display contents of specified file.

**VER**

Internal command. Display current version number of system files.

**VERIFY** [ON] [OFF]

## MS-DOS for Single-Drive Systems

If your system has only one disk drive, you can use all the instructions in MS-DOS for two-drive systems. Please keep in mind that your computer will *simulate* two-drive operation; you will be prompted to switch disks.

As long as you remember you must insert the proper disk into the single drive when prompted, everything will be fine. If you insert the wrong disk, you may experience some difficulties.

The two prompts you will see are:

Place disk B in drive A:.

Hit any key when ready.

and

Place disk A in drive A:.

Hit any key when ready.

Any command that can access more than one drive will be affected. Such commands include, but are not limited to: DIR, RENAME, ERASE, COPY, TYPE, CHKDSK, FORMAT, DSKCOPY, and DSKCOMP.

## MFM-150 Command Summary

Multi-Function Monitor 150 (MFM-150) is the name of the firmware resident in your Z-100 PC Series Computer. This firmware contains the basic input/output drivers used by the operating system for communication with the machine. The MFM-150 also contains:

- Power-up diagnostics capable of detecting almost any problem which would prevent the disk-based diagnostics from being run.
- A debugging facility similar to Microsoft's DEBUG, a utility used to monitor, debug, and edit assembly language programs.
- Ability to boot up from any drive attached to the system.
- Menu-selectable diagnostics that run diagnostics more advanced than the power-up tests. Since these diagnostics repeat until ended by the user, this permits long-term testing of the machine.

An important element of the MFM-150 firmware is the monitor/debugger. This debugger, similar to the Microsoft DEBUG utility supplied with MS-DOS, contains a number of debugging facilities, including:

- Boot operating system from disk;
- Change video and scroll modes;
- Display contents of memory;
- Display/change contents of CPU registers;
- Input/output to/from I/O ports;
- Fill memory with a string;
- Search memory for a pattern;
- Disassemble a user program;

- Execute a user program;
- Single-step a user program;
- Display a color bar chart.

As well as containing a substantial subset of the commands available in the Microsoft DEBUG debugger, the MFM-150 monitor contains additional commands which support the system operation of the Z-100 PC Series Computers. These commands are summarized in Table 5.1.

The syntax notation used is as follows:

- Items in brackets [like this] are optional, and need not be entered.
- Items in braces, separated by a vertical bar '|', {like this | and this}, represent a series of choices. Only one selection should be made from the alternate choices presented. In the above example, either 'like this' or 'and this' would be entered.
- Items enclosed in angle brackets as in <address> are to be replaced with a user-supplied entry (here, 2000:0 may be an actual entry).
- If an item is followed by three periods '...', then the item may be repeated an arbitrary number of times. For instance, <byte>... means that one or more bytes may be entered.
- When a number is called for, a register name may be entered in its place — the contents of the specified register will be used.
- **RETURN** means to press the **RETURN** key.

## Software Summaries

Table 5.1. MFM-150 Command Summary

EXPLANATION	COMMAND	SYNTAX
Help	? ?	
Boot from disk	B	B[{F   W}][<drive>][:<partition>]
Color Bar	C	C
Display memory	D	D <address>[{L<length>   <offset>}]
Examine memory	E	E <address>
Fill memory	F	F <range>,<list>
Execute (Go)	G	G [= <addr>][,<breakpoint>] ...
Hex math	H	H <number1>,<number2>
Input from port	I	I <port>
Move memory block	M	M <range>,<address>
Output to port	O	O <port>,<value>
Examine registers	R	R [<register>]
Search memory	S	S <range>,<list>
Trace program	T	T [= <address>][,<value>]
Unassemble program	U	U <address>[{L<length>   ,<offset>}]
Set Video/Scroll	V	V [M<mode>][S<scroll>][100][150]
Extended diagnostics	TEST	TEST
<b>NOTE:</b> In the above table <range> is: <addr>{,<addr>   L<length>}. and <list> is: {<byte>   "string"}		

## Command Summary

### Help

Example: ? *RETURN*

The help command displays a list of the commands available in the MFM-150 monitor, along with a syntax diagram.

**Boot** Syntax: B[{F | W}][<drive>][:<partition>]

Example: B 1 *RETURN* or BW1:2 *RETURN*

**Color Bar**

Syntax: C

Example: `C RETURN`

Displays a 16-color bar chart that can be used to adjust a color RGB-input monitor.

**Display Memory**

Syntax: D[&lt;address&gt;[{L&lt;length&gt; | &lt;offset&gt;}]]

Example: `D1234:5678 L200 RETURN` or `D3312:0,13E RETURN`

Displays contents of memory in hexadecimal and ASCII (an ASCII period '.' is used for non-printing characters). If <length> is specified, the display is done for <length> bytes. If no address is specified, the next 128 bytes will be displayed.

**Examine/Change Contents of Memory**

Syntax: E &lt;address&gt;

Example: `E 0:100 RETURN` or `E DS:7000 RETURN`

Displays the contents of a byte of memory, and requests user input. If a '-' is entered, the contents of the previous byte is shown, a <space> will display the contents of the next byte. Otherwise, entry of a hexadecimal number from 0-FF will modify the contents of the byte currently being examined. RETURN is pressed to finish the E command.

**Fill Memory with a Constant**

Syntax: F &lt;range&gt;,&lt;list&gt;

Example: `F 1800:0,3FF,"Testing!",0D,0A RETURN`

Fills contents of memory starting at <range> with data from the <list>. Data is reused from the list as often as necessary to fill the <range>.

Go (begin execution of user program)

Syntax: G[ = &lt;addr&gt; ][, &lt;breakpoint&gt; ] . . .

