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The Commodore Plus/4 Book

Sarah C. Meyer

THE COMMODORE PLUS/4 BOOK

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THE COMMODORE PLUS/4 BOOK

by

Sarah C. Meyer

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PREFACE

This book was written to explain the features that make Commodore's new Plus/4 home computer a useful advance in the home computer field. You'll read about the computer's improved keyboard, its eight programmed function keys, and a new version of BASIC that has more than twice the number of commands that are built into the Commodore 64. In addition, you'll learn about the built-in software, simple drawing commands, screen windowing, and all the other special features of the Plus/4.

Part I explains the Plus/4 features, accessories, and software, and discusses how to choose and set up your computer system. In Chapter 1, the features of this new computer are described, while Chapter 2 compares the Plus/4 to other home computers and provides charts that show you what distinguishes the features of the Plus/4 from those other computers, including the popular Commodore 64.

Chapter 3 explains how to choose the additional equipment you will need. It tells you about the Plus/4 peripherals, including the Model 1541 disk drive and a variety of printers. Both the Commodore printers and some printer models that are not made by Commodore are examined and discussed. This chapter tells you which of the Commodore 64 peripherals are compatible with the Plus/4 (and which aren't), and it gives you advice on building a home computer system that is tailored to your requirements. The difference between types of computing equipment, such as the difference between dot-matrix and letter-quality printers is explained, so you can make informed decisions before you buy.

Chapter 4 shows you how to set up your home computer system. Thus, the information in Chapters 3 and 4 teaches you what you need to know to select and set up your entire system without having to refer to other manuals.

Next, Chapter 5 explains the software programs that are built into the Plus/4. This chapter describes each program and provides a demonstration of how the programs can work together. Then, in Chapter 6, the types of software available, and what that software can do, is explained. You'll also be advised on how to investigate software before you buy. The chapter also contains a reference chart of the commands used for loading and saving software, as well as other disk commands.

Part II teaches you how to use the keyboard. It gives a complete explanation of all the keys on the Plus/4 keyboard and includes a summary section at the end of each chapter for quick reference.

Chapter 7 offers introductory keyboard exercises and BASIC lessons so you can see how easy it is to use the Plus/4 computer. Next, Chapter 8 teaches you mathematical operations and some additional BASIC lessons. Then, Chapter 9 shows you how to use the Function Keys. It explains how these eight keys work and discusses a simple procedure for redefining them to suit your programming needs.

This book also contains an extensive glossary that explains many computer terms. Three appendices briefly describe the many BASIC commands as well as the commands used by the built-in machine-language monitor. A large index helps you find information quickly. The book also offers insightful advice, step-by-step tutorials, problem-solving tips, and careful explanations so that even those who suffer from computerphobia can understand.

For those planning to buy a home computer system, this book provides indispensable facts about the Commodore Plus/4 and its peripheral computing equipment. For those who have bought the Plus/4, this book teaches in a clear and simple style how to use the newest computer from Commodore, the number 1 home computer company.

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INTRODUCTION

Since introducing the PET® computer several years ago, Commodore Business Machines, Inc. has been the industry leader in manufacturing low-priced versatile home computers with state-of-the-art technology. The PET, at $795, was the first computer priced under $1000. The VIC-20, which offered both color and advanced graphics, was the first computer priced under $300. The Commodore 64, originally priced at $595, combined 64K of RAM memory with sophisticated sound and graphics capabilities.

Each Commodore home computer led the way in price and features, and each was designed to fulfill the desires of computer buyers. Now, in response to the current demands of well-informed consumers, Commodore has departed from the game-playing emphasis of most home computers to introduce the Commodore Plus/4, its first new home computer since the Commodore 64 was unveiled in 1982. Commodore originally announced the new computer under the name *Commodore 264*; the Plus/4 is essentially the same machine as the Commodore 264. Commodore changed the name and also clarified its decision to include built-in software.

The Plus/4, which Commodore calls its productivity computer, is designed for use in practical computing so that the home computer can become a serious utility instead of a fascinating toy. The Plus/4 combines Commodore's traditional trend of low prices for a computer and its extra computing equipment with the following features:

- Built-in integrated software package.
- 64K of built-in RAM memory, with over 60K of memory available for use.
- Eight defined function keys, which include a HELP key.

- Built-in drawing commands.
- Expanded BASIC.
- Screen windowing and many editing functions.
- 121 colors.
- Easy-to-use music commands.
- Easy-to-use programming and disk-handling commands.
- A built-in machine-language monitor.

You'll find that the Plus/4 runs superior home- and personal-management software (Fig. I-1), and offers some excellent educational and developmental benefits for children (Fig. I-2). These features make the Commodore Plus/4 a true family computer.

Fig. I-1. Home- and personal-management software.

Fig. I-2. Educational and developmental software.

BUILT-IN SOFTWARE FOR THE PLUS/4

The software built into the Commodore Plus/4 is an integrated package of four programs:

1. Word processor.
2. Spreadsheet
3. File manager.
4. Graphics generator.

Integrated software lets you switch between programs and transfer information from one program to the other. Since information is easily shared between programs, the integrated software has the effect of being four programs in one. Not only does program integration save time, but it also increases the potential of each of the programs. Although each of the four programs has fewer features than the many versions of the programs that are sold individually, the advantage of having

integrated programs make this package more versatile than separate programs. For example, you can write a letter using the word processor and, while the letter remains intact in computer memory, get addresses from a list organized by the file manager.

The built-in programs are automatically loaded when you press a function key. You switch between the programs with a simple command.

OTHER SOFTWARE FOR THE PLUS/4

Commodore and other software producers are offering a variety of software packages for the Commodore Plus/4. Many of these programs reflect the practical uses for which Commodore designed the Plus/4. For example, you'll be able to choose from among several word processors and financial programs as well as packages designed for specific business applications (Fig. I-3). In addition, programs designed for Commodore's other new computer, the Commodore 16, will also run on the Plus/4.

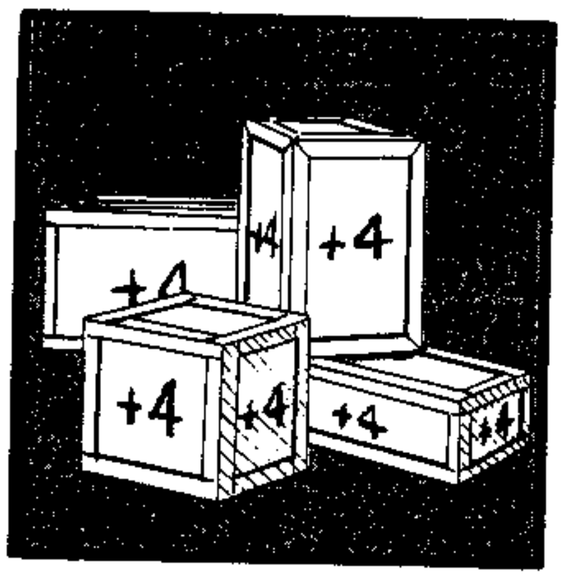
Fig. I-3. Business applications software.

The selection of software that Commodore is releasing for the Plus/4 includes many of the best programs presently available for the Commodore 64 (Fig. I-4), such as LOGO, Easy Calc, and the Manager, as well as new programs, such as Script/Plus (a word processor), B-Graph (a statistical analyzer and graphics generator), and a number of business programs (such as general ledger, accounts receivable, payroll, etc.). You can also run educational

Fig. I-4. Some of the better software programs.

programs, adventure games, and arcade-type games. Besides the software offered by Commodore, several independent software companies will offer a variety of programs for the Plus/4.

Software that runs on the Commodore 64 or the VIC-20 does not, unfortunately, run on the Plus/4. Commodore has, however, been working with outside software developers for over a year to ensure that a plentiful variety of software is available.



THE COMMODORE PLUS/4 HOME COMPUTER SYSTEM

THE PLUS/4 HOME COMPUTER

The Commodore Plus/4 (Fig. 1-1) is the first new home computer Commodore has introduced since the phenomenally successful Commodore 64 made its debut in 1982. Commodore sold over one million VIC 20's and two million 64's by combining powerful small computers and low prices. The Plus/4 follows this tradition.

Commodore calls the Plus/4 its "productivity computer" because the Plus/4 was designed with practical applications and ease of use in mind. A lot of the software for the Plus/4 is intended for those personal and small business applications that include word processing, financial planning, and record keeping.

FEATURES OF THE PLUS/4

Unlike a lot of home computers, the Plus/4 computer is not a glorified game machine. Instead, the Plus/4 offers the features discussed in the following sections.

Built-in Software

The Commodore Plus/4 computer has a built-in integrated software package. Integrated software combines several complementary software programs into one package. The programs are loaded automatically when you press the appropriate function key. You can move between the programs and use them together. The integrated package in the Plus/4 contains four programs:

1. A word processor for writing and editing documents quickly.
2. A file manager for storing information, such as addresses and inventories, in records that are easy to access and reuse.

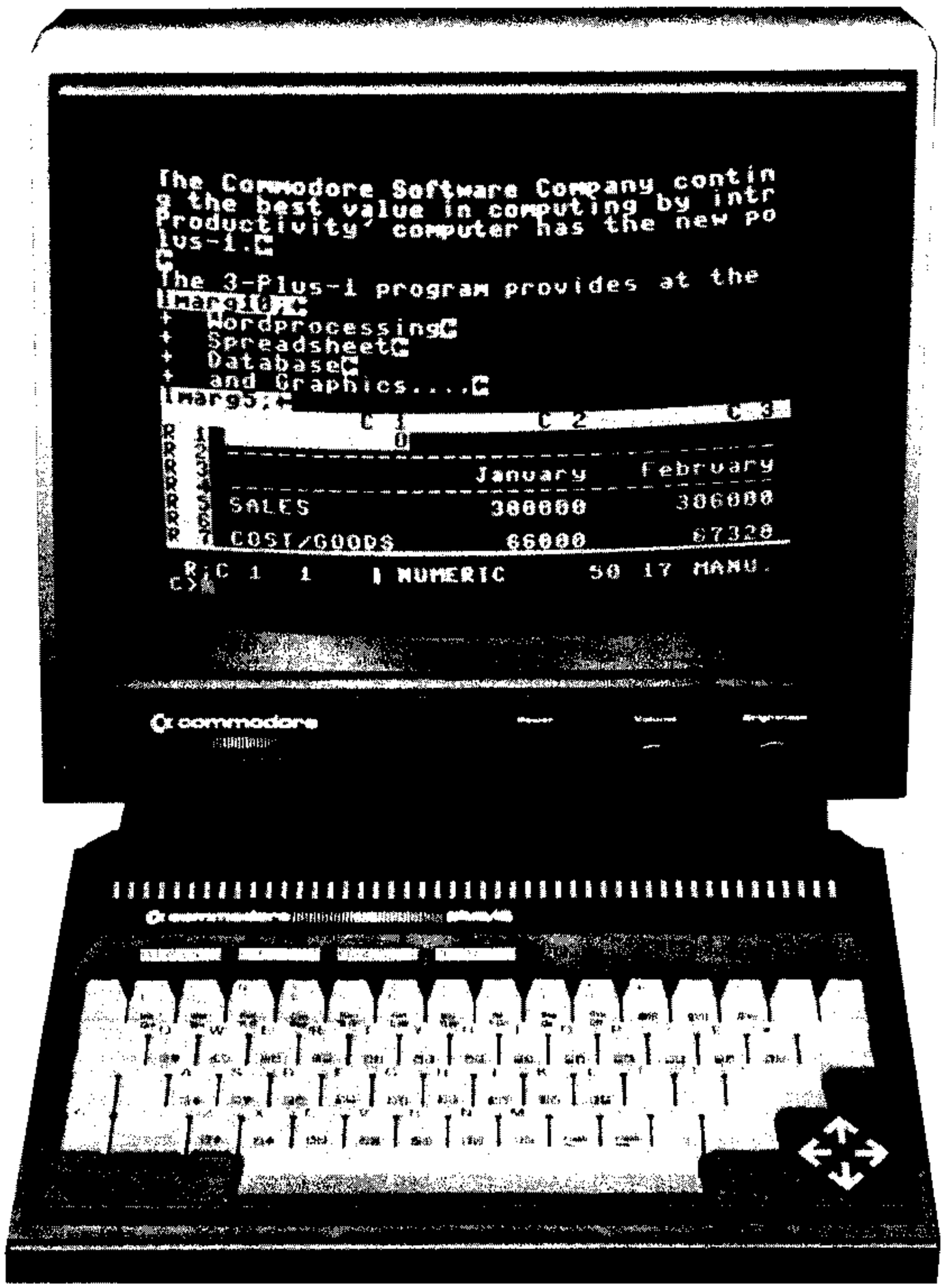


Fig. 1-1. The Commodore Plus/4 computer (Courtesy Commodore Business Machines, Inc.).

3. An electronic spreadsheet for charting and calculating groups of information, such as budgets, financial records, and diet programs.
4. A graph generator for drawing bar and point graphs that depict spreadsheet results that can be incorporated into a document written with the word processor.

You can get data from the file manager and the spreadsheet programs while you're writing a report using the word processor. Then you can draw graphs to illustrate the important results you calculated while using the spreadsheet. To do this, you just issue a simple command and go back and forth between the four programs.

The advantages of built-in software include the following features:

1. You don't have to use a disk drive or a cassette tape recorder. The software is permanently contained inside the computer and is always present for your use.
2. You don't have to worry about losing or damaging the software.
3. You don't have to wait while the software is loading into the computer memory.

Built-in 64K RAM Memory

The Plus/4 computer has just as much built-in memory as the Commodore 64. However, though both computers have 64K of RAM, the Plus/4 has over 60K bytes available for use, while the Commodore 64 has just less than 39K bytes available. This means that you can run and write longer programs and can store more data in the computer's memory.

A Variety of Add-On Equipment

Most of the Plus/4 peripherals are the same equipment used with the Commodore 64 and the VIC 20, but some of them are specially designed for the Commodore 16 and the Plus/4. This equipment is described below:

- The Commodore 1541 disk drive shown in Fig. 1-2 was made for the Commodore 64 and VIC 20, but it also works with the Plus/4.

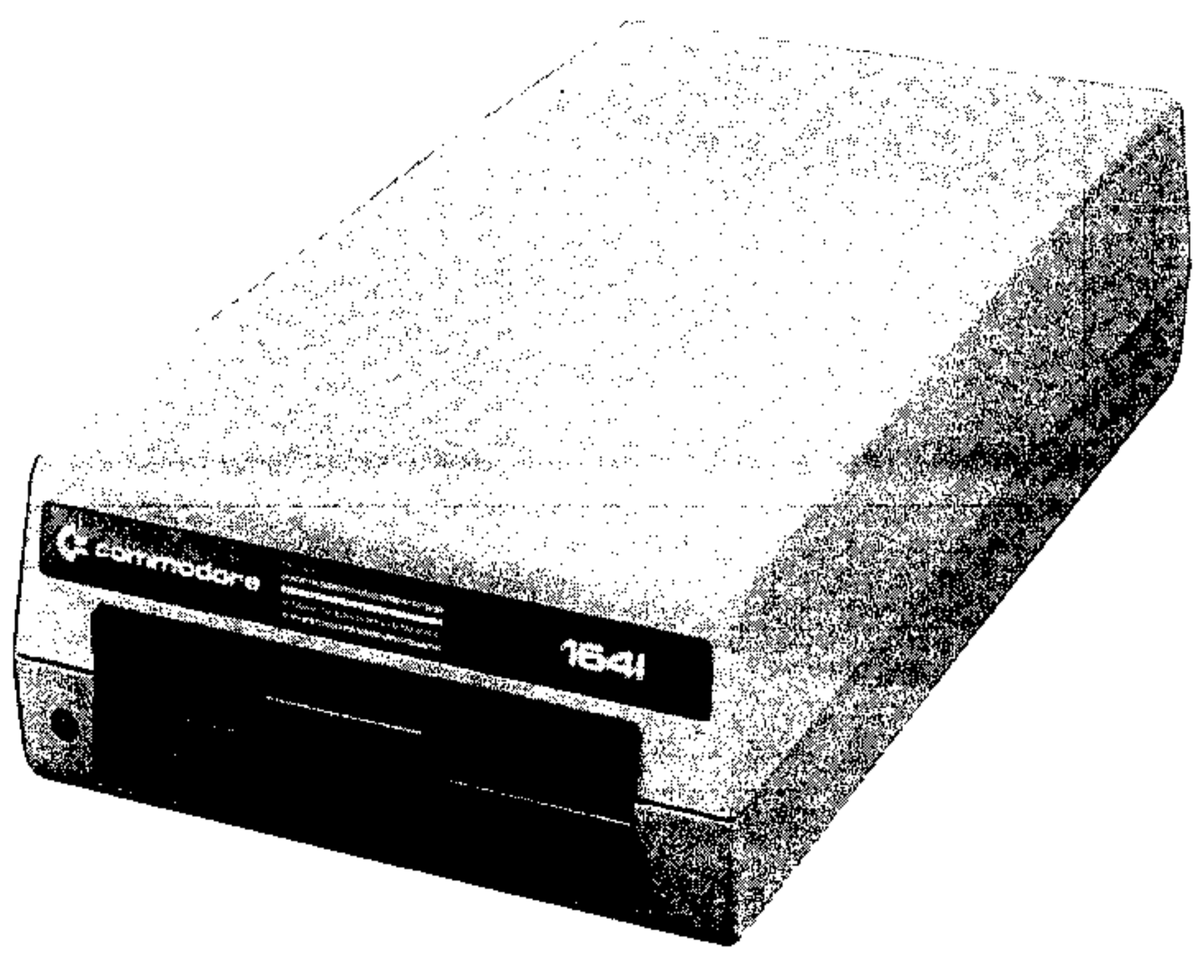


Fig. 1-2. Commodore 1541 disk drive (Courtesy Commodore Business Machines, Inc.).

- New and previously introduced printers, all of which work with all Commodore computers. These include the new MPS 802 dot-matrix printer (Fig. 1-3), and the 1520 printer/plotter (Fig. 1-4). You can also use printers made by other companies, though these usually require the additional purchase of a special interface cable.