Example: `G 5000:3ACD RETURN` or `G246 RETURN`

**Hex Math**

Syntax: H<number1>,<number2>

Example: H 43C7,99FA RETURN

Displays the sum and difference of the two hex offsets.

**Input from Port**

Syntax: I <port>

Example: I 3FE RETURN

Displays the contents of the selected input port.

**Move Memory**

Syntax M <range>, <address>

Example: M3219:FEDC,FFFF,3905:0 RETURN

Moves the block of memory specified by <range> to the destination <address>. The move is performed so that overlapping moves will not result in overwriting of any data.

**Output to Port**

Syntax: O <port>,<value>

Example: O 21,BC RETURN or O DX,A RETURN

Outputs the specified byte value to an output port.

**Examine/Modify Registers**

Syntax: R[<register>]

Example: R SP RETURN or R RETURN

With a single register name specified, the contents of that register is shown, and you are prompted for input. If a valid hexadecimal number is entered at the prompt, the register's value is changed to that entered.

With no register name specified, all registers are displayed.

The flags register (FL) is displayed as a sequence of two letter abbreviations for each of the flag bits. The abbreviations are:

FLAG	ON	OFF
Overflow	OV (overflow)	NV (no overflow)
Direction	DN (down)	UP (up)
Interrupts	EI (enabled)	DI (disabled)
Sign	NG (negative)	PL (plus)
Zero	ZR (zero)	NZ (not zero)
Auxiliary Carry	AC (aux. carry)	NA (no aux. carry)
Parity	PE (even)	PO (odd)
Carry	CY (carry)	NC (no carry)

When changing the flags register, any of the listed abbreviations may be entered to set/reset individual flag bits. For instance, entering *NV ZR* would reset the overflow flag and set the zero flag. In the case of multiple abbreviations for the same flag being entered, the last one entered will take effect.

### Search for String

Syntax: S<range>,<list>

Example: S 2400:15,8CD,"Alpha",3,"Beta" RETURN

Scan through the <range> of memory for <list>. Each time the search command finds an occurrence of the string, the start address of the string is printed.

### Trace User Program

Syntax: T[ = <addr> ][, <value>]

Example: T=400:0,200 RETURN or T 5 RETURN

Trace single-steps through a user program, printing the contents of the CPU registers after every instruction is executed.

If = <address> is entered, single-stepping will begin at the new address. The current CPU address is used if no new CPU address is specified.

## Software Summaries

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**Unassemble**                      Syntax: U[<address>[<length> | ,<offset>]]

Example: U RETURN            or            U 1527 RETURN

Unassemble (or disassemble) a memory area into assembly-language form. If the address is not given, it will disassemble following the last unassemble. If <length> and <offset> are not specified, the next 32 bytes will be disassembled.

### Video Mode/Scroll Mode Set

Syntax: V[M<mode>][S<scroll>][100][150]

Example: V M3 RETURN            or            V S0 RETURN            or            VM6 S2 RETURN

The V command is used to set the current video or scroll mode. The different modes are discussed in the Video Mode section of this manual.

Also set by the 'V' command is the current scroll mode. The scroll mode determines how information is moved off of the screen once it has been filled. The following scroll modes are acceptable:

- 0 — Software (compatible) scroll mode. Information is scrolled by actually moving text around on the screen. This mode is the default on the Z-100 PC Series.
- 1 — Hardware (jump) scroll mode. This mode, while not compatible with all application packages, is faster than software scroll mode. This scroll mode may be used only in the 80 × 25 or the graphics video modes.
- 2 — Smooth scroll mode. This scroll mode, usable only with high-resolution graphics, generates a display which is more readable than other scrolling modes. Readability is enhanced by moving characters upward a small piece at a time.

### Extended System Diagnostics

Example: TEST RETURN

## Special Function Keys

Several keys have special meanings to the MFM-150 monitor.

BACK SPACE	This key is pressed to correct typing errors prior to beginning execution of a command. Each depression of the BACK SPACE key deletes a single character.
RETURN	Used to begin processing commands which have been entered by the user.  The comma is usually used as a separator between elements of a command, but in all cases a space may be used identically.
SCROLL LCK	When pressed, this key will cause any output to pause on the screen until the key is pressed a second time.
CTRL-S	Same as above.
CTRL-NUM LCK	This key sequence will cause the computer to halt until any other key is typed.
CTRL-SCROLL LCK	If this key sequence is pressed, any MFM-150 command which is executing will be terminated and control will return to the MFM-150 monitor.
CTRL-C	Same as CTRL SCROLL LOCK.
CTRL-ALT-DEL	This three-key combination will cause the computer to act as though it were just turned on. Diagnostics will be performed and the system is initialized.

## Software Summaries

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### CTRL-ALT-INS

This sequence acts the same as CTRL ALT DEL, except that the machine does not actually reset, but rather, control is forced to the system monitor. Since a reset is not performed, the machine does not autoboot. This permits users to boot from an alternate drive.

### CRTL-ALT-RETURN

This three-key sequence is used to suspend a program (usually during the debugging process). It saves the contents of the CPU registers, and acts as though a user breakpoint had been executed. The user may then use the MFM-150 facilities to examine/modify the CPU registers, I/O ports, or the contents of memory. To begin execution again where the processor left off, the MFM-150 G command is used (without specifying the '= <address>').

### ALT-ESC

When used with a Zenith keyboard, this sequence toggles the key click. This means that pressing these keys will turn the key click on if it is off, and vice versa.

## ASCII Codes

Table 5.2 is a decimal (DEC) to hexadecimal (HEX) code conversion table of the ASCII codes your computer can generate. The KEY column represents the key you would press to obtain the code illustrated. The CHAR column represents the accepted acronym or letter in the ASCII standard. Since you cannot obtain many of the first thirty-one codes by pressing a single key, the control key combination is shown in the CTRL column. Finally, a brief description is given for each code.

**Table 5.2. ASCII Code Conversion**

DEC	HEX	CHAR	KEY	CTRL	DESCRIPTION
0	00	NUL	...	@	Null.
1	01	SOH	...	A	Start of heading.
2	02	STX	...	B	Start of text.
3	03	ETX	...	C	End of text.
4	04	EOT	...	D	End of transmission.
5	05	ENQ	...	E	Enquiry.
6	06	ACK	...	F	Acknowledge.
7	07	BEL	...	G	Rings bell.
8	08	BS	BACK SPACE	H	Back Space.
9	09	HT	TAB	I	Horizontal tab.
10	0A	LF	LINE FEED	J	Line feed: advance cursor to next line.
11	0B	VT	...	K	Vertical tab (VTAB).
12	0C	FF	...	L	Form feed to top of next page.
13	0D	CR	RETURN	M	Carriage return to beginning of line.
14	0E	SO	...	N	Shift out.
15	0F	SI	...	O	Shift in.
16	10	DLE	...	P	Data link escape.
17	11	DC1	...	Q	Device control 1: turns transmitter on (XON).
18	12	DC2	...	R	Device control 2.
19	13	DC3	...	S	Device control 3: turns transmitter off (XOFF).
20	14	DC4	...	T	Device control 4.

## Software Summaries

Table 5.2 (continued). ASCII Code Conversion

DEC	HEX	CHAR	KEY	CTRL	DESCRIPTION
23	17	ETB	...	W	End of transmission block.
24	18	CAN	...	X	Cancel (CANCL). Cancels current escape sequence.
25	19	EM	...	Y	End of medium.
26	1A	SUB	...	Z	Substitute.
27	1B	ESC	ESC	[	Escape.
28	1C	FS	...	\	File separator.
29	1D	GS	...	]	Group separator.
30	1E	RS	...	^	Record separator.
31	1F	US	...	-	Unit separator.
32	20	SP	...		Space (spacebar).
33	21	!	!	...	Exclamation point.
34	22	"	"	...	Quotation mark.
35	23	#	#	...	Number sign.
36	24	\$	\$	...	Dollar sign.
37	25	%	%	...	Percent sign.
38	26	&	&	...	Ampersand.
39	27	'	'	...	Acute accent or apostrophe.
40	28	(	(	...	Open parenthesis.
41	29	)	)	...	Close parenthesis.
42	2A	*	*	...	Asterisk.
43	2B	+	+	...	Plus sign.
44	2C	,	,	...	Comma.
45	2D	-	-	...	Hyphen or minus sign.
46	2E	.	.	...	Period.
47	2F	/	/	...	Slash.
48	30	0	0	...	Number 0.
49	31	1	1	...	Number 1.
50	32	2	2	...	Number 2.
51	33	3	3	...	Number 3.
52	34	4	4	...	Number 4.
53	35	5	5	...	Number 5.
54	36	6	6	...	Number 6.
55	37	7	7	...	Number 7.
56	38	8	8	...	Number 8.
57	39	9	9	...	Number 9.
58	3A	:	:	...	Colon.

Table 5.2 (continued). ASCII Code Conversion

DEC	HEX	CHAR	KEY	CTRL	DESCRIPTION
64	40	@	@	...	At sign.
65	41	A	A	...	Letter A.
66	42	B	B	...	Letter B.
67	43	C	C	...	Letter C.
68	44	D	D	...	Letter D.
69	45	E	E	...	Letter E.
70	46	F	F	...	Letter F.
71	47	G	G	...	Letter G.
72	48	H	H	...	Letter H.
73	49	I	I	...	Letter I.
74	4A	J	J	...	Letter J.
75	4B	K	K	...	Letter K.
76	4C	L	L	...	Letter L.
77	4D	M	M	...	Letter M.
78	4E	N	N	...	Letter N.
79	4F	O	O	...	Letter O.
80	50	P	P	...	Letter P.
81	51	Q	Q	...	Letter Q.
82	52	R	R	...	Letter R.
83	53	S	S	...	Letter S.
84	54	T	T	...	Letter T.
85	55	U	U	...	Letter U.
86	56	V	V	...	Letter V.
87	57	W	W	...	Letter W.
88	58	X	X	...	Letter X.
89	59	Y	Y	...	Letter Y.
90	5A	Z	Z	...	Letter Z.
91	5B	[	[	...	Open brackets.
92	5C	\	\	...	Reverse slash.
93	5D	]	]	...	Close brackets.
94	5E	^	^	...	Caret.
95	5F	_	_	...	Underscore.
96	60	`	`	...	Grave accent.
97	61	a	a	...	Letter a.
98	62	b	b	...	Letter b.
99	63	c	c	...	Letter c.
100	64	d	d	...	Letter d.
101	65	e	e	...	Letter e.

## Software Summaries

Table 5.2 (continued). ASCII Code Conversion

DEC	HEX	CHAR	KEY	CTRL	DESCRIPTION
106	6A	j	j	...	Letter j.
107	6B	k	k	...	Letter k.
108	6C	l	l	...	Letter l.
109	6D	m	m	...	Letter m.
110	6E	n	n	...	Letter n.
111	6F	o	o	...	Letter o.
112	70	p	p	...	Letter p.
113	71	q	q	...	Letter q.
114	72	r	r	...	Letter r.
115	73	s	s	...	Letter s.
116	74	t	t	...	Letter t.
117	75	u	u	...	Letter u.
118	76	v	v	...	Letter v.
119	77	w	w	...	Letter w.
120	78	x	x	...	Letter x.
121	79	y	y	...	Letter y.
122	7A	z	z	...	Letter z.
123	7B	{	{	...	Left brace.
124	7C			...	Vertical bar (broken).
125	7D	}	}	...	Right brace.
126	7E	~	~	...	Tilde.
127	7F	DEL	DELETE	...	Delete (rub out).
128- 255	80- FF				Outside the standard range; used by computers for special purposes.