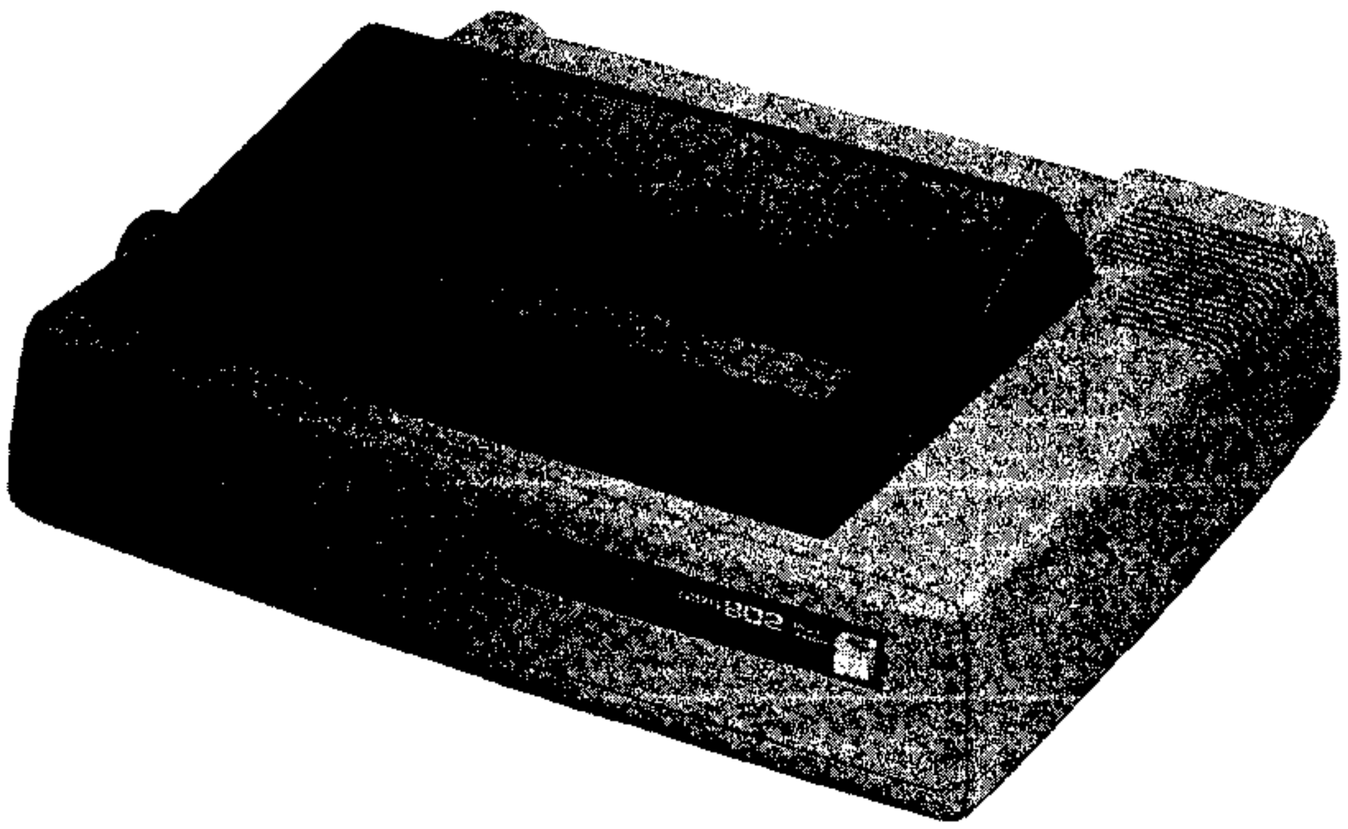


Fig. 1-3. Commodore MPS 802 printer (Courtesy Commodore Business Machines, Inc.).

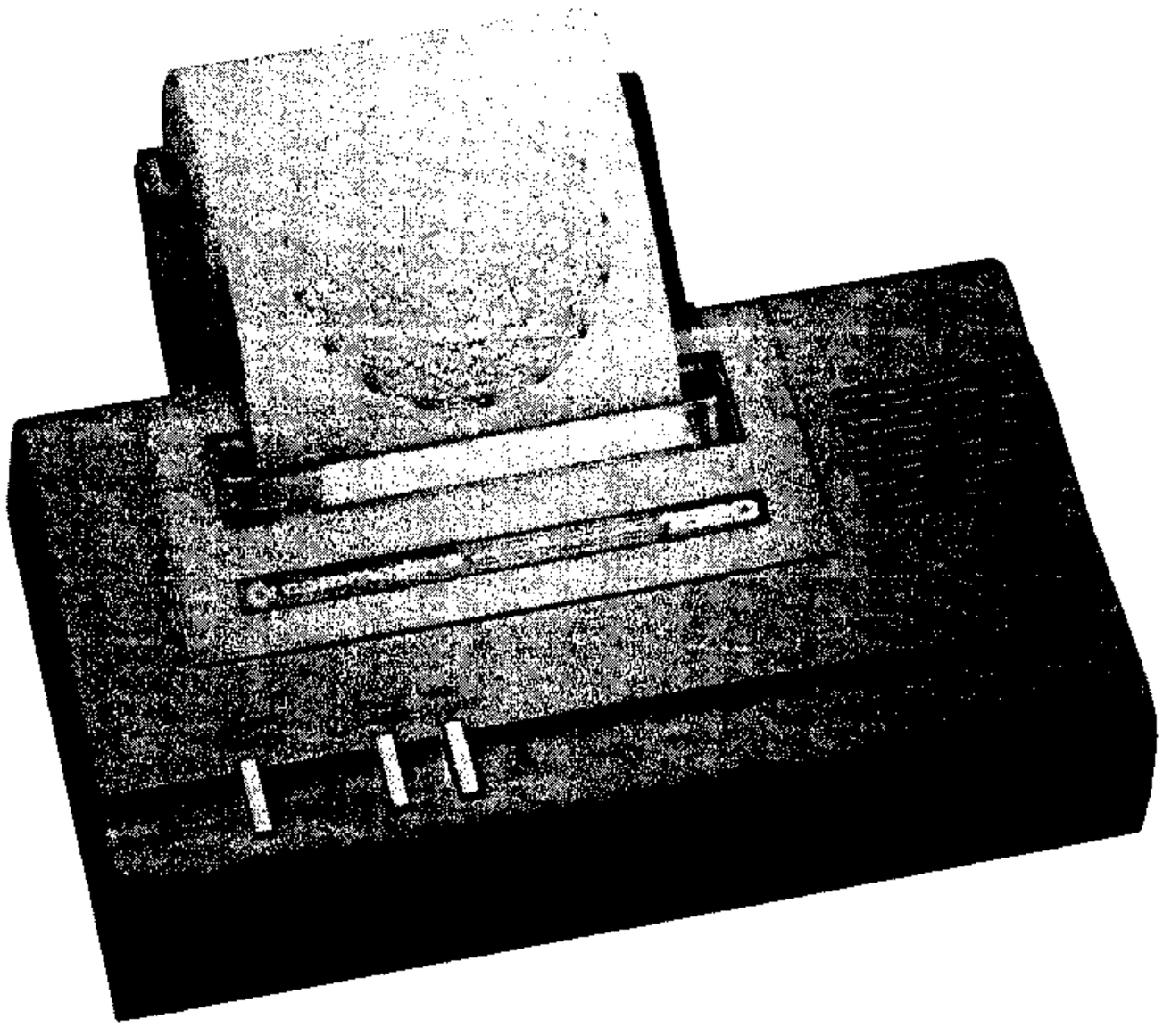


Fig. 1-4. The Commodore 1520 printer/plotter (Courtesy Commodore Business Machines, Inc.).

- The new 1531 Datassette™ cassette tape recorder (Fig. 1-5). Note that you can't use the Datassette™ that works with the Commodore 64 and the VIC 20. (Confusingly, that Datassette™

is called both the C2N and the 1530, but it's the same machine.)

- A monitor specially designed to display the pictures that computers produce (Fig. 1-6). Commodore makes several, but any monitor can be plugged into your Plus/4 computer. (By using the tv switchbox and rf cable that come with the Plus/4, you can use a television set to display the computer video.

In Chapter 3, we'll explain more about these and other devices.

Fig. 1-5. The 1531 Datassette recorder (Courtesy Commodore Business Machines, Inc.).

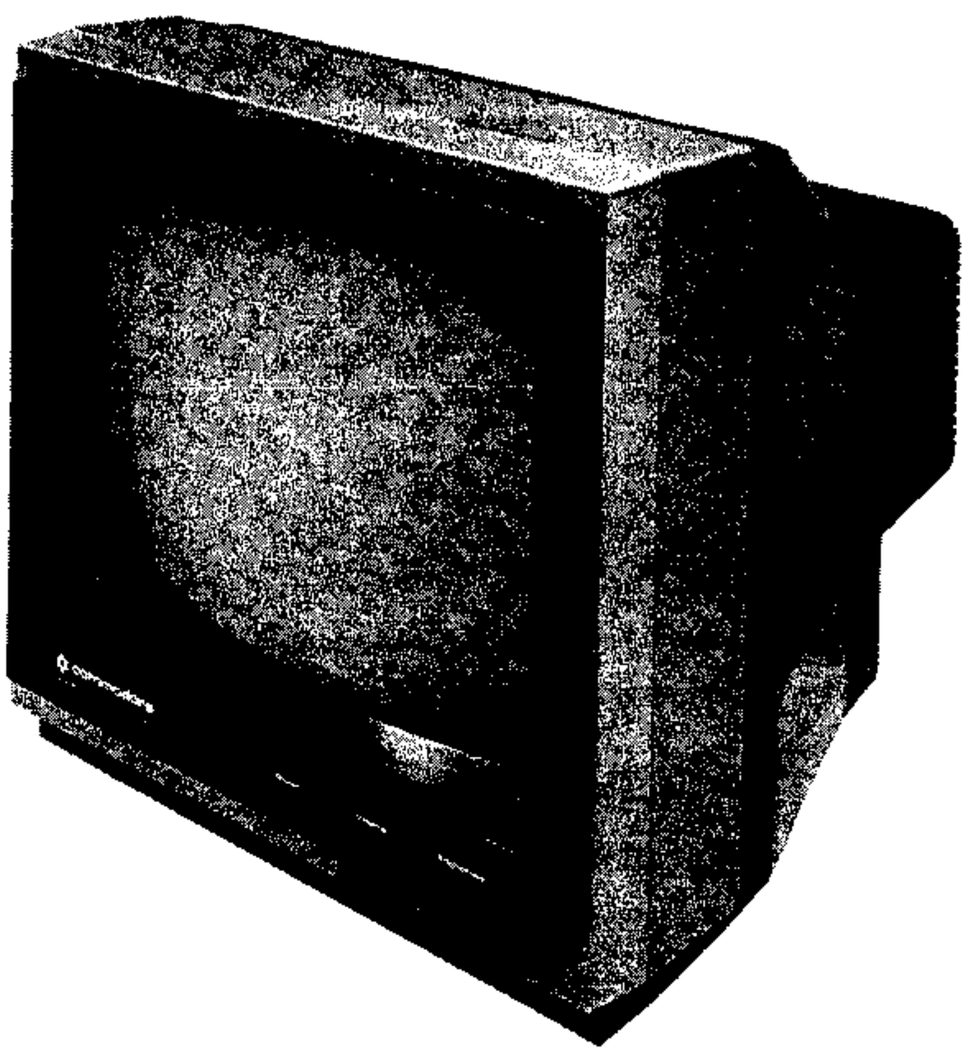


Fig. 1-6. A Commodore monitor (Courtesy Commodore Business Machines, Inc.).

Compatibility With the Commodore 16

The Plus /4 computer is compatible with Commodore's other new home computer, the Commodore 16. All the software for the Commodore 16 will also run on the Plus/4. In addition, all the peripheral computing equipment is interchangeable. There are two major features that distinguish the Plus/4 and the Commodore 16:

1. The Commodore 16 has 16K of built-in RAM memory, while the Plus/4 has 64K of built-in RAM memory.
2. The Plus/4 has built-in software; the Commodore 16 does not.

The built-in software and larger memory of the Plus/4 make it the more sophisticated machine.

Comfortable Easy-To-Use Keyboard

If you're going to use your computer often, especially for word processing, the quality of the keyboard is very important. Some home computers have keys that are more like those on a calculator than on a typewriter and after a while you notice the difference. The Plus/4 computer has a typewriter-quality keyboard, which means that the keys are large, well-spaced, and curved (concave) to fit your fingers comfortably. The keyboard is shown in Fig. 1-7.

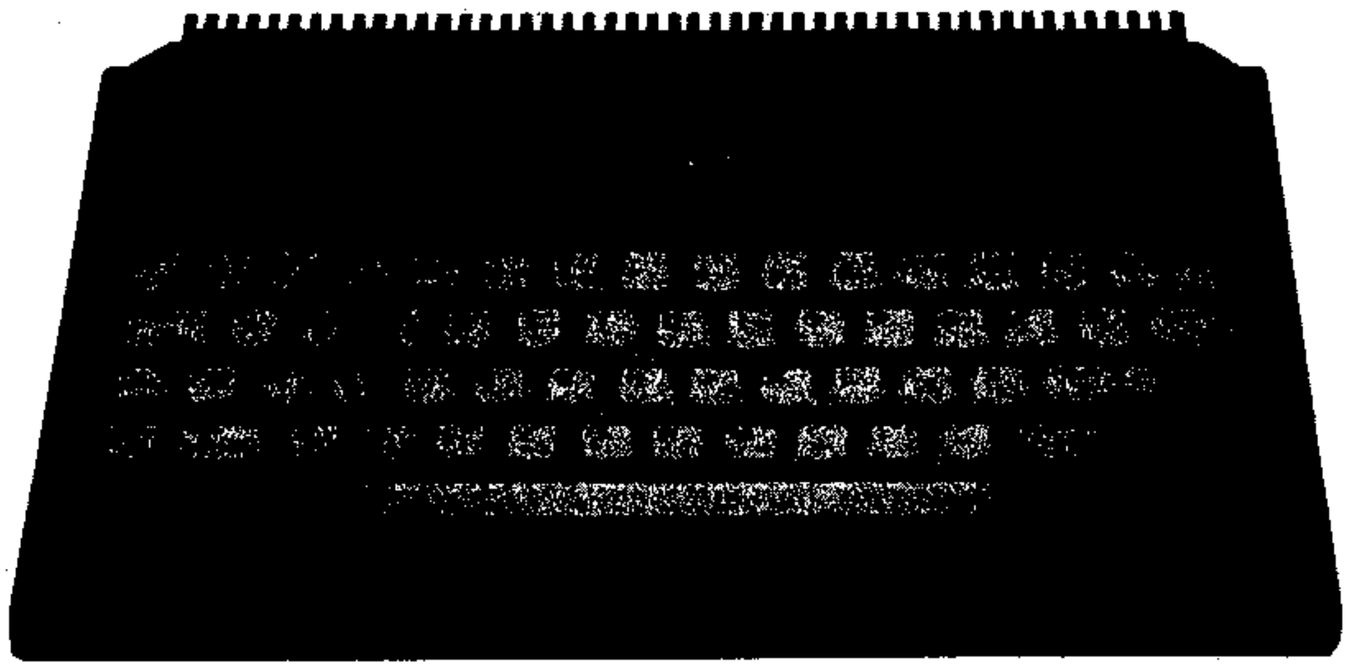


Fig. 1-7. The Commodore Plus/4 keyboard (Courtesy Commodore Business Machines, Inc.).

Four Separate Cursor Keys

The place on the screen where you are entering data can be controlled by the cursor keys. These keys are arrow-shaped and are detached from the other keys so they're easy to find. They are located in the lower right-hand corner of the keyboard. You don't have to take your eyes off the screen or use the SHIFT key in order to move the cursor quickly around the screen.

121 Colors

The Commodore Plus/4 has 16 basic colors available. They are given in the following list.

1	Black	9	Orange
2	White	10	Brown
3	Red	11	Yellow-Green
4	Cyan	12	Pink
5	Purple	13	Blue-Green
6	Green	14	Light Blue
7	Blue	15	Dark Blue
8	Yellow	16	Light Green

Each of the sixteen colors (except black) has eight shades, called luminances. Commodore says that you can get 128 colors (16 colors times 8 shades), but black only comes in one shade (what, after all, is light black?). So there are actually 121 colors (15 colors times 8 shades, plus black). Still, 121 are a lot of colors.

You might also wonder what dark white could be. The luminances of white are from bright white to grey. Lest you assume that some color shades repeat, be assured that, for example, there is no shade of BLUE (color 7) that is the same as any shade of DARK BLUE (color 15).

You can select colors (but not shades) directly from the keyboard. This is explained later in Chapter 7. You can select colors and shades using the very simple COLOR command. You can select the color of the screen background, the border, and the characters that appear on the screen. When you are in one of the high-resolution or multicolor graphics modes, you can select additional screen colors.

Programmed Function Keys

These keys speed up the loading of software, the saving and listing of programs, and the performance of other repetitious tasks. Function key [F1] loads the built-in software programs.

Most of the function keys will have different functions when you are using commercial software. Software developers normally use the function keys to display menus instantly, to change screen colors, to print results on a printer, etc. In addition, you can easily program these keys to do what you want them to do. It is much easier to program the function keys on the Plus/4 computer than it is to program the Commodore 64 function keys. Later, in Chapter 9, you will learn how simple it is to program the function keys.

The [HELP] Key

This special function key helps diagnose errors when you are

writing a program in BASIC. When you are using commercial software, the [redacted] key gives other kinds of assistance; usually the [redacted] key is used to display a brief description of the keys and commands used in the program.

A Powerful and Sophisticated Version of BASIC

BASIC 3.5, which is the computer language built into the Plus/4 computer, is an easy-to-learn set of commands for telling the computer what to do. This expanded version of BASIC contains over 75 commands, including:

- Graphic plotting commands, such as CIRCLE, BOX, and PAINT.
- Easy-to-use SOUND and COLOR commands.
- Commands for dual disk drives, such as BACKUP and COPY.
- Print-formatting commands, such as PRINT USING and PUDEF.
- Structured BASIC commands, such as DO, LOOP, WHILE, and UNTIL.
- Debugging commands, such as TRAP, TRON, and TROFF.

All the BASIC commands are listed and briefly described in Appendix A.

Built-in Drawing Commands

These commands are easy to learn. With these commands, you can draw both simple shapes and intricate designs. For example, all you do to draw a box is give the X,Y coordinates for the top left corner and the bottom right corner. The command BOX, 10,20 100,100 draws a rectangle, as shown in Fig. 1-8.

Four Graphic Modes

Each of the four graphic modes lets you choose different conditions and features for designing pictures on your screen.

High-Resolution Graphics

In this mode, you can control each of the 64,000 dots that make up your screen. This means you can draw highly detailed pictures.

Split-Screen High-Resolution Graphics

In this mode, the top three quarters of the screen displays graphics and the bottom of the screen displays up to five lines of text. You can see the commands you type in at the same time that you see the design you commanded your computer to draw. Fig. 1-9 illustrates the split-screen high-resolution mode.