## Z-100 PC Keyboard Codes

Table 5.3 illustrates codes returned by Z-100 PC Series computer hardware. Operating systems and program languages (such as MS-DOS and GW-BASIC) will not receive the same information; the hardware codes will be intercepted and converted.

For most keys, the value received will be the least significant byte of the key code shown in the following table. For instance, 2C7AH would be received as 7AH.

However, keys where the least significant byte is 0, will generate two bytes, the first having a value of zero (0) to indicate a special key and the second being the code of the key itself. Thus, function key F10 (which generates 7100H in hardware) will generate 00H followed by 71H.

**Table 5.3. Keyboard Codes (Hardware)**

KEY	NOT SHIFTED	SHIFTED	CONTROL	ALT	CAPS LOCK
ESC	011BH	011BH	011BH	----	011BH
1/!	0231H	0221H	----	7800H	0231H
2/@	0332H	0340H	0300H	7900H	0332H
3/#	0433H	0423H	----	7A00H	0433H
4/\$	0534H	0524H	----	7B00H	0534H
5/%	0635H	0625H	----	7C00H	0635H
6/^	0736H	075EH	071EH	7D00H	0736H
7/&	0837H	0826H	----	7E00H	0837H
8/*	0938H	092AH	----	7F00H	0938H
9/(	0A39H	0A28H	----	8000H	0A39H
0/)	0B30H	0B29H	----	8100H	0B30H
-/_	0C2DH	0C5FH	0C1FH	8200H	0C2DH
=/+	0D3DH	0D2BH	----	8300H	0D3DH
BACK SPACE	0E08H	0E08H	0E7FH	----	0E08H
TAB	0F09H	0F00H	----	----	0F09H
Q	1071H	1051H	1011H	1000H	1051H
W	1177H	1157H	1117H	1100H	1157H

## Software Summaries

Table 5.3. Keyboard Codes (Hardware)

KEY	NOT SHIFTED	SHIFTED	CONTROL	ALT	CAPS LOCK
U	1675H	1655H	1615H	1600H	1655H
I	1769H	1749H	1709H	1700H	1749H
O	186FH	184FH	180FH	1800H	184FH
P	1970H	1950H	1910H	1900H	1950H
[/{	1A5BH	1A7BH	1A1BH	----	1A5BH
]}/	1B5DH	1B7DH	1B1DH	----	1B5DH
RETURN	1C0DH	1C0DH	1C0AH	----	1C0DH
CTRL	----	----	----	----	----
A	1E61H	1E41H	1E01H	1E00H	1E41H
S	1F73H	1F53H	1F13H	1F00H	1F53H
D	2064H	2044H	2004H	2000H	2044H
F	2166H	2146H	2106H	2100H	2146H
G	2267H	2247H	2207H	2200H	2247H
H	2368H	2348H	2308H	2300H	2348H
J	246AH	244AH	240AH	2400H	244AH
K	256BH	254BH	250BH	2500H	254BH
L	266CH	264CH	260CH	2600H	264CH
;/:	273BH	273AH	----	----	273BH
' / "	2827H	2822H	----	----	2827H
` / ~	2960H	297EH	----	----	2960H
Left SHIFT	----	----	----	----	----
\ /	2B5CH	2B7CH	2B1CH	----	2B5CH
Z	2C7AH	2C5AH	2C1AH	2C00H	2C5AH
X	2D78H	2D58H	2D18H	2D00H	2D58H
C	2E63H	2E43H	2E03H	2E00H	2E43H
V	2F76H	2F56H	2F16H	2F00H	2F56H
B	3062H	3042H	3002H	3000H	3042H
N	316EH	314EH	310EH	3100H	314EH
M	326DH	324DH	320DH	3200H	324DH
, / <	332CH	333CH	----	----	332CH
. / >	342EH	343EH	----	----	342EH
// ?	352FH	353FH	----	----	352FH
Right SHIFT	----	----	----	----	----
* / PRT SC	372AH	(Note 1)	7200H	----	372AH
ALT	----	----	----	----	----
(Space)	3920H	3920H	3920H	3920H	3920H
CAPS LOCK	----	----	----	----	----

**Table 5.3 (continued). Keyboard Codes (Hardware)**

KEY	NOT SHIFTED	SHIFTED	CONTROL	ALT	CAPS LOCK
F4	3E00H	5700H	6100H	6B00H	3E00H
F5	3F00H	5800H	6200H	6C00H	3F00H
F6	4000H	5900H	6300H	6D00H	4000H
F7	4100H	5A00H	6400H	6E00H	4100H
F8	4200H	5B00H	6500H	6F00H	4200H
F9	4300H	5C00H	6600H	7000H	4300H
F10	4400H	5D00H	6700H	7100H	4400H
NUM LCK	----	----	(Note 2)	----	----
SCROLL LCK	----	----	(Note 3)	(Note 4)	----
HOME / 7	4700H	4737H	7700H	(Note 5)	4737H
(Up) / 8	4800H	4838H	----	(Note 5)	4838H
PGUP / 9	4900H	4939H	8400H	(Note 5)	4939H
-	4A2DH	4A2DH	----	----	4A2DH
(Left) / 4	4B00H	4B34H	7300H	(Note 5)	4B34H
5	----	4C35H	----	(Note 5)	4C35H
(Right) / 6	4D00H	4D36H	7400H	(Note 5)	4D36H
+	4E2BH	4E2BH	----	----	4E2BH
END / 1	4F00H	4F31H	7500H	(Note 5)	4F31H
(DOWN) / 2	5000H	5032H	----	(Note 5)	5032H
PGDN / 3	5100H	5133H	7600H	(Note 5)	5133H
INS / 0	5200H	5230H	----	(Note 5)	5230H
DEL / .	5300H	532EH	----	----	532EH
ENTER	540DH	540DH	540AH	----	540DH

## Software Summaries

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**Table 5.3 (continued). Keyboard Codes (Hardware)**

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**NOTES:**

- 1: SHIFT-PRT SC causes the contents of the screen to be printed.
  - 2: CTRL-NUM LCK causes the running program to pause until another key is pressed.
  - 3: CTRL-BREAK is used to break (abort) a program. This key sequence sends a special key code of 0000H.
  - 4: ALT-BREAK is used to empty the type-ahead buffer.
  - 5: Special keycodes can be entered directly by pressing and holding the ALT key, and then entering the three-digit keycode (in decimal) on the numeric keypad. Releasing the ALT key will then generate the desired keycode. For example, pressing ALT, then entering 1, 2, and 3 on the numeric keypad, then releasing ALT, will generate a keycode of 123 decimal = 7BH. When entering these special keycodes, the high byte of the key code is set to 38H, which is the scan code for the ALT key. Thus, the complete key code for ALT-1-2-3 is 387BH.
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# Glossary

The following is a short glossary of the commonly used computer terms that you may encounter while working with your Z-100 PC Series 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 (and back again) that are transmitted over standard telephone lines. 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.

## Glossary

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**Application** — A system, problem, or task 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. It is the industry standard used to transmit information to printers, other computers, and other peripheral devices. The most notable exceptions are some IBM equipment which uses an EBCDIC code. See "EBCDIC."

**Assemble** — 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 copy preserved as a protection from the destruction of the original (or processed) data and/or programs.

**Batch processing** — An operation where large amounts of data are 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. 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 based on two rather than ten (decimal). The individual element (or digit) can have a value of zero or one and in computer memory is known as a bit.

**Bit** — Binary digit. 1. A single binary element or digit. 2. The smallest element in computer storage capability.

**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 hardware configuration of a computer system.

**Board** — A printed circuit board assembly that mounts onto (a portion of) 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."

## Glossary

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

**Break** — The process of interrupting and (temporarily) halting 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 which 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 (line) used to carry data or power between two or more locations.

**Byte** — A term used to describe a number of consecutive bits. In microcomputers, a byte 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.

**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.

**Check (sum)** — A method of checking the accuracy of characters transmitted, manipulated, or stored. The check sum is the result of the summation of all the digits involved.

**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 high-level language is used in a wide number of operations, 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 portion of 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. May be either color or monochrome (black and white). See “Video,” “Monitor,” “RGB video,” and “CRT.”

## Glossary

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**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 instantaneous printing speed.

**CPU** — Central Processing Unit. The CPU is the brain of a computer. It is the circuitry which actually processes the information and controls the storage, movement, and manipulation of that 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.

**CRT** — Cathode-Ray Tube. This term is used interchangeably with display, screen, and video monitor. It refers to the television-like screen in a computer, terminal, or monitor.

**Cursor** — A character, usually an underline or graphics block, used to indicate position on a display screen.

**Cylinder** — Used to describe the tracks in disk units 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 paper when a hammer strikes an arm or projection of the print wheel. The print quality from such printers is usually high, similar to that of a quality office electric typewriter.

**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 a 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.

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

**Decimal** — The numbering system based on ten and comprising the digits 0 through 9.

**Delete** — To remove or eliminate.

**Density** — The closeness of space distribution on a storage medium such as a disk.

**Descenders** — That portion of a character which descends below the base line of a line of print. 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 (and back again) that are transmitted over standard telephone lines. 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: 5¼” and 8” in diameter. Also called a “floppy disk” “floppy

## Glossary

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**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.

**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. ASCII code is the computer industry’s standard and is similar. See “ASCII.”

**Edit** — To change data, a program, or a program line.

**EEPROM** — Electrically Erasable Programmable Read-Only Memory. Similar to EPROM, and PROM, except that this memory may be selectively erased by electronic means and reprogrammed. Similar in nature to RAM, except that special voltages are needed for erasing and programming the memory. Nonvolatile in nature. See “Volatile,” “RAM,” “ROM,” “PROM,” and “EPROM.”

**EPROM** — Erasable Programmable Read-Only Memory. Similar to PROM, except that this memory is erased by exposing it to a high-intensity ultraviolet light after which it may be reprogrammed. Nonvolatile in nature. See “Volatile,” “RAM,” “ROM,” “PROM,” and “EEPROM.”

**Execute** — To perform a command.

**Field** — A set of related characters that make up a piece of data. For instance, a field of characters spelling a person's first name would be one field in a person's name and address record in a mail program's data file.

**File** — A collection of related records that are treated as a unit. A file may contain data or represent a computer program. A file can be stored on disk. 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 in a computer program; usually very detailed.

**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, or points, which may be lit (number of points per row by number of rows).

**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 and indicates a type of disk that has multiple timing holes which 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."

## Glossary

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**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 controlled jets of ink. The print quality from such printers is (usually) quite high and similar to that produced by a quality office electric typewriter. These printers are often capable of producing multicolored copy and screen images of high quality.

**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 program step that tells the computer exactly what to do for a single operation in a program.

**Integer** — A whole entity (number). Not a part, fraction, or a number with a decimal point.

**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.

**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** — The symbol used to equal 1,024. Also the abbreviation of Kilo, which stands for 1,000. However, in computers it is the power of two closest to the number 1000 ( $2^{10}$ ); hence the amount of 1,024. As an example, 16K would equal 16 times 1,024, or 16,384. See “Kilo.”