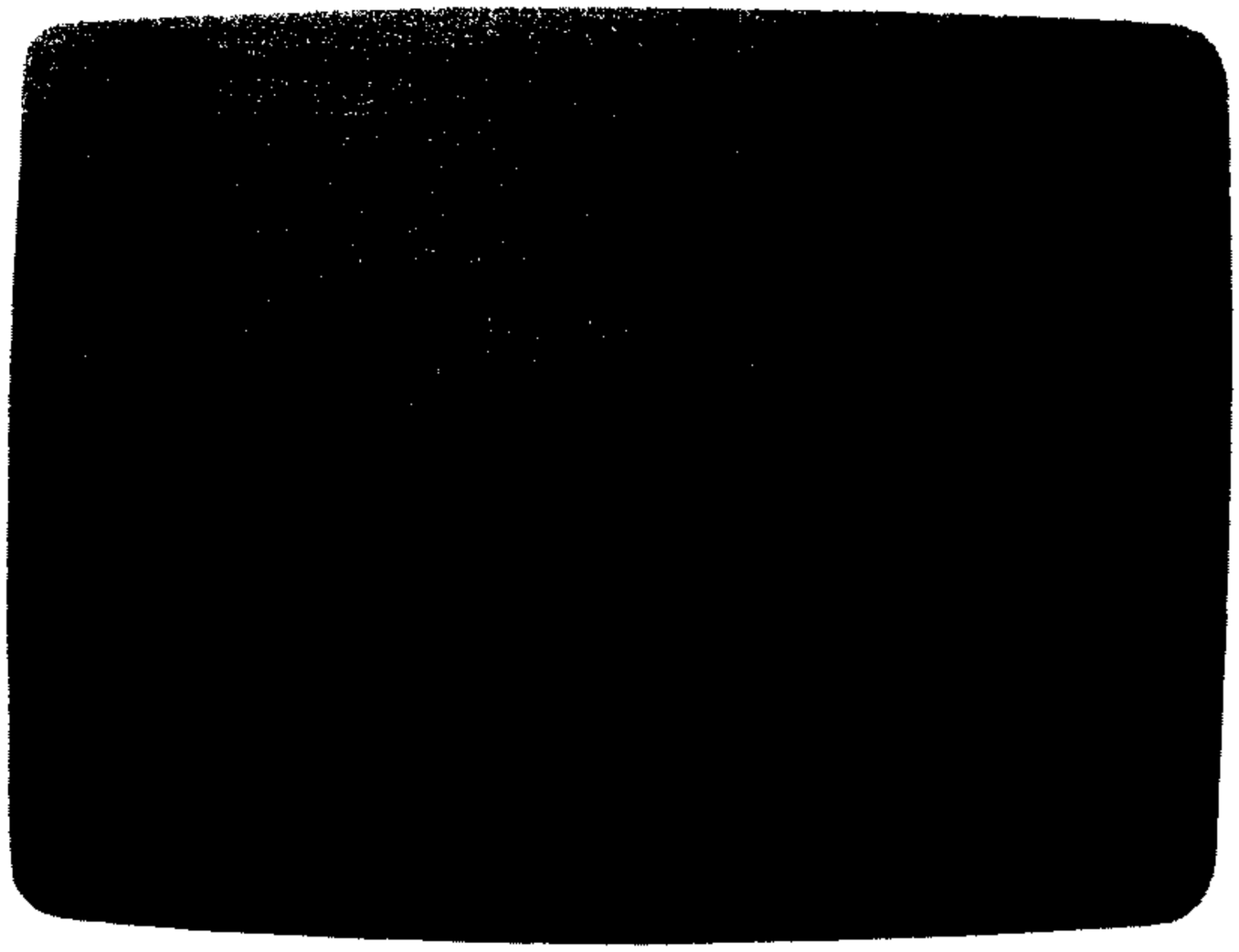


Fig. 1-8. A rectangle drawn using the BOX command.

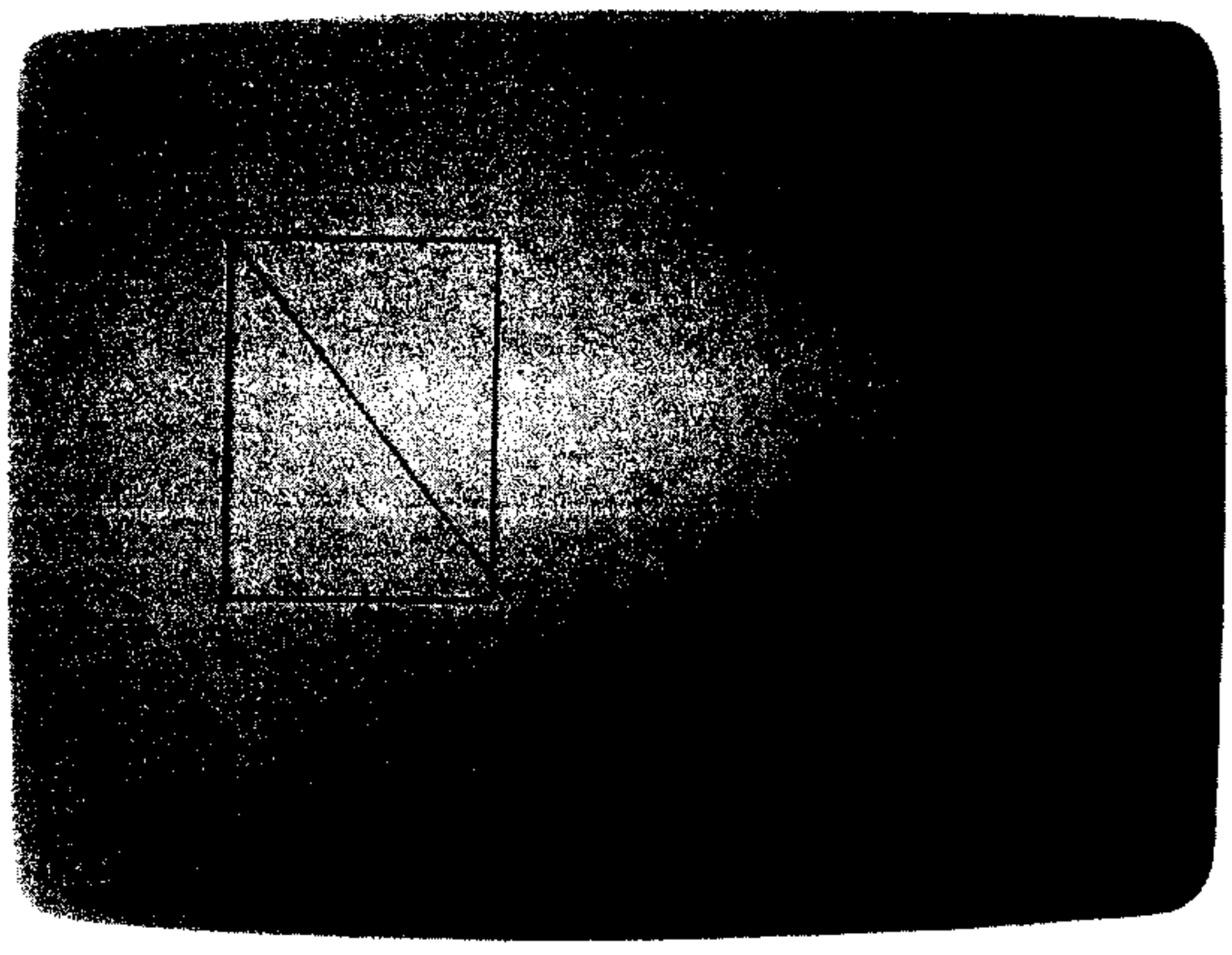


Fig. 1-9. Drawing in the split-screen high-resolution graphic mode.

Multicolor Graphics

In this mode, you can use more color in your designs than is possible in the high-resolution mode. However, each dot on the screen is twice as wide, so you can control only half as many dots (32,000).

Split-Screen Multicolor Graphics

Like the split-screen high-resolution mode, this mode displays

graphics in the top three quarters of the screen and displays up to five lines of text at the bottom of the screen.

The short programs given in Figs. 1-10 through 1-13 demonstrate the power and simplicity of the graphic commands that are built into the Plus/4 computer.

```
5 GRAPHIC 1,1
10 FOR X = 40 TO 80
20 X = X + 10
30 CIRCLE, 100, 100, 60, X
40 NEXT X
```

Fig. 1-10. Circular graphic design drawn by the CIRCLE command.

```
5 GRAPHIC 1,1
10 FOR X = 20 TO 90
20 X = X + 10
30 CIRCLE, 100, 80, X, 50
40 NEXT X
```

Fig. 1-11. Second circular graphic design drawn by the CIRCLE command.

```
5 GRAPHIC 1,1
10 FOR X = 10 TO 100
20 X = X + 10
30 Y = Y + 10
40 BOX, 50,50, X,Y
50 NEXT X
```

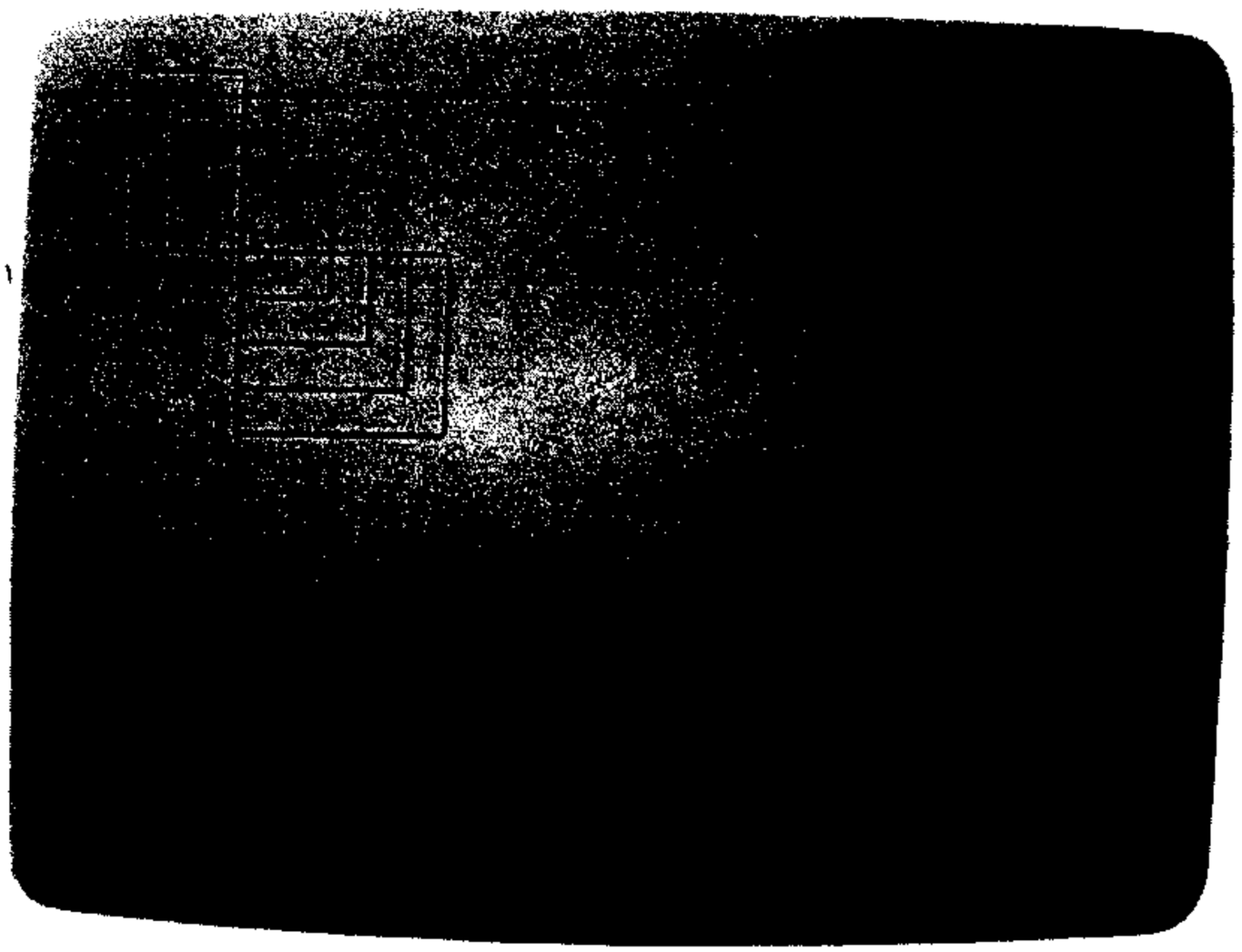


Fig. 1-12. Graphic design drawn by the BOX command.

```
5 GRAPHIC 1,1
10 FOR X = 10 TO 360
20 X = X + 50
30 BOX, 50, 50, 100, 100, X
40 NEXT X
```

Fig. 1-13. Second graphic design drawn by the BOX command.

In addition to the high-resolution and multicolor graphic modes, the Plus/4 keyboard contains a full set of graphic symbols that you

can use to create a variety of designs. These keys are explained in detail in Chapter 7.

Screen Windowing

This feature lets you separate part of the screen into a smaller work area. By using this feature, you can create a smaller screen, or window, within the regular screen that your computer displays. A screen window is shown in Fig. 1-14.

After you follow the simple steps for setting a screen window, everything you type will appear inside the window. Whatever appears on the rest of the screen is not affected. Chapter 7 will explain more about screen windows, including how to set and how to clear them.

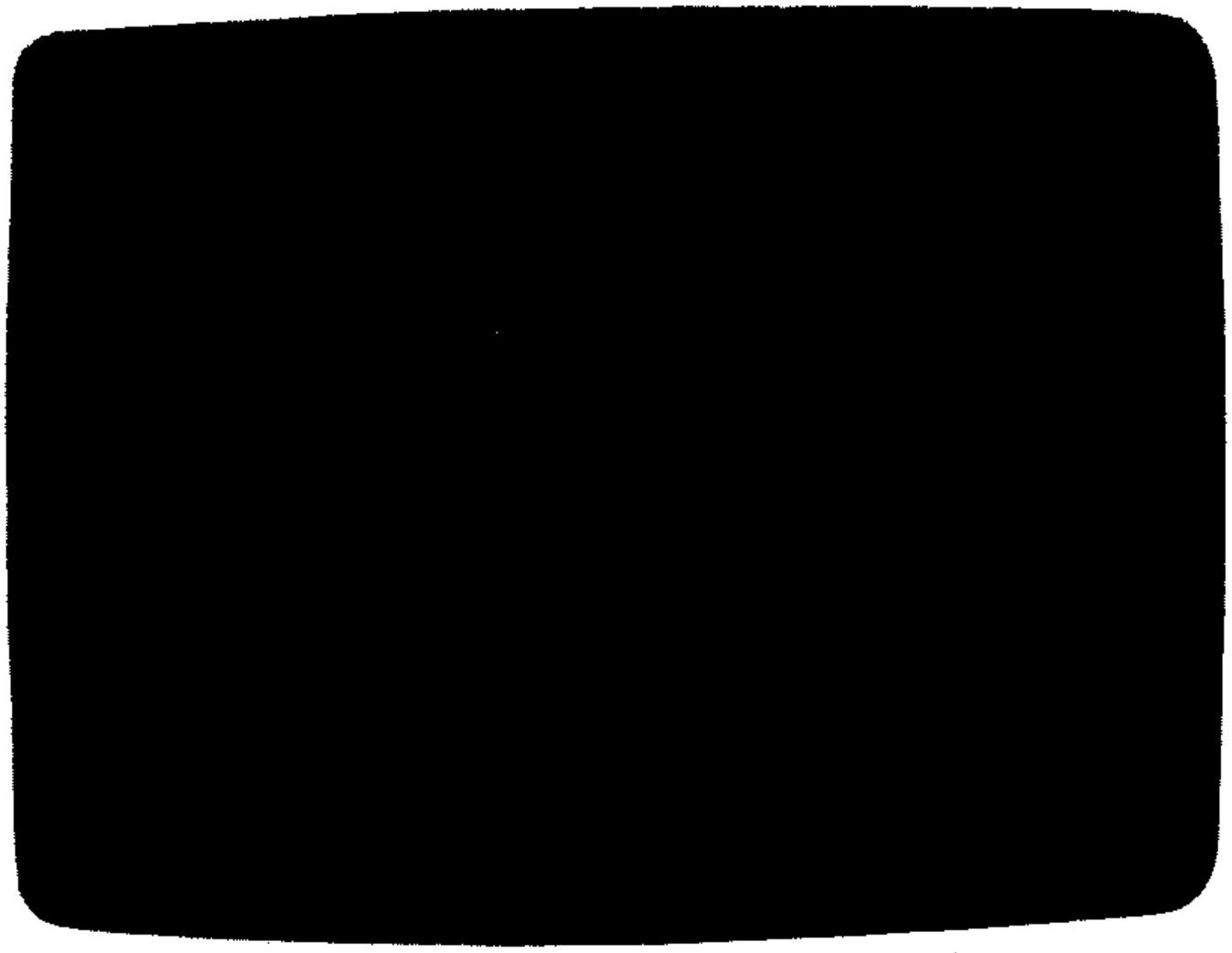


Fig. 1-14. Text displayed in a Screen Window.

Other Features

In addition to the preceding, the Plus/4 computer offers the following features:

- A 40-column by 25-line screen display.
- Color selection from keys or from the COLOR command.
- A large selection of graphic symbols displayed on the fronts of the keys.
- Reversed-image characters.

- Flashing characters, which you can also combine with reversed imaging to display characters that flash in reversed image.
- Two sound generators so you can create music and sound effects with the simple Sound and Volume commands.
- A built-in machine-language monitor with 13 commands.

Just use the MONITOR command to leave BASIC, and the X command to return to BASIC. The machine-language commands are listed and briefly described in Appendix B.

PLUS/4 PORTS AND SWITCHES

The peripherals you connect to the Plus/4 computer are installed in various outlets, called *ports*, that are located on the back and sides of the computer. Though some of the ports look alike, they have different configurations that prevent you from plugging a peripheral into the wrong port. For example, the SERIAL BUS and VIDEO ports appear to be the same but, if you look closely, you will notice that each one has a different number and arrangement of holes.

You'll be introduced to each port and switch on the computer individually, as you are shown how to connect peripherals. Fig. 1-15 shows each of the ports on the back of the Plus/4 computer.

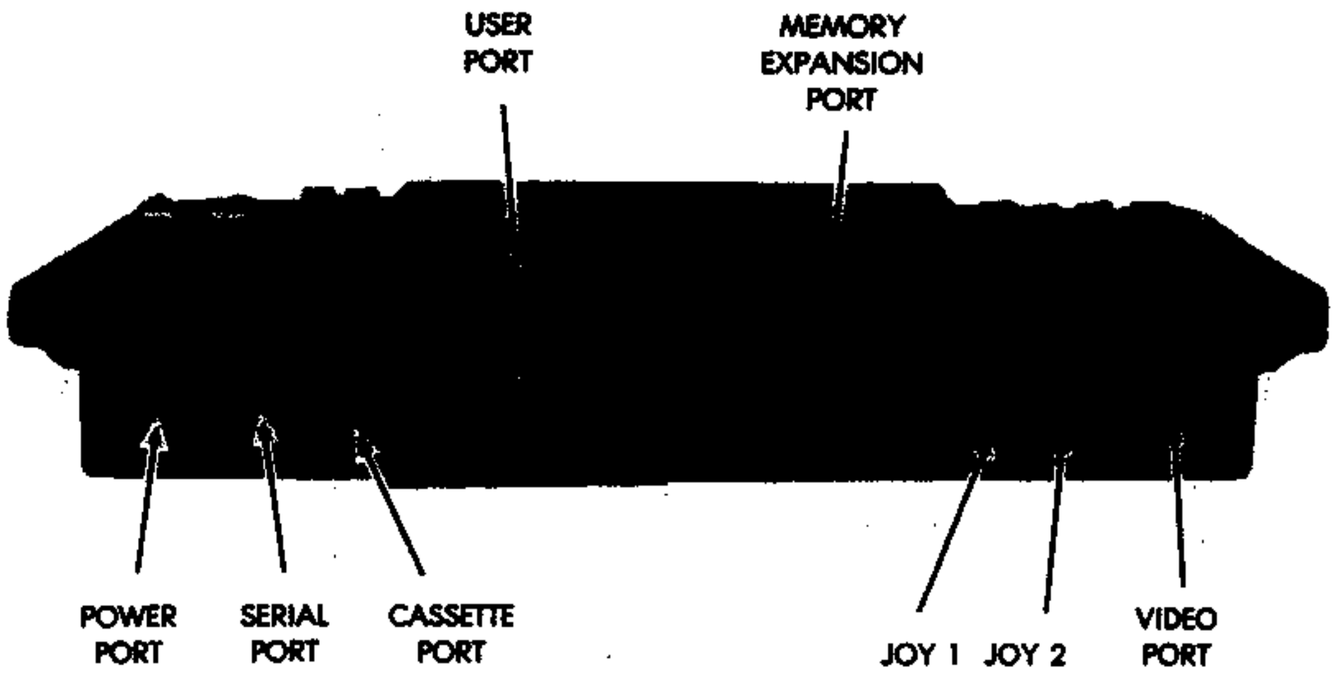
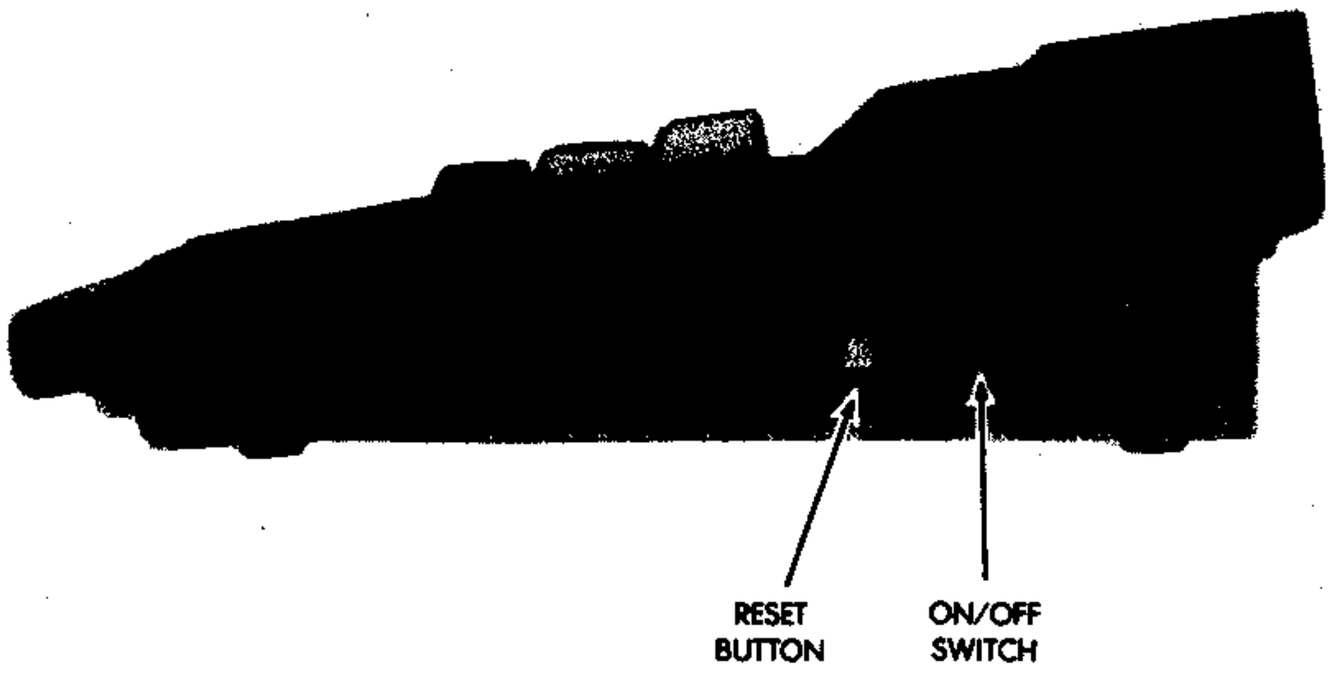


Fig. 1-15. Ports on the back of the Plus/4 computer (Courtesy Commodore Business Machines, Inc.).

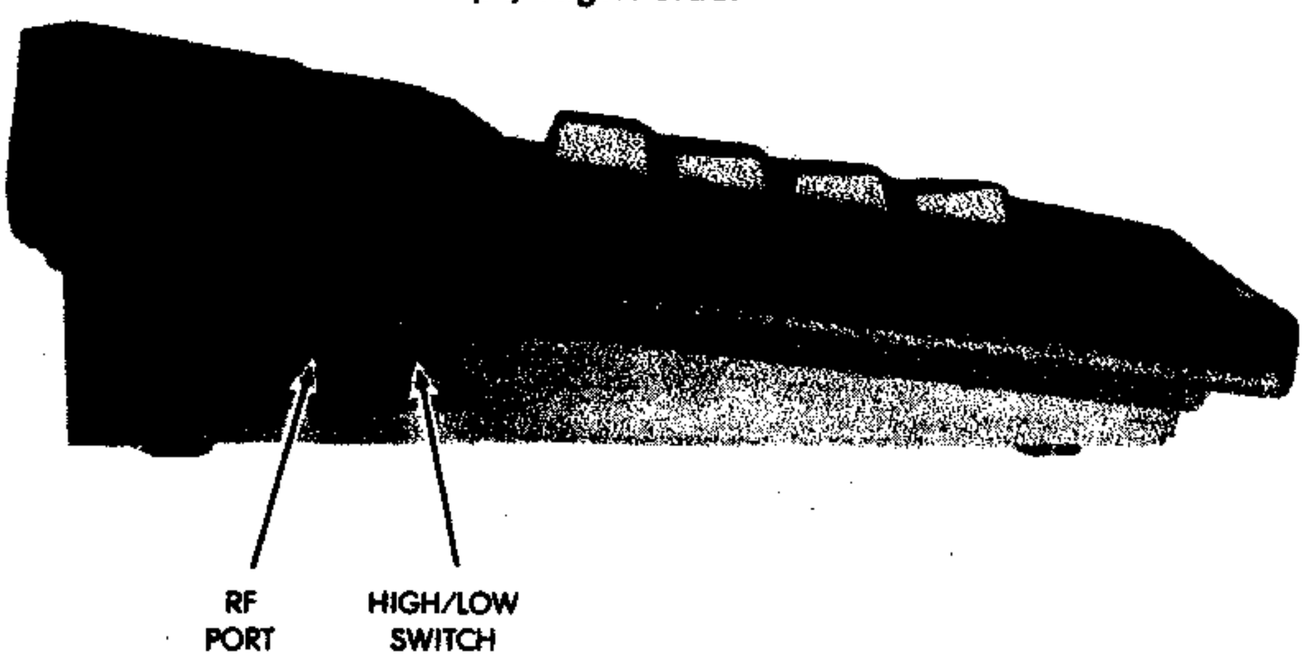
- POWER PORT: Connects the power-supply cable to the computer.
- SERIAL PORT: Connects a disk drive or a serial printer to the computer.
- CASSETTE PORT: Connects the Datassette cassette tape recorder to the computer.

- RS-232C PORT: Connects RS-232C peripherals, such as a modem.
- MEMORY EXPANSION PORT: Connects cartridges and most interface cables to the computer.
- JOY 1 and JOY 2: Connect joysticks to the computer.
- VIDEO PORT: Connects a video monitor to the computer.

Figs. 1-16A and 1-16B show the switches and rf port on the sides of the Plus/4 computer.



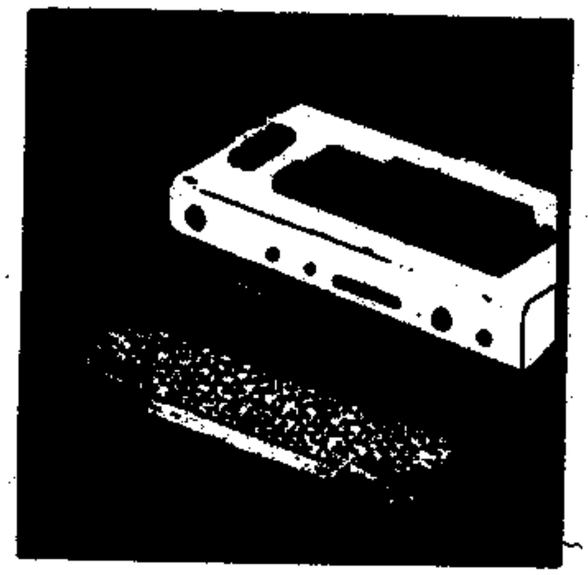
(A) Right side.



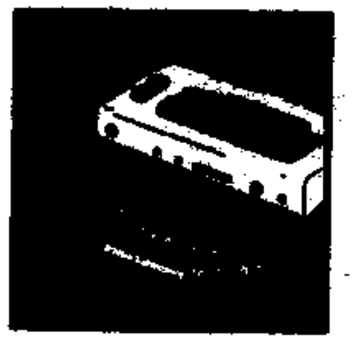
(B) Left side.

Fig. 1-16. Switches and port on the sides of the Plus/4 computer.

- RESET BUTTON: Clears the screen and the computer memory.
- ON/OFF SWITCH: Turns the computer on and off.
- RF PORT: Connects the rf cable to the tv switchbox.
- HIGH/LOW SWITCH: Selects Channel 3 (LOW) or Channel 4 (HIGH) for video display on a television set. Not used with monitors.



THE PLUS/4 VS. OTHER MICRO-COMPUTERS



As you've learned from Chapter 1, the Commodore Plus/4 computer offers quite a few unique features that distinguish it from its sibling, the Commodore 64. These features include:

- Built-in software.
- Programmed function keys.
- A [redacted] key.
- Built-in machine-language monitor.
- A much more advanced and easier-to-use version of BASIC.
- Built-in drawing commands.
- Screen windowing.
- 121 different colors.
- Separate cursor keys.
- Split-screen graphics.
- Escape-key functions for editing what you type in.

There are a number of similarities between the Plus/4 and the Commodore 64. One notable similarity is the amount of RAM memory built into the Plus/4 and the Commodore 64 — 64K for each machine. However, the Commodore 64 has only about 39K of available RAM in BASIC, while the Plus/4 has 60K available. To help you understand the differences between the Plus/4 and the Commodore 64, Table 2-1 compares the important features of the two computers.

Table 2-1. Comparison of the Plus/4 and Commodore 64 Computers

Feature	Plus/4	Commodore 64
Built-in RAM (usable memory)	64K	64K
Available RAM (in BASIC)	60671 bytes	38911 bytes
Number of keys on keyboard	67, plus a [redacted] button	66
Cursor keys	4	2
Function keys	8, programmed	8, unprogrammed
Function key programming	1 command (KEY)	Command sequence
[redacted] key	Yes	No
High-resolution graphics	Yes	Yes
Multicolor graphics	Yes, 2 modes	Yes, 1 mode
Split-screen graphics	Yes, 2 modes	No
Sprite graphics	No	Yes
Sound generators	2	3
Built-in BASIC	Yes, over 75 commands	Yes, over 35 commands
Built-in software	Has an integrated 4-program package	Not available
Built-in machine-language monitor	Yes, 13 commands	No
Built-in drawing commands	Yes	No
Structured BASIC commands	Yes	No
Screen windowing	Yes	No
Colors	121	16
Escape-key editing functions	18	No

PLUS/4 PERIPHERALS

You'll read about add-on computing equipment for the Plus/4 computer in Chapter 3. As you'll learn, much of the computing equipment (called peripherals) that works with the Commodore 64 and the VIC 20 will also work with the Plus/4 computer. Some items, however, are not compatible. Table 2-2 lists which equipment works with all Commodore home computers and which

is designed just for use with the Plus/4 (and the Commodore 16) computers. Table 2-3 compares the features of the Plus/4 computer to the features of several other home computers.

Table 2-2. Peripheral Compatibility

Peripheral	Plus/4	Commodore 64	VIC 20
Commodore color monitors* (1700 and 1800 series)	Yes	Yes	Yes
1541 disk drive	Yes	Yes	Yes
1530 Datassette	No	Yes	Yes
1531 Datassette	Yes	No	No
1525 and 1526 dot-matrix printers	Yes	Yes	Yes
MPS 801/802/803 dot-matrix printers	Yes	Yes	Yes
1520 printer/plotter	Yes	Yes	Yes
Parallel printers (with interface)	Yes	Yes	Yes
1600 VICModem	No	Yes	Yes
1650 Automatic Modem	No	Yes	Yes
Modem/300	Yes	No	No
Commodore 64 joysticks	No	Yes	Yes
C-16 and Plus/4 joysticks	Yes	No	No
IEEE-488 interface cable	Yes	Yes	Yes

*Commodore makes several color monitors, including the 1701, 1702, and 1802. Each model is fully compatible with the Plus/4 computer.

Table 2-3. Comparison of Home Computer Features

	PLUS/4	COMMODORE 16	ATARI 800XL	TRS-80 COLOR 2	APPLE IIe
Built-in software	Yes	No	No	No	No
RAM	64K	16K	64K	64K	64K
Built-in BASIC	Extended	Extended	Limited	Extended	Limited
Function keys	8	8	1	No	No
[redacted] key	Yes	Yes	Yes	No	No
Cursor keys	4, separate	4, separate	4, not separate	Yes	Yes
Total keys	67	67	62	53	62
Keyboard graphics	Yes	Yes	No	No	No

SUMMARY OF THE PLUS/4 FEATURES

Built-in Software

The integrated software built into the Plus/4 computer combines several complementary software programs in one package. You can move between the programs and use them together. This integrated package contains four programs:

1. A word processor.
2. A file manager.
3. An electronic spreadsheet.
4. A graphing generator.

Add-On Equipment

Most of the following peripherals are the same equipment as used with the Commodore 64 and the VIC 20, but some is specially designed for use with the Plus/4 and the Commodore 16. This equipment includes:

- The Commodore 1541 disk drive.
- New and previously introduced printers, all of which work with all Commodore computers. You can also use non-Commodore printers.
- A new Datassette cassette tape recorder, the 1531. The 1530/C2N Datassette that works with the Commodore 64 and the VIC 20 does not work with the Plus/4 computer.
- A monitor that is specially designed to display the pictures that computers produce.
- Specially designed joysticks that work only with the Plus/4 and the new Commodore 16 (Fig. 2-1).

The Keyboard

The Plus/4 computer has a typewriter-quality keyboard (Fig. 2-2). It is comfortable, easy-to-use, and has 67 keys. This includes the four separate cursor keys. These keys are arrow-shaped and are located separately from the other keys so they're easy to find. Also included in the 67 keys are the programmed Function keys. These keys speed up the loading of software and the performance of other repetitious tasks. Function key ≡F1≡ loads the built-in software programs. However, when you are using commercial software, these keys have different functions, such as instantly displaying menus, printing results on a printer, etc. One of the

Function keys is the [HELP] key. This special Function key helps diagnose errors when you are writing a program in BASIC. When you are using commerical software, the [HELP] key gives other kinds of assistance. In addition, you can reprogram these keys to do what you want them to do.

Fig. 2-1. Joysticks for the Plus/4 and Commodore 16 computers (Courtesy Commodore Business Machines, Inc.).

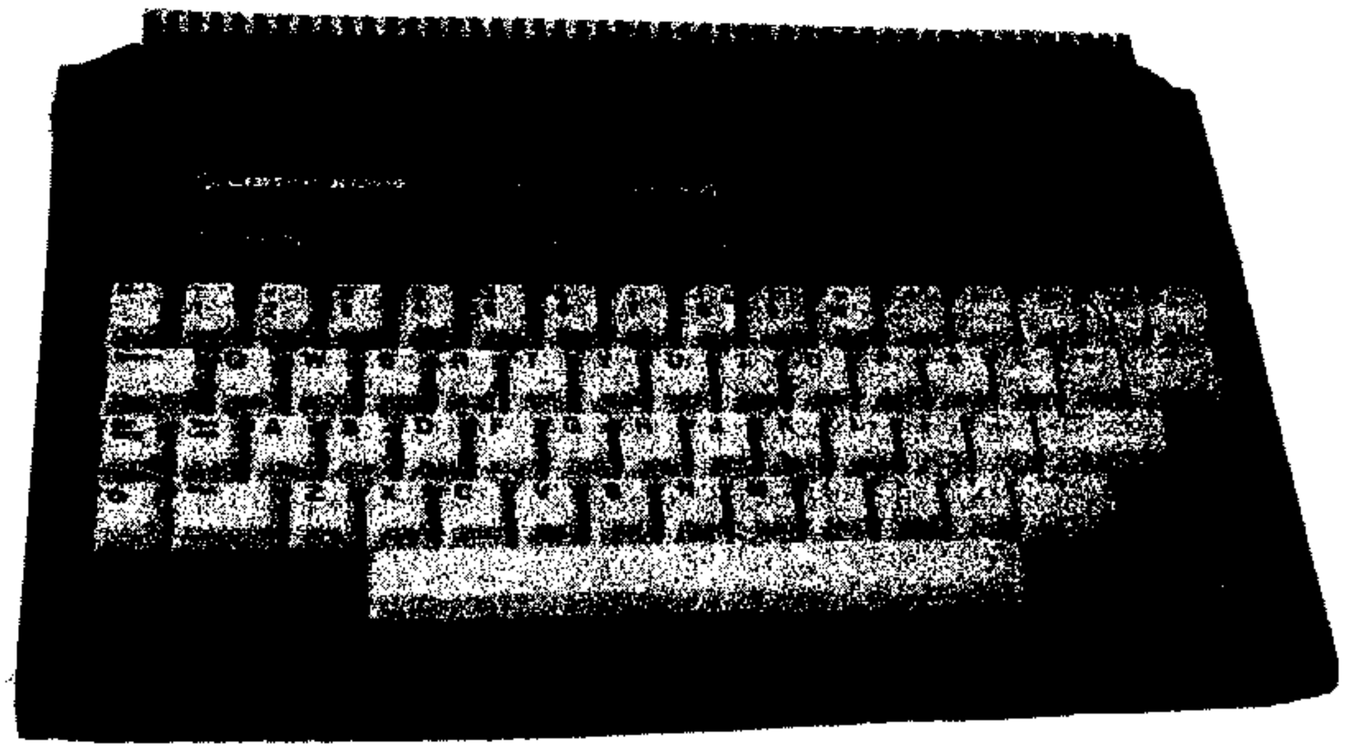


Fig. 2-2. The Plus/4 keyboard.