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

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

**Kilo** — A prefix meaning one thousand. In computers, it is abbreviated as K and refers to the power of two closest to the number 1000 — 4,096 is 4K. See “K.”

## Glossary

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**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 keyboard, disk, or other source.

**M** — Abbreviation for Mega. See "Mega."

**Machine Language** — A programming language consisting only of numbers or symbols that the computer can understand without translation.

**Mainframe** — 1. The actual central hardware of a computer, containing the central processing unit. 2. The largest type of computer, usually associated with financial and government institutions and having the ability to 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 maintenance, or repair, this also includes preventive maintenance, or cleaning and adjustment. With software, maintenance refers to updating critical tables and routines to maintain accountability with established standards (as in the updating of tax tables for Income and Social Security Tax deductions in a payroll program).

**Matrix** — 1. A rectangular array of datum, usually numeric, subject to mathematical operations or manipulation; any table is a matrix. 2. A rectangular array of elements which, when used in combination, may form symbols and/or characters, as in a dot-matrix printer or video display.

**Mega** — A term meaning one million. Abbreviated M.

**Megabyte** — 1,048,576 bytes. See "Mega."

**Memory** — A portion of a computer that is used to store information (either data or programs). The size of a microcomputer is often determined by the amount of user memory (measured in Kilobytes) in the system.

**Microcomputer** — A term that (usually) applies to smaller, desktop and personal computer systems. See also “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.

**Modulo** — A mathematical operation resulting in the remainder of a division operation.  $42 \text{ modulo } 5 = 2$  (the remainder of 42 divided by 5).

**Monitor** — 1. A control program in a computer. 2. A separate peripheral used to display information; a black and white (monochrome) or color (RGB) 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 entry 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. While this usually applies to computers with more than one CPU, it also may apply to time sharing. See “Time share.”

**Multitasking** — Doing two or more tasks at the same time; often used synonymously with multiprocessing. Further, as differing from multi-

## Glossary

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**Network** — The interconnection of a number of points by means of a common interface or communications facility, such as a telephone.

**Numeric** — Composed of numbers. The value of a number as contrasted to a character representation.

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

**Operation** — A defined action; 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.

**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.).

**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 (type) written 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 compute, assemble, compile, interpret, generate, etc.

**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.

**Programming 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. Nonvolatile in nature. See “Volatile,” “ROM,” “EPROM,” and “EEPROM.”

**Prompt** — A symbol, character, or other sign that the computer is waiting for some form of operator input. The prompt may request data and be made up of text that requests specific data. 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 false.

## Glossary

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**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 portion of the computer that maintains the actual time of day and 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 for serial communication adopted by the Electronic Industries Association (EIA) to ensure uniformity of interfacing signals between computers and peripherals. This capability

**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 item 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** — Refers (as referenced to data in computers) to data that has been broken down into component parts (characters or bits) and handled in a sequential manner.

**Sign** — An indication of whether the value is greater than zero ( $>0$ ) or less than zero ( $<0$ ). The dash or hyphen (-) 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 and indicates a type of disk that has a single timing hole which 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

## Glossary

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**Synchronous** — To be controlled by and synchronized 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 data into a form suitable for easy reference.

**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. Some (usually older models) also may include a paper tape punch and reader.

**Thermal printer** — A “hard copy” device that works by forming printed “characters” with tiny heated elements against heat sensitive paper. The print quality from such printers is (usually) less than that produced by most electric typewriters and requires (usually) special paper.

**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 by a different vendor.

**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** — The act of comparing an original against stored data to assure correctness of the data.

**Volatile** — A characteristic of becoming lost or erased when operating power is removed from the hardware. See "RAM."

**Winchester** — A term which has come to be applied to most forms of high-density, nonremovable disk storage. The term originally was a pun on the first Winchester-type disk storage system. It had a capacity of 30 megabytes each on a dual drive system.

**Word processing** — The ability to enter, manipulate, correct, delete, format, and print text. It is an application that is widely used in microcomputers. Uses for word processors include writing letters and preparing documents such as magazine articles, manuscripts, manuals, and books.

**Write** — To record data on some object, such as a display, disk, or paper.



# Installation of 256K Memory Upgrade

**NOTE:** If your computer application requires the use of the 8-megahertz clock feature, the memory upgrade must be done with 150-nanosecond or faster memory devices.

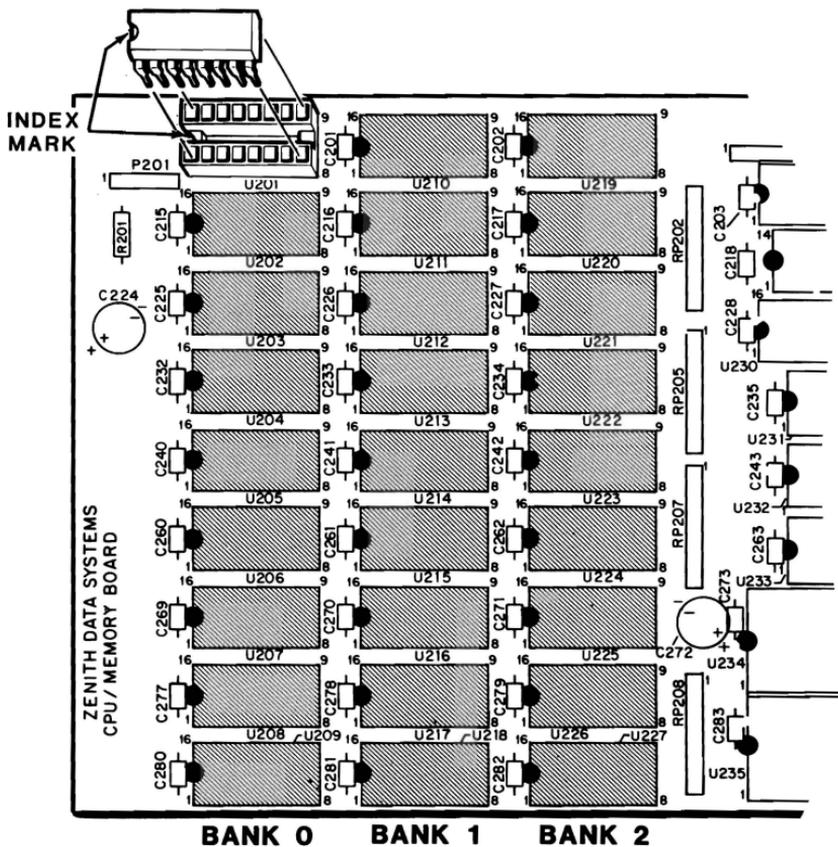
Refer to Figure A.1.