121 Colors

The Plus/4 computer has sixteen basic colors. Each of the sixteen colors (except black) has eight shades, called luminances. This provides 121 colors.

BASIC 3.5

BASIC 3.5 is the computer language that is built into the Plus/4 computer. This expanded version of BASIC contains over 75 commands, including:

- Graphic plotting commands, such as CIRCLE, BOX, and PAINT.
- Easy-to-use SOUND and COLOR commands.
- Commands for dual disk drives, such as BACKUP and COPY.
- Print-formatting commands, such as PRINT USING and PUDEF.
- Structured BASIC commands, such as DO, LOOP, WHILE, and UNTIL.
- Debugging commands, such as TRAP, TRON, and TROFF.

Built-in Drawing Commands

With these easy-to-learn commands, you can draw both simple shapes and intricate designs.

Graphics

Using the four graphic modes, you can choose different conditions and features for designing pictures on your screen:

- High-resolution graphics.
- Split-screen high-resolution graphics.
- Multicolor graphics.
- Split-screen multicolor graphics.

Screen Windowing

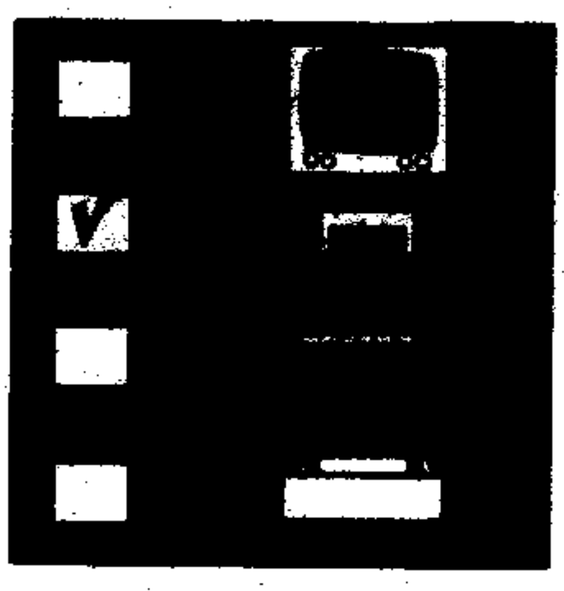
This new feature lets you isolate part of the screen to get a separate smaller work area.

Other Features

In addition, the Plus/4 computer offers the following features:

- Color selection from keys or from the COLOR command.
- A variety of graphic characters (identified by symbols on the fronts of the keys).
- Reversed-image characters.

- Flashing characters.
- Two sound generators.
- A built-in machine-language monitor with 13 commands.



HOW TO CHOOSE ADDITIONAL COMPUTING EQUIPMENT

The Plus/4 computer offers a variety of useful, entertaining, and interesting features. However, you will need software to make your computer really useful. Software is the set of instructions that makes your computer perform special tasks, such as electronic bookkeeping, word processing, or teaching the alphabet to pre-schoolers. Your Plus/4 computer contains built-in software, but you'll certainly want some additional programs.

Chapter 5 shows you how the built-in software works and, then, in Chapter 6, you'll learn more about other available types of software. In this chapter, you'll learn about the computing equipment, or hardware, that you will need to run and record software, make printed copies of your work, communicate with other computers over telephone lines, display video from your computer, and perform other computer functions.

RUNNING AND RECORDING SOFTWARE

Some software comes built into your computer. Besides the integrated software package of four programs that's built into your Plus/4 computer, the BASIC language that is built into your computer is also a software program. (Some home computers do not have BASIC language built in.)

In addition, the Plus/4 computer has built-in drawing and music commands that are similar to the Super Expander software that is available for the VIC 20. The Plus/4 has a built-in machine-language monitor that lets you program in machine language, which is a sophisticated and high-speed programming language.

Software packages that you buy come in three forms:

1. On a cartridge.
2. On a cassette tape.

3. On a floppy disk (also called a diskette).

Each type of software package is loaded into the computer memory by a different procedure. To use tapes and disks, you need additional computing equipment.

CARTRIDGES

Software cartridges plug directly into your computer, so no additional computing equipment is required. However, you can't use cartridges for recording programs and other information without buying a lot of expensive special equipment. Chapter 4 offers some additional tips about using cartridges.

CASSETTE RECORDERS

Some commercial software comes on cassette tape. These cassette tapes are just like the tapes that play recorded music but, instead of music, tapes that are recorded with software hold recordings of signals that a computer can understand..

This chapter contains information about the Datassette tape recorder, the machine you use to play and record programs on tape. Other information on using cassette tapes is also included.

Software on Cassette Tapes

You should be aware that most software companies don't generally give you a choice of buying their product on cartridge, cassette, or disk. Usually, each product is offered on only one medium. Powerful programs, such as word processors and financial packages, are generally not available on cassette because the programs are too long to fit onto a tape. The cassette tapes used to store computer programs cannot hold as much information as floppy disks can.

If you plan to use a cassette tape recorder for playing commercially recorded software, be sure to find out what software is available on cassette before you buy the recorder. Generally, cassette-based software is limited to simple versions of educational programs and games and what are called "life style" programs, such as menu planners, IQ tests, and personality evaluation quizzes.

Any complex program, such as a word processor, that is offered on tape is going to be a watered-down version. If you only want a simple word processor, however, you shouldn't reject cassettes and tape recorders. Ask your software dealer for more information about cassette-based software titles, but don't expect to find any sophisticated software on cassette. The trend in the software

development industry is away from cassette-based programs.

However, don't let trends run your life; cassette recorders have several advantages. Cassette recorders are inexpensive (around $40.00 to $65.00) and durable. They're especially good for young children because they aren't as fragile as disk drives and disks. If you're using a computer for the first time, you may want to get a cassette recorder right away and then, perhaps, get a disk drive when you're ready for more sophisticated programs. Commodore is determined to tailor the Commodore 16 to first-time users; this means they'll emphasize cassette recorders and make sure cassette software is available. All this software will also run on the Plus/4 computer.

Storing Programs on Cassette Tapes

If you want to store your own programs on cassette tapes, you can use the regular tapes that are used for music. You don't need to use the expensive tapes that are labeled as being especially made for holding computer data. Regular cassette tapes that are of reasonably good quality are perfectly sufficient.

You should not, however, store programs or other information on tapes that are longer than thirty minutes in length. Longer tapes can stretch slightly and this can damage or destroy the data you stored on the tapes. The best tape length to use is the 10- to 15-minute cassette. This length is best for two reasons:

1. The tape recorder, unlike the disk drive, must search the entire tape for the program you have commanded it to load. Therefore, the shorter the tape, the shorter the loading time. Since cassette recorders don't load very quickly, shorter tapes can save time.

2. The tape recorder, unlike the disk drive, requires you to be responsible for positioning the tape when you save programs. To avoid losing programs, you're better off with shorter cassette tapes that contain only one or two programs on each side.

Although we've cautioned you in this chapter about the shortcomings of cassette tapes and cassette-based software, cassettes do have some advantages over disks. Cassette tapes and cassette tape recorders are cheap, easy to use, and don't require special handling. The following tips can help you preserve software cassette tapes:

1. Keep cassette tapes in their boxes when you aren't using them. Tapes tend to attract dust, and dust isn't good for tapes or tape recorders.

2. Don't leave tapes confined in the cassette recorder when you aren't using them. Eject the tape when you are through loading a program. Pressure exerted on tapes that are left in the recorder can cause warping, which can damage or destroy stored data.
3. Keep tapes in a cool, dry place. Don't leave them on top of warm machinery, such as your tape recorder.
4. Keep tapes away from magnets, water, heat, cold, and dirt.

The Datassette Recorder

Although cassette-based software for the Plus/4 is recorded on regular cassette tapes, these cassette tapes DO NOT play on standard cassette recorders. Instead, you need a special cassette tape player, such as the Commodore Datassette recorder, that is designed to work with Commodore computers.

Datassette Models

Commodore makes two Datassette models. The older one, the 1530/C2N, works with both the Commodore 64 and the VIC 20. The newer one, the Model 1531, works only with the Plus/4 and the Commodore 16 computers (Fig. 3-1). The two models are *not* interchangeable. If you already have an old Datassette that you used with a VIC 20 or a Commodore 64, it won't work with the Plus/4 (or the Commodore 16). There's a minor difference between the two models in the cassette-loading procedure, but the most important difference is that you can't plug the older Datassette into the Plus/4 computer, and you can't plug the new Datassette into the VIC 20 or Commodore 64 computers. The plug/socket connection that joins the Datassette to the computer is rectangular on the older computers and round on the new computers.

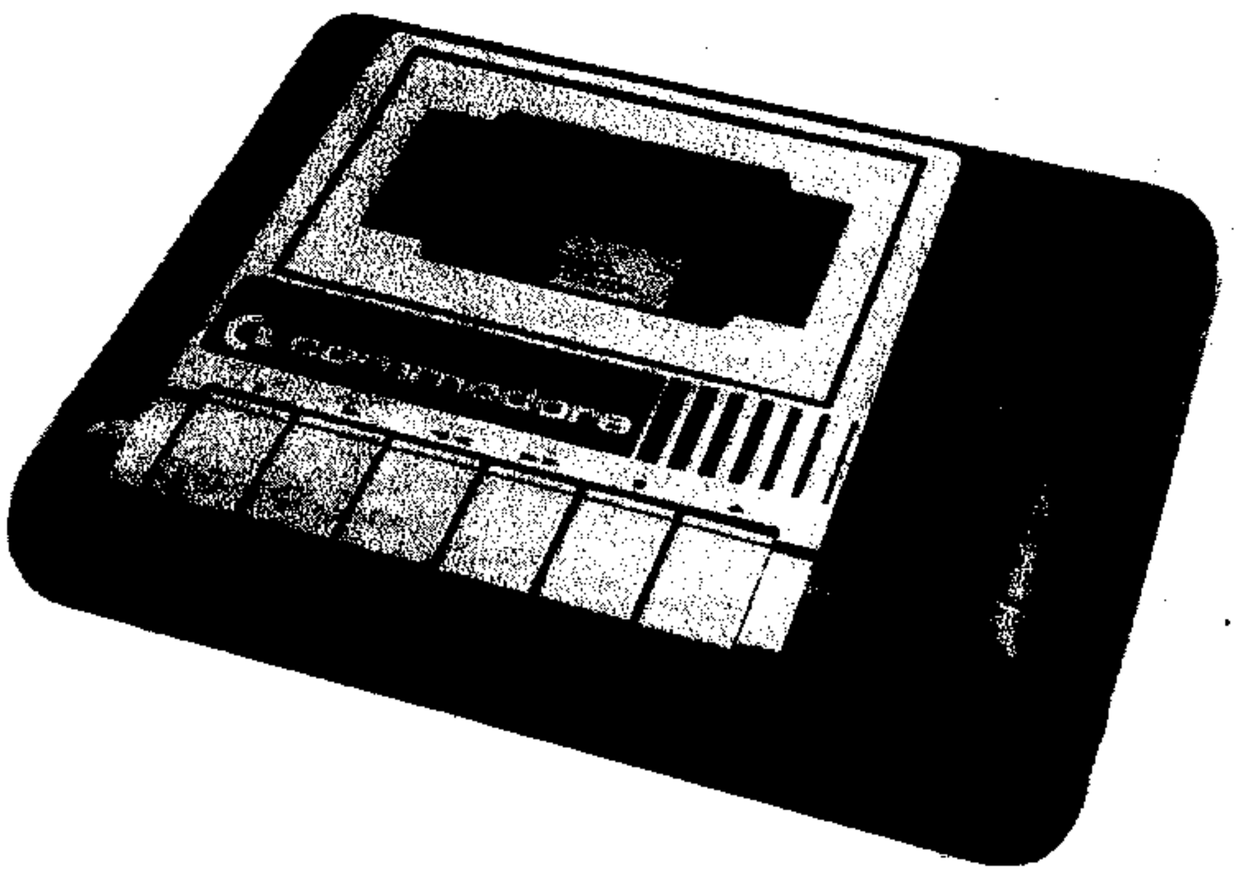


Fig. 3-1. The 1531 Datassette recorder (Courtesy Commodore Business Machines, Inc.).

Commodore redesigned the new Datassette to make it work more efficiently with the Plus/4 and Commodore 16 computers. However, this may not console you if you already own an old model Datassette. Be sure to get the Commodore Datassette or a cassette recorder that's specifically advertised as being compatible with the Plus/4 computer. Don't buy just any cassette tape recorder, even if it's designed for home computer use. Commodore computers don't work with other tape recorders. Also, be sure the recorder works with the Plus/4 computer. If a cassette recorder claims to be compatible with all Commodore computers, you should assume, because of the newness of the Plus/4 and Commodore 16 machines, that it actually works only with the VIC 20 and the Commodore 64 computers.

Maintaining a Datassette Recorder

Cassette tape recorders need to be cleaned and demagnetized every few months. This is important because most tapes leave a residue that builds up on the tape heads and inhibits cassette-recorder reliability. How often you should clean the recorder depends on how often you use the machine, but don't neglect this chore. You can tell that the Datassette (or any other recorder) is in desperate need of a cleaning and demagnetizing when you can see dark brown marks on the tape heads. The operating manual that comes with the unit explains how to clean and demagnetize your Datassette.

Should You Buy a Datassette Recorder?

Choosing the right computing equipment can be confusing, especially for the new computer user. Once you discover that you need a device to run and record software, you may be undecided about whether to buy a Datassette recorder or a disk drive. Before buying, consider some of the positive and negative points about adding a Datassette tape recorder to your home-computer system.

1. Tape recorders are relatively inexpensive. You can buy one for $40.00 to $65.00, depending on your dealer's prices.
2. Tape recorders are reliable. They don't need much maintenance and, with reasonable care and regular clearning, you should be able to use one for years.
3. Tape recorders are easy to use. There are very few commands involved in using a cassette tape recorder.
4. Children have an easier time using (and not abusing) tapes than they do disks.
5. Both introductory level and educational software often come on cassette tapes.

In short, cassette recorders and cassette tapes are relatively cheap and easy to use. They can provide a good simple way to learn how to use software and store your own programs when you're just starting out with computers. They're especially great for kids since a lot of the "learning" software for the Commodore 16 and the Plus/4 computers will be on cassette tape. However, before you make a decision, consider the negative side of purchasing a cassette recorder.

1. Cassette tapes are not the most common medium for commercial software (especially sophisticated software), so you may not be able to get the software you want.
2. If you intend to do much recording of your own programs, or of documents you write with a word processor, cassette tapes end up being pretty impractical. They're too slow, their storage capacity is too small, and they don't have some of the very useful features of disks, such as rapid program searching or a disk directory (a list of what's on the disk).
3. They require more manual labor (such as positioning the tape) than disk drives do.
4. You can't use them to store work you do with the built-in programs.

Briefly, though cassette recorders are easy to use and cheap, they may not be useful enough to justify their purchase. Before you buy any peripheral, you should think about what you expect to do with your computer system. Who in your family will use the computer? For what? Will anyone want to use a word processing program regularly? Does anyone in your family want to learn to write and store programs?

Most significantly, you should consider what types of commercial software your family members will want. As we mentioned before, Commodore plans to push cassette-based software for the Commodore 16. Since they are also marketing this computer as a beginner's machine, the cassette software designed for it will undoubtedly reflect this perspective. However, rather than let Commodore's assumptions guide your purchases, think about your needs. Whether or not you are a first-time user, if the software you normally want is not on a cassette, you probably will not want a cassette recorder.

Because cassette recorders are less expensive than disk drives, you may want to defer the larger disk drive investment until you know how your family will use the computer system. But, there's no reason that you should not have both a cassette recorder and a disk drive. You may want the cassette recorder for your kids and a disk drive for yourself.

DISK DRIVES

The machine that runs and records disk-based data is called a disk drive. Disk drives are powerful but fragile memory-storage devices. They can be integral to your computer system if they are one of the computing machines you need. This section should help you decide whether you need a disk drive.

If you get a disk drive other than one made by Commodore, be very sure it will work with the Plus/4 computer. Commodore makes only one disk drive that works with the Plus/4: the Model 1541 Disk Drive. This drive is compatible with both the Commodore 64 and the VIC 20 as well as with the Commodore 16 and the Plus/4. The Commodore 1541 disk drive is pictured in Fig. 3-2. The drive plugs into the serial port on the back of the Plus/4 (shown in Fig. 3-3).

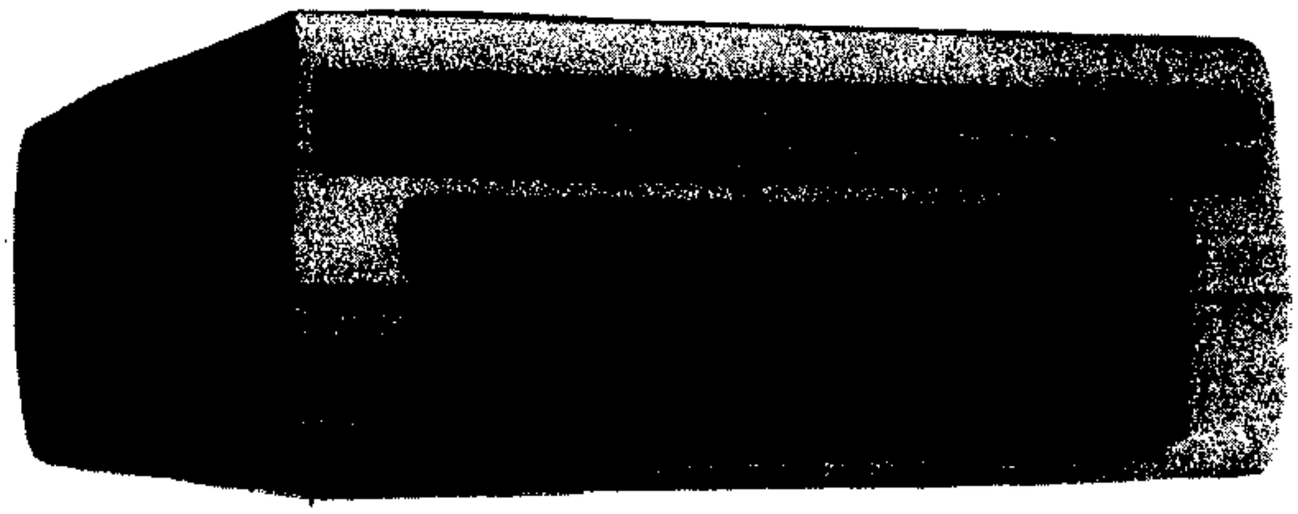


Fig. 3-2. The Commodore 1541 disk drive.