- Remove the cover and the CPU/memory card following the procedure outlined in Chapter 4 of this manual.

**NOTE:** Note the identification of the memory banks (rows) on Figure A.1. The 256K chips can be installed in: 1) the first, 2) the first and second, or, 3) all three memory banks. **IMPORTANT:** The first bank (bank 0) always must be the first (or only) bank with 256K chips. Each bank of memory must consist of the same type of ICs; you **cannot** mix 64K chips with 256K chips within the same bank. Each different bank can contain different chips, for example, bank 1 may consist of 256K chips, bank 2 may have 64K chips, and so on.

- Remove any ICs from the bank(s) in which the 256K chips will be installed.
- Install the 256K chips in the appropriate bank(s), being sure to line up the notch in the chip with the white index mark on the circuit card.
- Double check to make sure 256K chips are installed in the first bank (bank 0), and that each separate bank includes all the same type of chips within that bank.
- Refer to Tables 2.3A, 2.3B, and 2.3C in Chapter 2 and make the

- Replace the card and cover following the instructions in Chapter 4 of this manual.



**Figure A.1. Installation of 256K Memory Upgrade**

## **Installation of Bit-Mapped Video Graphics Card**

### **Card Configuration**

Carefully remove the Z-319 Bit-Mapped Video Graphics Card from its conductive package and lay it on top of the package for protection.

The Z-319 Card is shipped ready to install in the Z-150 Computer; no configuration changes or special adjustments on the card are necessary. Figure 2 illustrates the factory-set jumper positions. These jumpers select the number of video memory modules in use, the video sync signals required by the monitor, and other factors. A complete explanation of the jumper settings is detailed in Table 1. **Do not change these factory set jumper positions.**

MEMORY MODULES

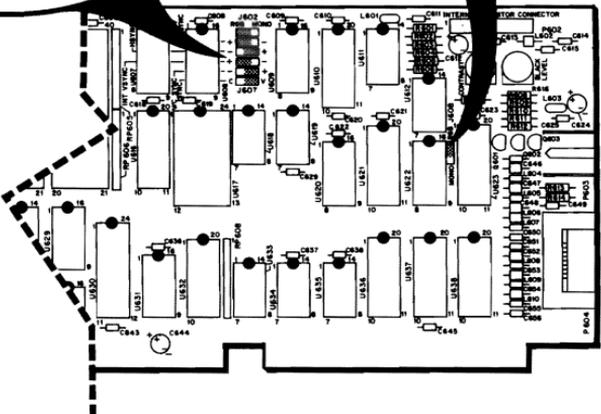
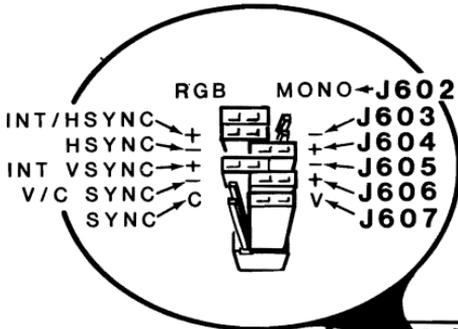
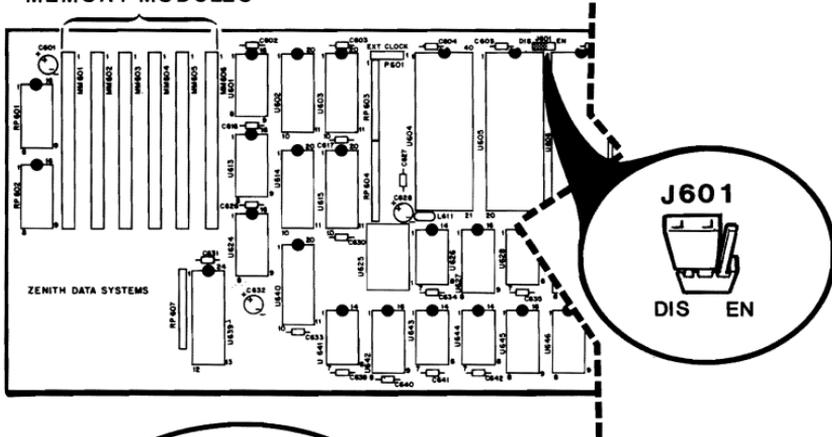


Figure B1. Z-319 Card Jumper Settings

**Table 1. Description of Jumper Settings**


---

JUMPER NUMBER			DESCRIPTION
---------------	--	--	-------------

---

DIS	J601	EN	Scratchpad memory
-----	------	----	-------------------

This jumper enables the onboard scratchpad memory and has no effect on the operation of the Z-319-T Card. It is set at DIS.

---

RGB	J602	MONO	RGB or green video RAM bank select
-----	------	------	------------------------------------

Selects RGB or green video RAM bank (for a monochrome display). It is used in conjunction with J608. This jumper is in the RGB position because all memory modules are installed in this card.

---

+	J603	-	Horizontal sync for internal monitor
---	------	---	--------------------------------------

Selects either a positive (+) or negative (-) signal. Operation with an external monitor is not affected by this jumper. It is set at "+".

---

-	J604	+	Horizontal sync polarity for external monitor
---	------	---	-----------------------------------------------

Selects either a positive (+) or negative (-) horizontal polarity signal, depending upon what is required by the monitor. It is set at "+".

---

+	J605	-	Vertical sync polarity for internal monitor
---	------	---	---------------------------------------------

Selects either a positive (+) or negative (-) signal. Operation with an external monitor is not affected by this jumper. It is set at "+".

---

-	J606	+	Sync signal polarity select
---	------	---	-----------------------------

Selects the polarity of either the composite or vertical sync signal. It is set at "+".

---

C	J607	V	Vertical/composite sync select
---	------	---	--------------------------------

This jumper selects the sync signal: either a composite (vertical and horizontal together) signal, or a separate (horizontal and vertical separate) signal. In the "C" position, the sync will be a composite signal. The jumper is set to the "V" position for the vertical sync signal required by ZDS approved monitors for this system.

---

RGB	J608	Mono	RGB or monochrome select
-----	------	------	--------------------------

## Card Installation

The Z-319 Bit-Mapped Video Graphics Card may be installed in any unused card slot on the backplane board. The computer back panel will have a blank cover plate installed corresponding to each unused card slot. The blank cover plate must be removed from the location selected for installation of the Z-319 Card.

**NOTE:** Despite the fact that the Z-319 Card can be installed in any unused card slot, the **recommended** slots are P102 or P103 (see Figure 2).

- Remove the screw and cover plate from the slot selected for installation of the Z-319 Card. Save the screw; the cover plate may be discarded.

**CAUTION:** Handle the Z-319 Card with extreme care when installing it in the computer. **Do not** put pressure on the card's memory modules (see Figure 3) or handle these static devices more than necessary during installation.

- Install the Z-319 Card into the selected location on the backplane board. Gently, but firmly, push the card edge connector into the backplane connector. Be careful not to damage any components on the card. Make sure the card is seated securely.
- Secure the Z-319 Card to the computer chassis with the screw removed from the cover plate.

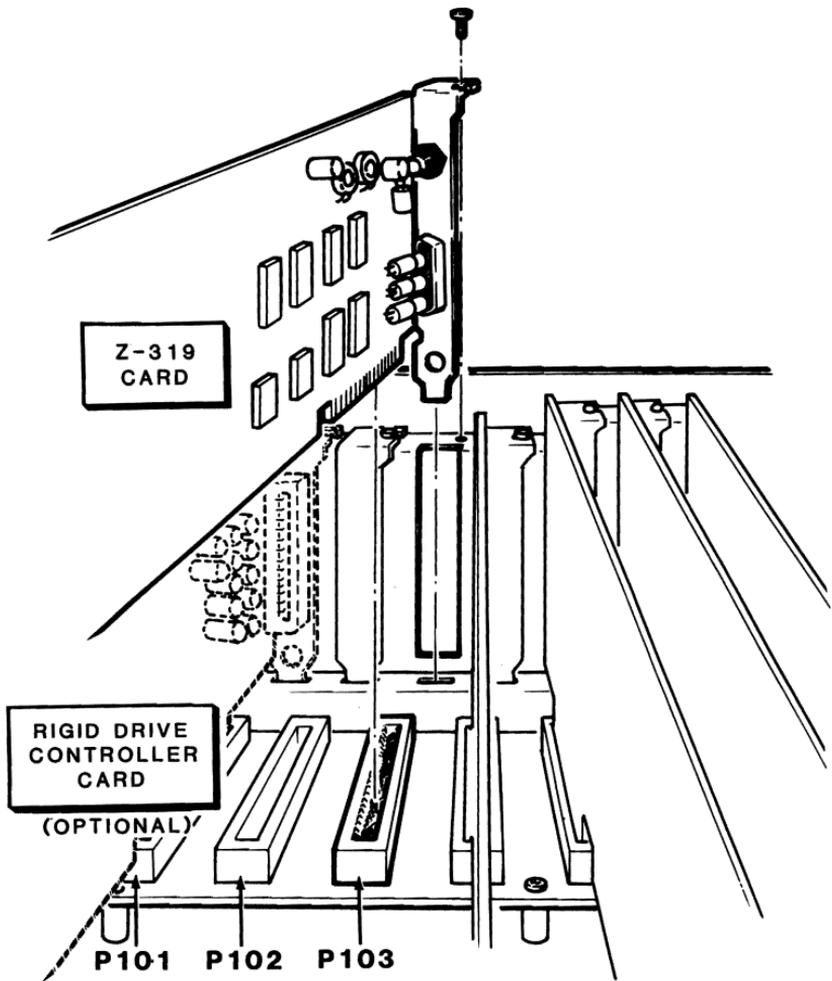


Figure B.2. Z-319 Card Installation

## Operation

To quickly verify that the Z-319 Card is operational, complete the following brief test.

- Connect the monitor input to the appropriate connector on the Z-319 Card, and the monitor line cord to an AC outlet.
- Switch on power to both the computer and monitor.
- Type V100 and press **Return**.
- The monitor should display a message or prompt (depending on the program). This indicates that the Z-319 Card is operating properly.

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To locate a subject in this manual, first check the Table of Contents for the location of the general subjects or illustrations; the Software Summaries for specific machine, operating system, or language commands and statements; or the Glossary for definitions of commonly-used computer or computer-related terms. The User's Guide has its own index.

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