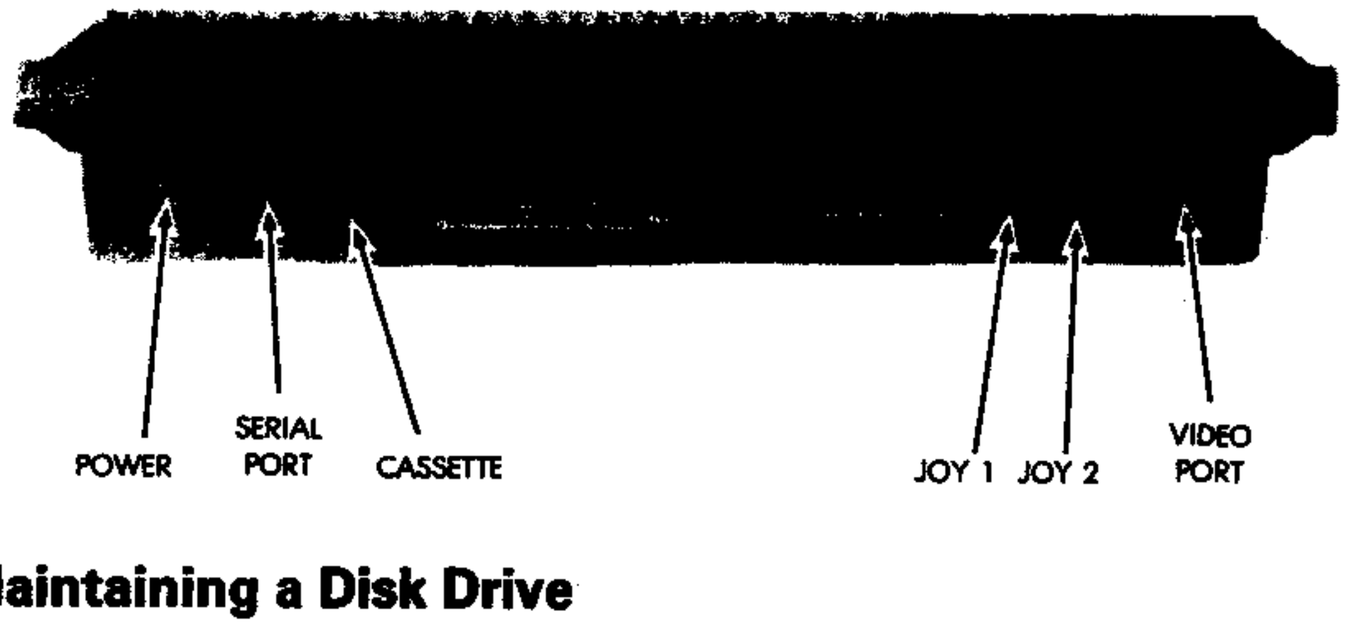


Fig. 3-3. The disk drive plugs into the serial port, second socket from the left (Courtesy Commodore Business Machines, Inc.).

Maintaining a Disk Drive

Unlike cassette tape recorders, disk drives don't need to be cleaned and demagnetized every few months. There are cleaning procedures for disk drives, but if you take care of your disk drive, you should do this only rarely.

The most important things to remember about taking care of your disk drive are:

1. Keep your disk drive as dust-free as possible. Once dust settles inside the drive, it's not likely to come out voluntarily.

Try to keep fans away from disk drives. Fans stir up a lot of dust.

2. Make sure your disk drive has adequate ventilation. Disk drives, like most machines, create heat. If the heat can't be dissipated, it can cause your disk drive to overheat, and this is highly undesirable.

   A good compromise between the need to shelter the disk drive from dust and the need to provide ventilation is to put your disk drive under some sort of cover, such as an overhead shelf, that leaves plenty of room both above and on the sides of the disk drive.

3. Don't leave the disk drive on all day. As we just mentioned, disk drives can overheat. Even with proper ventilation, heat builds up after hours of use.

4. Handle with care. Disk drives are delicate machines. Rough treatment can misalign the read/write head, which is the part that reads signals from and writes signals to the disk. If the read/write head is improperly aligned because the disk drive was dropped or jarred excessively, the drive might not be able to read data that you recorded earlier.

5. Keep disks as dust-free as possible so you aren't putting dust into the disk drive when you insert the disk.

6. Avoid using a disk drive during an electrical storm. Although it's unlikely that the electricity from a storm will cause damage, don't take the risk.

Should You Buy a Disk Drive?

The following lists contain some positive and negative points about adding a disk drive to your home computer system:

1. Diskettes are the most common media for commercial software, so you will most likely be able to get the software you want. You should, however, investigate software offerings before you buy either a cassette recorder or a disk drive so you can be sure you're getting the type of memory drive that runs the software you want.

2. If you intend to record a lot of your own programs or documents that you write with a word processor, disk drives are the more practical devices because they're fast, hold a lot of information, and have some unique and very useful features, such as rapid program searching, automatic positioning, and a disk directory (a list of what's on the disk).

3. They permit you to do more than a cassette tape recorder does.

In short, disk drives are fast, powerful, and versatile. Most really good commercial software comes on disk. If you want to store your own programs, and especially if you plan to do a lot of word processing, disk drives are virtually indispensable. But there are other factors to consider:

1. Disk drives are relatively expensive. They cost between $200 to $350 depending on the store you visit and the disk drive you buy. The cost of the disk drive can exceed the cost of the computer. Diskettes are also more expensive than tapes. A box of 10 blank diskettes costs about $25.00 to $30.00.
2. Disk drives and diskettes are more easily damaged than are cassette recorders and cassette tapes.
3. Children can have a harder time when handling (and, not abusing) disk drives and disks than when handling cassette recorders and tapes.
4. Using disk drives can involve more software commands than when using cassette recorders.
5. Introductory level software often comes on cassette tapes and games almost always come on a cartridge. You may not need a disk drive if you don't want the kind of software that comes on a disk.

Although a disk drive is the most powerful recording device, it may not be useful enough to justify its purchase if you aren't interested in software that comes on disk or don't wish to store a lot of your own programs or other documents. Before you make this major purchase, be sure you know what you want to do with your computer system.

DISKETTES

A growing body of commercial software comes on diskettes. Diskettes, which are also called disks, floppies, and floppy disks, are thin round circles of magnetic film that are permanently sealed in a square plastic envelope and stored in a paper sleeve for protection. Diskettes, like the one pictured in Fig. 3-4, can hold hundreds of kilobytes of information. This large capacity makes a disk the natural selection as the medium for sophisticated programs like word processors, financial analyzers, spreadsheets, and so on. (Sometimes these programs will appear on cartridges, which also can hold a lot of information.)

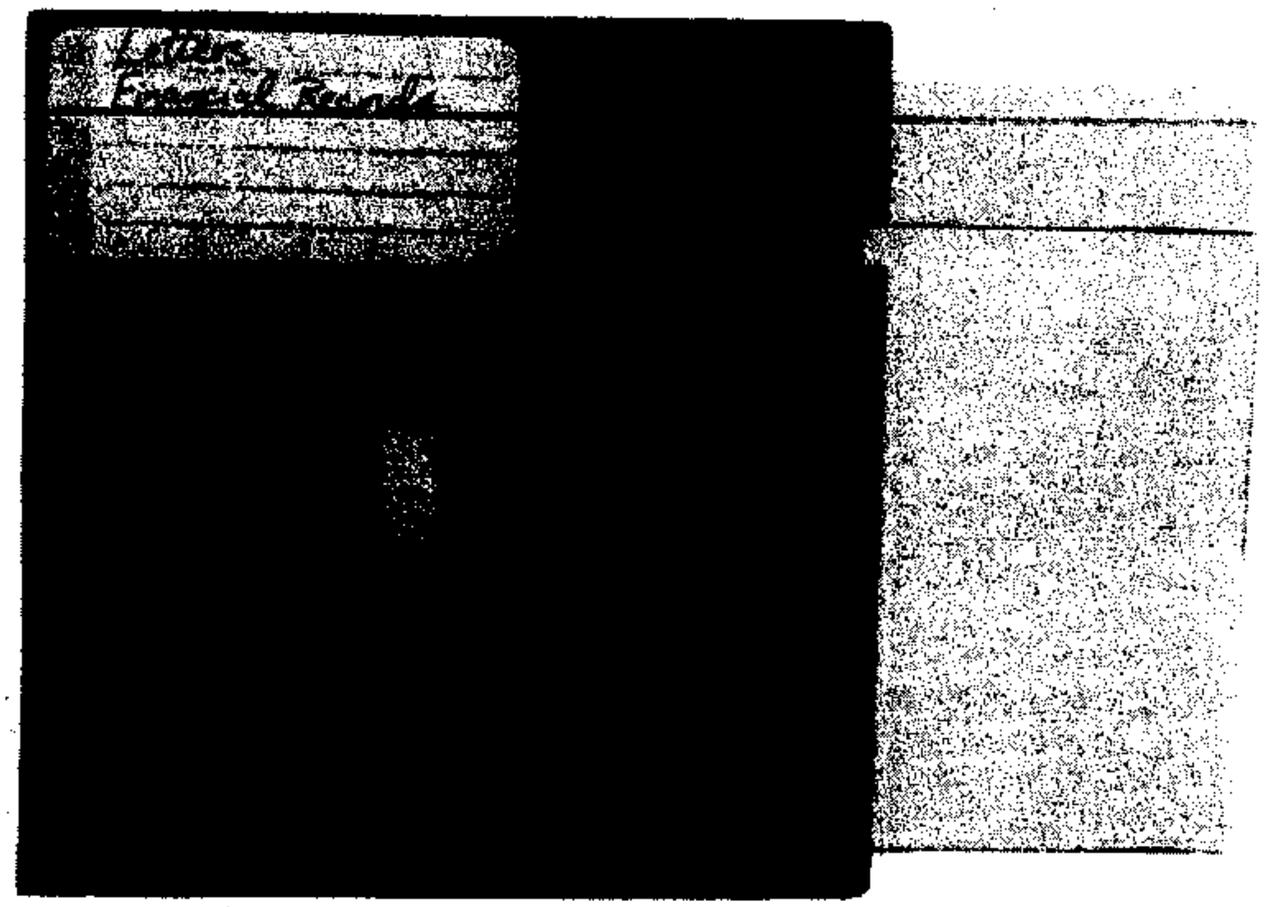


Fig. 3-4. A floppy diskette.

Diskette Care

Though more sophisticated and versatile than cassette tapes, diskettes are easy to use, but they require special care. Though you can sometimes get away with mistreating a disk, you will most likely deeply regret your action. The following tips should guide you in preserving diskettes.

1. Never touch the exposed parts of the disk, especially the oval cut-out section in the disk envelope.
2. Never remove or tamper with the disk envelope.
3. Keep diskettes in their paper sleeves when you aren't using them. Disks tend to attract dust and dust isn't good for either disks or disk drives.
4. Store disks in their envelope sleeves inside a covered box. Stand disks on end rather than storing them flat. You can buy plastic disk boxes for this purpose at computer stores.
5. Don't leave disks in the disk drive when you aren't using them. It's a good idea to remove the disk from the drive when you are through loading a program. Pressure exerted on disks that are left in the drive for a long time can cause warping, which can damage the disk.
6. Keep disks in a cool (but not cold) dry place. Don't leave them on top of warm machinery, such as your disk drive. Don't EVER let disks get wet.
7. Keep disks away from magnets, which will erase data stored on disks. Ringing telephones, speakers, and other electronic

equipment have magnetic fields, so don't leave disks near them.

8. Don't bend disks.
9. Insert disks and take them out of the disk drive carefully.
10. Don't turn the disk drive of your Plus/4 (or Commodore 16) computer on or off while a disk is in the drive. If you should accidentally turn off the drive while a disk is inside, remove the disk BEFORE you turn the drive back on.
11. Don't write on disks. Don't write on the disk label with anything but a soft felt-tip pen.
12. Don't put paper clips, staples, or anything but a disk label on the disk.
13. Don't become overconfident about disk treatment just because you violated one of these rules and the disk survived.

As we pointed out earlier in the section on cassette tapes, most commercial software is available only on one storage medium. Although disks have become the principal commercial media, you should still find out what software is available on disk. Ask a salesperson in a computer store for more information about diskette-based software titles for the Plus/4 computer.

If you want to store your own programs on diskettes, you can buy blank 5¼-inch floppy diskettes at office supply and computer stores. A box of ten blank disks costs about $25.00 to $ 30.00. However, before you can store information on a disk, you must prepare the new disk by a process called *formatting*, or *headering*. The headering command is explained in the reference chart for software commands in Chapter 6. The procedure is explained in greater detail in the *Commodore Plus/4 User's Handbook*.* An explanation is also given in your *Commodore Plus/4 User's Manual*.

PRINTERS

If you have a printer, you can print a copy of the work you've done on the computer. A printer lets you make a printed copy (also called "hard copy") of anything that appears on your screen, such as documents you've written with a word processor, reports you've generated from a financial program, test results from an educational game, etc.

*The *Commodore Plus/4 User's Handbook* (Cat. No. 22390), by Sarah C. Meyer, is published by Howard W. Sams & Co., Inc.

Choosing a Printer

Selecting the right printer is complicated by the many brands and types available as you are not limited to printers made by Commodore. In fact, Commodore offers a limited selection of printers. If you do buy a non-Commodore printer, you will almost certainly have to buy a special adapter cable called a *Parallel Interface Card* or *Interface Cable*; this is discussed later in this section.

This section describes most of the general types of printers and some specific printers. We'll give you advice on how to shop for a printer and what characteristics we consider as the most important.

Printer Types

The plethora of brands is one problem; the variety of printer types is another. Basically, the types refer to two different aspects of printers:

1. The quality of the printed characters.
2. The type of outlet and cable that connect the printer to the computer.

There are basically two types of printers: *dot matrix* and *daisy wheel*. Dot-matrix printers are cheaper and generally print faster, though not as fast as the large and expensive daisy-wheel printers used by businesses. Daisy-wheel printers print better-quality characters; they are often called letter-quality printers.

Dot-Matrix Printers

Dot-matrix printers are relatively fast, but the print is not letter quality. What this means is that the printed characters don't look like they came from a typewriter. Fig. 3-5 shows a print sample from a dot-matrix printer.

```
%&' ()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrst
&' ()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstu
' ()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuv
 ()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]
```

Fig. 3-5. Print sample from a dot-matrix printer.

Dot-matrix characters are made up of dots printed close together. A printer matrix is a rectangular area of rows and columns of dots. The dimensions of the matrix are the maximum

size of any character. Each character the printer prints is composed of appropriate dots in the matrix. Dot-matrix characters are formed in much the same way as the numbers for time and temperature are formed on those big signs outside banks.

The print quality of dot-matrix printers varies. Fig. 3-6 shows examples of several dot-matrix printers and a letter-quality printer.

```
THIS IS AN EXAMPLE OF THE 1526 TYPE.
THIS IS AN EXAMPLE OF THE 1526 TYPE.
```

(A) Commodore 1526 printer.

```
THIS IS AN EXAMPLE OF THE 1525 TYPE.
THIS IS AN EXAMPLE OF THE 1525 TYPE.
```

(B) Commodore 1525 printer.

```
THIS IS AN EXAMPLE OF THE MPS801 TYPE.
```

(C) Commodore MPS 801 printer.

```
HELLO THERE I am the Epson printer

%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`ab
&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abc
'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcd
()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcde
)*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdef
*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefg
+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefgh
 ./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghi
```

(D) Epson RS-80 printer.

```
!"#$%&'()*+,-./0123456789:;<=>?@[\]|¬}ABCDEFGHIJKLMNOPQRSTUVWXYZyz{ !!!!!!
!"#$%&'()*+,-./0123456789:;<=>?@[\]|¬}ABCDEFGHIJKLMNOPQRSTUVWXYZyz{ !!!!!!
!"#$%&'()*+,-./0123456789:;<=>?@[\]|¬}ABCDEFGHIJKLMNOPQRSTUVWXYZyz{ !!!!!!
!"#$%&'()*+,-./0123456789:;<=>?@[\]|¬}ABCDEFGHIJKLMNOPQRSTUVWXYZyz{ !!!!!!
!"#$%&'()*+,-./0123456789:;<=>?@[\]|¬}ABCDEFGHIJKLMNOPQRSTUVWXYZyz{ !!!!!!
```

(E) Commodore 6400 printer.

```
REVISION NO. = 3.0
$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`
%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`a
&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`ab
'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abc
()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcd
```

(F) Okidata 92A printer.

Fig. 3-6. Print samples of dot-matrix and letter-quality printers.

In addition, many dot-matrix printers can print in different styles, called *Enhanced, Emphasized,* or *Doubled*. These styles, though slower than the normal print mode, will print darker characters with less space evident between the dots that make up the characters. Fig. 3-7 shows an example of enhanced print. In many cases, you may find the enhanced print is close enough to letter-quality printing for your needs, especially if you only need better quality occasionally.

```
The presence of normal ferritin levels, however, does not
eliminate the possibility of iron deficiency. Other diseases that
produce a coinciding increase in ferritin concentrations may also
be present simultaneously and mask an underlying deficiency
state.
```

Fig. 3-7. Example of enhanced printing from a dot-matrix printer.

Letter-Quality Printers

If you're interested in using your computer for word processing or for business purposes, you might want to use a letter-quality printer. Letter-quality printers are usually the daisy-wheel type of printer. "Daisy wheel" refers to the round flat disk that bears the type face. If you look at the end of each spike on a daisy wheel, you'll see that the characters are solid, like those on a typewriter key.

Some dot-matrix printers have a letter-quality mode that produces nearly letter-quality print. However, if you intend to use your computer for serious word processing or business, you'll probably want a true letter-quality printer.

Printer Outlet and Cable Types

There are several types of outlet and cable combinations that are used to connect printers to computers. The different types of connections refer to the way that the electronic transmissions are made between the printer and the computer. The following are the most common types:

- Serial
- Parallel
- IEEE
- RS-232C

Serial Printers

The Plus/4 computer is connected to a printer through a round outlet called a *serial bus* (Fig. 3-8). Unfortunately, the term "serial" as used here can be confusing because not all serial outlets are round. *Serial* refers to a type of signal transmission, not to a type of outlet. But Commodore calls this round outlet on the Plus/4 (second port from left) the Serial Bus, and printers that fit this outlet are a serial type of printer.

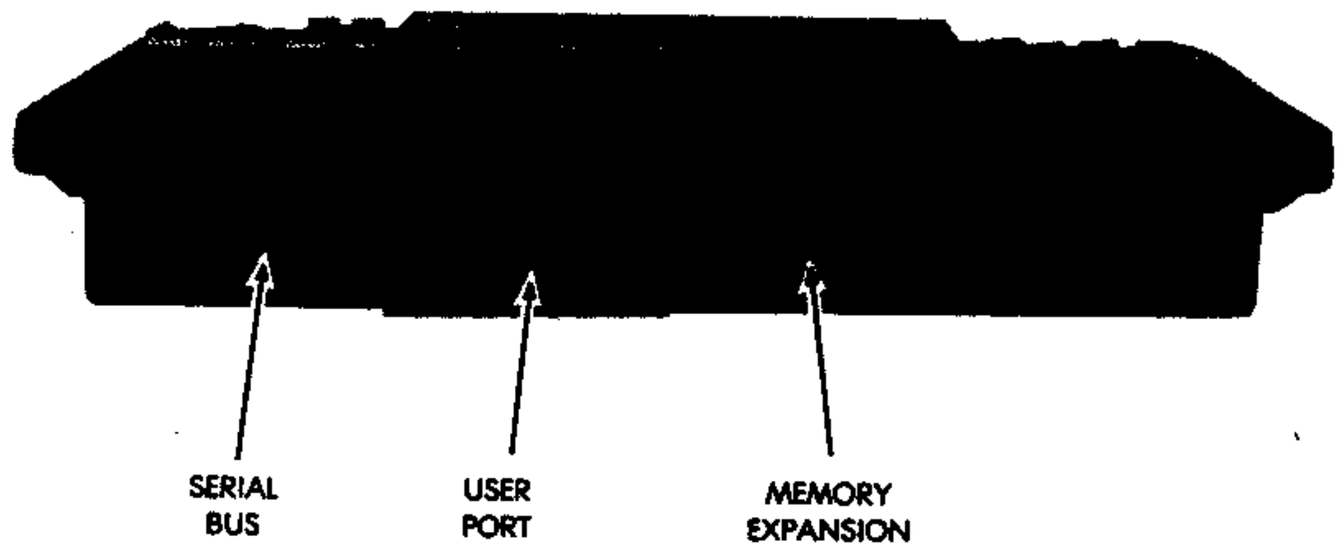


Fig. 3-8. The Serial Bus, second port from the left (Courtesy Commodore Business Machines, Inc.).

Be careful when you look at printers. Some that are called serial do not have serial connections like those shown on the Plus/4 computer. Commodore's printers for the Plus/4, Commodore 16, Commodore 64, and VIC 20 will connect directly into the serial bus on the back of the computer. These printers include the MPS 801, the MPS 802 (Fig. 3-9), the MPS 803 (Fig. 3-10), the 1526, and the 1525. These are all dot-matrix printers.

If you buy a serial printer that is not from Commodore, make sure the product includes a round serial cable plug. These cables

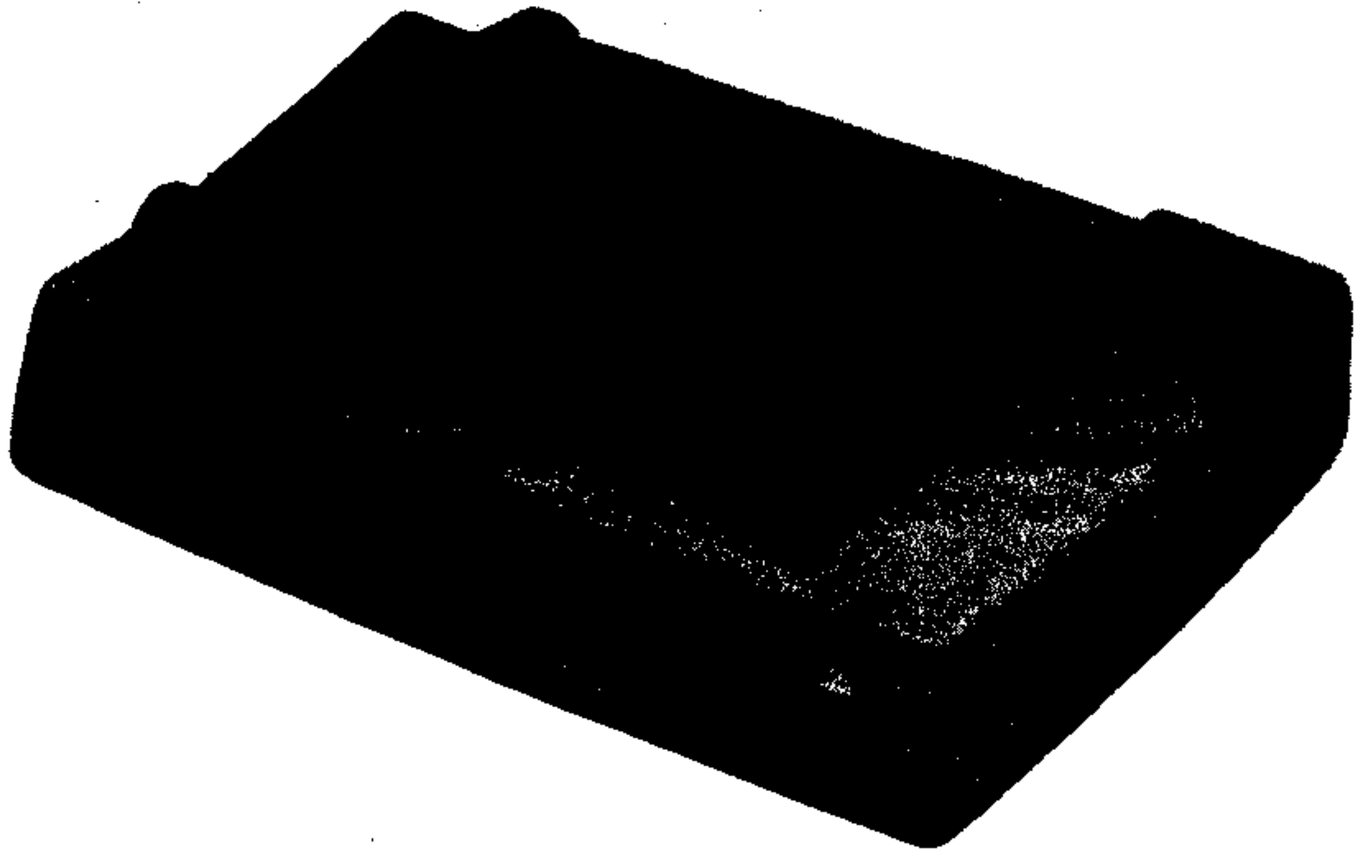


Fig. 3-9. Commodore MPS 802 printer (Courtesy Commodore Business Machines, Inc.).

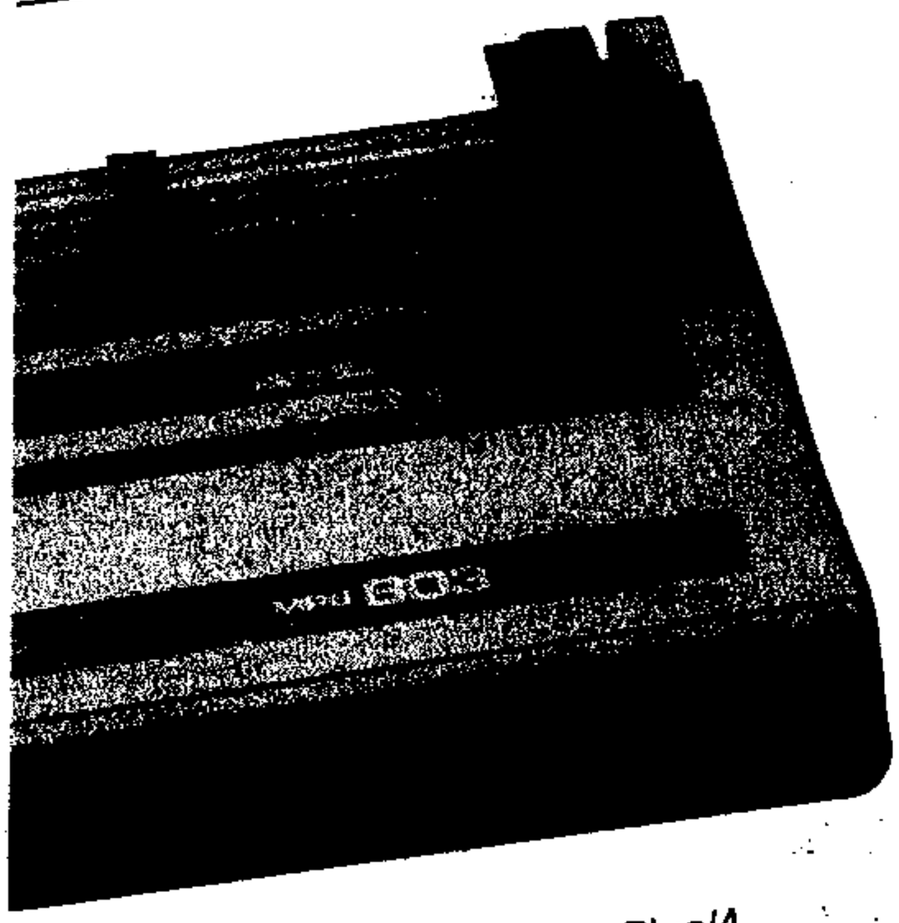


Fig. 3-10. Commodore MPS 803 printer (Courtesy Commodore Business Machines, Inc.).

nmodore printers. Because the Plus/4
, outlet, no special interface cards or additional

ave a different type of connector than the serial
he serial bus outlet has a series of holes
, a parallel outlet consists of two parallel rows,
ghtly longer at both ends. Although the Plus/4
ıt have a parallel outlet, this doesn't mean you
ıl printer.
ɔn of a special printer-interface cable (often called
d"), you can use parallel printers, such as those
ı, Epson, Centronics, and others. The interface
ter made up of a cable that plugs into the printer
rd that plugs into the computer. One end of the
al plug that fits into the serial bus on the Plus/4
ı the disk drive. The other end of the cable has a
:tor that plugs into the parallel outlet on the printer.
ɜ connectors have a third plug that goes into the
(also called the *user port*) on the Plus/4 computer.
two-ended adapter that doesn't affect your use of
; is where you plug in a modem or other RS-232C
en this interface is in place, you can plug a modem into
:he interface connector and the interface and modem
ıe port.
ore doesn't manufacture these interface cables, so
you buy one that states it is for Commodore home
. If an interface cable works with the VIC 20 and the
ıre 64, it should also work with the Plus/4 computer.
to-serial interface cables are available from computer and
:s stores. They can cost up to $120, but you should be

able to find them for around $90.00 if you shop around. Be sure to add that cost to the price of the printer when you consider how much you can spend for a printer. Be prepared to describe the cable/card in detail. Like so many home-computing devices, these cables/cards have no standardized name.

There's also a version of this cable that costs about $50.00, but it doesn't transmit graphic characters. You should avoid this cable unless you are certain you'll never want to print graphic characters.

IEEE-488 Printers and Interface Cards

Another type of connector is the IEEE-488 (pronounce that "I triple E"). This connector is similar to the parallel connector, but it's larger and (surprise!) not compatible. The Plus/4 computer does not have an IEEE outlet, but you can use an IEEE printer with an adapter.

Many business-quality printers have IEEE-488 connectors. For example, the Commodore 6400, which is a letter-quality printer, is an IEEE-488 printer. An example of the Commodore 6400 print capability is shown in Fig. 3-6.

To use an IEEE-488 printer, you must have an IEEE-488 interface card. This interface cable is similar to the parallel-to-serial interface cable. One end of the interface card plugs into the expansion port on your computer, and the other end of the interface card plugs into the printer cable, which is called an IEEE-488 cable. This interface cable is an adapter that permits cartridges and other devices to be plugged into one end of the interface card while the card is in place. The card and the cartridge share the port.

An IEEE-488 interface card designed for the VIC 20 and the Commodore 64 will also work with the Plus/4 computer.

RS-232C Printers and Interface Cards

Another type of printer is the RS-232C standard. There is an RS-232C connector (called the User Port) on the Plus/4 computer, but you must still have an RS-232C interface card to use these printers.

The RS-232C interface card is also similar to the parallel-to-serial interface cable. This interface cable is an adapter that permits cartridges and other devices to be plugged into one end of the interface card while the card is in place. The card and the cartridge share the port.

An RS-232C interface card designed for the VIC 20 and the Commodore 64 will also work with the Plus/4 computer.

Commodore Printers

Commodore makes several printers that you can use with the Plus/4:

- The MPS 800 series, including the MPS 801, MPS 802, and MPS 803, which are fairly new and similar models. Only the MPS 803 has a tractor-feed mechanism that guides continuous sheets of fanfold paper.
- The 1526, which was introduced in 1983 for the Commodore 64 and which also works with the Plus/4 computer.
- The older 1525 printer. Commodore has discontinued manufacturing the Model 1525, but if you have one, you can use it with a Plus/4 computer.

The MPS 801/802/803, 1526, and 1525 are all dot-matrix serial printers, which means they're relatively fast and inexpensive, but the printing is not letter quality. Commodore also makes a printer/plotter, the 1520, that prints both text and designs on adding-machine paper (Fig. 3-11).

Print samples from some of these printers appear in Fig. 3-6. The printers are also listed in Table 3-1, which compares the features of some of the printers you can use with the Plus/4 computer.

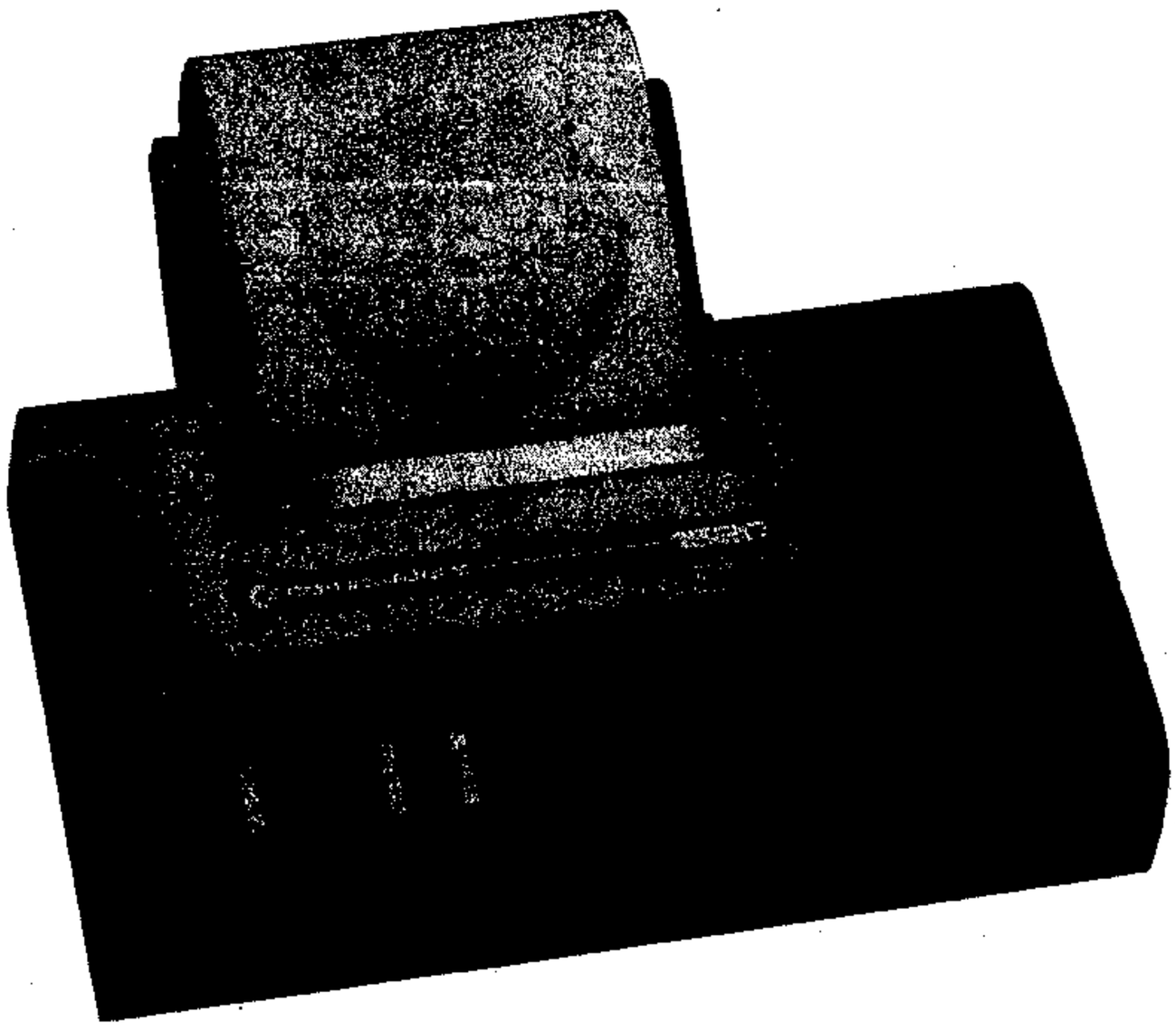


Fig. 3-11. Commodore 1520 printer/plotter (Courtesy Commodore Business Machines, Inc.).

Table 3-1. Printer Features

Brand	Print	Outlet	CPS*	Bidirect-tional	Char Size	Extras Needed	Enhanced Print
C-1525	DM**	Serial	30	No	5×7	None	No
C-1526	DM	Serial	70–80	Yes	8×8	None	No
C-MPS 801 through MPS 803	DM	Serial	50	No	5×7	None	No
Epson RX-80	DM	Parallel	100	Yes	9×9 to 18×18	Cable	Yes
Epson FX-100	DM	Parallel	160	Yes	9×9 to 18×18	Cable	Yes
Okidata 92	DM	Parallel	160	Yes	9×9	Cable	Yes
Commodore 6400	LQ***	IEEE	40	Yes	N/A	Cable	N/A (LQ)
Royal Alpha 2015	LQ	Optional			N/A	Cable	N/A (LQ)

*CPS stands for characters per second, the standard measurement for the rate at which printers operate.
**DM stands for dot matrix.
***LQ stands for letter quality.

Printers Other Than Commodore

You can also use printers manufactured by other companies. In most cases, you'll have to buy an interface cable to use a printer that is not from Commodore because most other companies build parallel or IEEE-488 connectors onto their printers. Print samples from some of these printers appear in Fig. 3-6 and some of the printers are listed in Table 3-1.

If you buy a printer made by a company other than Commodore, try to make sure that the company will be around for years. You will need to buy replacement ribbons, ribbon cartridges, and print wheels; you may need service or some other type of assistance. With so many companies in the business, you can be sure some will not survive. One of the best sources for information about printers and the companies that make them is various computer store managers. They should have an idea about the durability and reliability of the companies whose products they carry. You should ask at several stores to make sure you aren't unduly influenced by one person's opinions.

Electronic Typewriters

Many of the new electronic typewriters can be hooked up to computers and used as printers. This arrangement requires an interface cable, however, which usually costs extra. When you shop for a typewriter to use as a printer, make sure the typewriter is listed as having computer-interface capability.

Although these typewriters are not inexpensive, they do offer the advantage of providing letter-quality printing at a reasonable price and giving you a dual-purpose piece of euqipment. If you want letter-quality print capability, consider these points before you buy:

- An electronic typewriter costs less than a letter-quality printer that is designed for business use.
- You can use the typewriter for both printing and typing, but a printer is useless without the computer.

You should ask the salesperson how many columns wide the typewriter can print. If you expect to print documents that are wider than standard 80-column paper (such as a spreadsheet output), the typewriter may not suit your needs.

Do You Really Need a Printer?

By now, you're probably distressed by the number of different printers, and you wonder how you're supposed to decide what to buy. First, make sure you really want one. You'll need one if you answer YES to one of the following questions:

- Are you going to use the computer for word processing?
- Do you plan to generate budgets and other financial reports for which you'll want copies on paper?
- Will you create reports from a database manager about collections, recipes, descriptions of personal property, a club, an organization, or a business, etc.?
- Do you want to keep printed reports of your children's progress with educational programs?
- Do you plan to write your own programs?

In short, the software you want should indicate whether you need a printer. You won't need one for games, and one's not essential for educational programs. You won't need one if you just want quick answers to financial questions or if you're not interested in keeping computer-generated records on paper. You may want to defer your purchase of a printer until you have a clear need for one.

Which Kind of Printer Is Best for You?

After you decide that you need a printer, you need to define what you want the printer to do, how fast and how well you want it done, and how much you can spend for a printer. Commodore's printers are most likely the cheapest, especially since you don't

have to buy a $90.00 (or more) interface cable, which you most likely will need to use other printers.

Letter-Quality Printing

First, decide whether you will need letter-quality printing. Both letter-quality printers and electronic typewriters that interface with computers are more expensive than other printers. Some of the better dot-matrix printers will print crisp, readable characters that are acceptable in most circumstances. Dot-matrix printers are considerably cheaper.

You may want letter-quality printing if you intend to use the computer for a business that involves a lot of professional correspondence or if you expect to write a lot of reports and papers. If you decide you want letter-quality printing, you should consider buying a typewriter if you may have use for a typewriter that is independent of your computing needs.

Dot-Matrix Printing

As you have read in previous sections, dot-matrix characters are composed of dots that are printed close together. Although dot-matrix characters don't look like they were printed by a typewriter, some dot-matrix printers do print bold, readable characters. Also, some dot-matrix printers have *enhanced* print modes, which print especially readable characters. This is illustrated in Fig. 3-7.

The Importance of a Demonstration

A printer is one of the most expensive pieces of computing equipment that you can buy. Before you decide which printer you want, go to a store that is willing to demonstrate the models you are considering. Try to visit more than one store so you aren't persuaded by one person's bias. Be sure to check the following features:

1. *The quality of the printed character.*

   Whether you're interested in letter-quality or dot-matrix print, be sure you're satisfied with the readability of each letter, number, and special character. If you can't tell the O from the 0, or the g from the s, etc., you may not be satisfied with the printer. Don't forget to ask about the enhanced-print modes for dot-matrix printers. As you can see from the print samples in Figs. 3-6 and 3-7, enhanced-print modes can produce high-quality print.

2. *The printer speed.*

   This is usually stated in characters per second (cps). For example, the Commodore 6400 prints at 40 cps and the Okidata Microline 92A prints at 160 cps in normal mode, 80 cps in enhanced mode, and 40 cps in letter-quality mode. If

the speed is described in words per minute (wpm), you're safe to assume that the printer is so slow that the manufacturer doesn't want to use standard terminology. They're no doubt hoping you'll think, "Wow, that's a lot faster than I can type." Thus, 120 words per minute may sound fast, but remember that computer printing time is two-fold: the time you spend typing plus the time the printer spends printing. So if you type 45 words per minute and the printer types at 120, you're actually getting printed copy at 82.5 words per minute, which is slower than you might think.

Now let's convert words per minute to characters per second and compare a typical 40-characters-per-second letter-quality printer to a 120-wpm printer. 120 words per minute equals 2 words per second. Let's say that the average word is 5 characters, which comes to only 10 characters per second for the 120-wpm printer. That's four times slower than the letter-quality printer, which means printing will take four times longer. You can't really do anything else with your computer while the printer is in operation, so if you expect to do a lot of printing, speed should matter to you. If the slow printer is also noisy, your problems are compounded.

Printing speed may not, however, be much of a factor to you. If you're only going to print short documents, and those not often, you can save money by contenting yourself with a slower output.

3. *The printer noise.*

This may not be so easy to discover, but it can be important if you'll be using the printer often, especially in a closed area. All printers are somewhat noisy, but some inexpensive printers can make you feel like you're in a combat zone. Try to find out the decibel level. If you have to trust your ears, you may be misled. Stores, unfortunately, are not very good places for assessing noise levels.

4. *The paper-feed quality.*

Most printers print on connected sheets of perforated paper, called a *fanfold roll*. The advantage of a fanfold roll is that you can print continuous pages without hand-feeding the next page. The fanfold roll is usually fed through the printer on a *tractor feed*. This is a set of spiked wheels or clips that fit on the platen (the cylinder that the paper rolls around). The tractor feed secures the fanfold paper so it doesn't slip sideways as the pages feed through the machine.

Even with a tractor feed, cheap printers may not do a good job of feeding the paper through the printer. The potential trouble here is that the printer will print lines unevenly, especially when the printout is longer than one page. When you see the printer demonstrated, make sure to watch the

printer print a long document. Then, watch how the paper advances through the printer; is the advance regular and firm? Check the printout itself; are the lines evenly spaced or are they crooked in places? Does the weight of the paper slow down the printing?

The paper-feed mechanism may not be a major concern if you only intend to print short documents, or if you aren't terribly fussy about how the printout looks. However, if you expect to print long documents, paper-feed quality is important. If the paper doesn't feed properly, you will waste a lot of time watching over the printer, hoping to intervene when the feeding goes awry. You'll also waste time, paper, and patience reprinting your document when the lines print on top of each other or at creative angles on the page.

Printing Commands

Your computer will produce an output of everything you put in it — whether by typing in the input on the keyboard or by loading software into the computer memory. Often this input is somehow transformed by the computer before being output; for example, if you input a calculation, the computer outputs the answer — which is the calculation transformed.

Ordinarily, the computer sends the output to the screen, where it is displayed. This is illustrated in Fig. 3-12. You don't have to issue any extra commands to tell the computer to display output on the screen because the screen output is automatic.

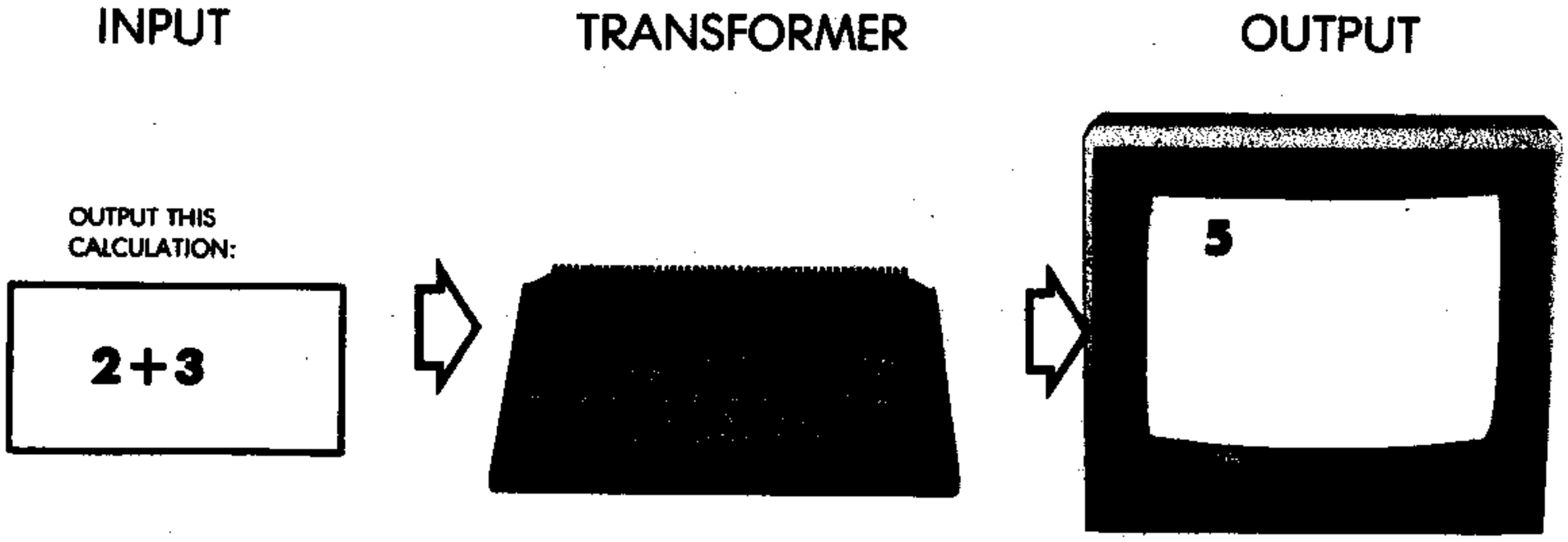


Fig. 3-12. Default computer output scheme.

When you tell your computer to print something on a printer, you are telling the computer to divert the output from the screen to the printer (Fig. 3-13). Since the screen is the automatic, or default, output device, you must issue extra commands to tell the computer to output to the printer.

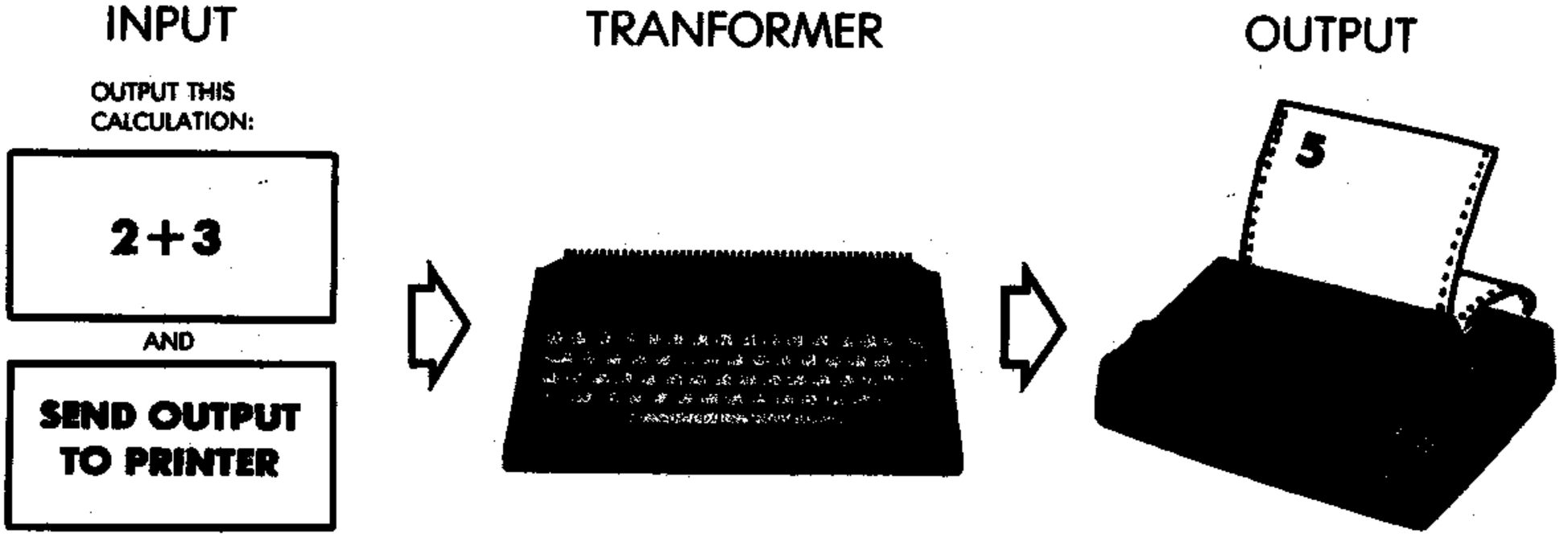


Fig. 3-13. Diverting the computer output to a printer.

Many software programs have the output-to-printer commands embedded in the program, so to print a copy of your work on paper, you only have to use the command in the software. When you want to print out something you've written in BASIC, you must use the commands described in Table 3-2.

Table 3-2. Printer Commands

Command	Command Function
OPEN	This tells the computer to open the communication line to a device such as the printer; the number 4 is the printer device number.
CMD	This tells the computer to divert output from the screen to the device that was named in the OPEN command.
PRINT#	This tells the computer what items to print.
CLOSE	This tells the computer to close the communication line to the device that was named in the OPEN command.

For example, this command tells the computer to print the current program on the printer:

```
OPEN 2,4
CMD 2
LIST
PRINT #2
CLOSE 2
```

The number 2 is called a *Logical File Number.* It's used to tell the computer that the commands marked with a 2 go together. This is an organizational device to make sure that the computer

understands which OPEN command goes with which CMD command, etc.

The number 4 shown in the OPEN command names the printer as the device to be accessed. As this command is written, the printed letters would be in uppercase only. If you want to print in both uppercase and lowercase letters, add a comma and 7 to the end of the OPEN command:

```
OPEN 2,4,7
```

The printer manual that comes with your printer will explain more about how to print out a document. Chapter 4 explains how to install a printer.

Displaying Computer Video

Computer companies generally assume that you will use a tv set to display the picture from your computer. You may well find, however, that the picture your tv displays is unsatisfactory. Television sets display different picture qualities, so you may get a fuzzy picture when you display computer video on a tv set. Unfortunately, there's no way to correct the fuzziness because it's part of the construction of your television set. Before you can consider your home computer system complete, you must consider this question:

What Are You Going To Use To Display the Computer Output?

The companies that sell home computers expect you to provide the means for displaying the output of the computer. You can use a television set or a monitor that's designed for computer display. Monitors virtually always give a better picture, but you can make do with a television set. Unfortunately, some television sets don't do as good a job displaying computer video as others do. If your tv displays an awful picture when you connect the computer, it's probably the fault of your tv, not the computer.

Using a TV Set for Video Display

If you're using a tv set that will double as both a computer screen and a television set, you'll have to put the computer near your tv. You might have to do some rearranging so you can conveniently use both the tv and the computer in the same area. The following list summarizes the reasons why you may want to use a tv set to display the computer video.

1. It's cheaper. Unless the picture is intolerable or unless using the tv is too inconvenient, this will most likely be the bottom line for you.

2. If your present tv doesn't display an acceptable picture, you might still prefer to find a tv set that can do a reasonable job. For you, it may make more sense to buy another tv instead of a monitor. After all, a tv set can serve two functions while a monitor is useless unless you have a computer or VCR plugged into it.

In addition, here are some things to consider if your computer video display unit will also be your television set:

1. The Plus/4 computer comes with a tv-to-computer switchbox that lets you select whether the tv set or the computer is controlling the screen. All you need do is flick the switch to go from tv to computer and vice versa. The advantage of the switchbox is that you can leave intact the only tricky part of the computer set up — attaching the switchbox to the tv antenna posts — when you're not using the computer. In fact, you can unplug the computer and store it away without disturbing the switchbox connection. Plugging the computer back into the switchbox is simple. You might want to do this so the computer isn't out collecting dust when you aren't using it.
2. You shouldn't set up the computer right in front of the television set. Remember your mother's warnings not to sit too close to the television. The screen display from the computer is big enough to be visible comfortably from several feet away.
3. It's possible that your computer may interfere with your tv reception. If your tv picture deteriorates after you install a computer, try rearranging the equipment. You can also plug the computer and the tv set into different power outlets. One solution to tv interference is to unplug and store the computer when you're not using it.

Using a Monitor for Video Display

If you can afford a monitor, the investment is well worth the money. The picture your computer displays will be much superior, and the convenience of having a monitor that's dedicated to computer use alone will make both computing and tv-watching more pleasant. With a monitor, you also have the freedom to set up your computer where you want the computer, not where you have already stationed the television set. Furthermore, most monitors can also display the video from a VCR (video cassette recorder), so a monitor can actually take the place of a tv set.

No tv is going to display the video from your computer as well as a monitor can. Most television sets show an acceptable picture, but some television sets display a terrible picture no matter what

you do. The following list summarizes the reasons for using a monitor for computer video display.

1. The picture displayed by a monitor is greatly superior. This is probably the most important argument for buying a monitor. This is especially significant if you plan to use your computer for word processing or for working with an electronic spreadsheet, because these applications are more likely to demand a careful scrutiny of the characters on the screen.
2. The place where you watch tv is probably not the same place that you want to use your computer. A monitor devoted solely to computer use lets you compute where it's most convenient.
3. Your family won't have to argue over whether to watch tv or use the computer.
4. Most monitors will also display the picture from a VCR, so a monitor can be as multipurpose as a television set.

MODEMS

A modem lets you communicate with information services and other computers. A modem lets you use telephone lines to connect your home computer to large data banks and other computers. Modems transform electrical signals from computers to signals that can be transmitted over telephone lines.

After a disk drive or cassette recorder, a modem is perhaps the most important piece of computing equipment you can own. A modem gives you access to dozens of information sources, such as CompuServe™, The Source℠, and Dow Jones News/Retrieval™ With a modem, you can also communicate with a friend's computer.

Details about computer information services are packaged with a modem and are also available from computer stores. These huge data banks provide electronic encyclopedias, current stock quotes, consumer information, shop at home catalogs, news, weather and sports, free software of all kinds, travel information and reservations, electronic mail and bulletin boards, electronic banking, and many specialized services.

Commodore makes modems, but you can use other brands, such as the Hayes Smartmodem™. When you shop for modems, make sure they're compatible with the Plus/4 computer. The Commodore Plus/4 Model 1660 MODEM/300 (Fig. 3-14) works with both the Plus/4 and the Commodore 16. Unfortunately, the Model 1600 and 1650 modems that Commodore made for the Commodore 64 aren't compatible with the Plus/4 computer.

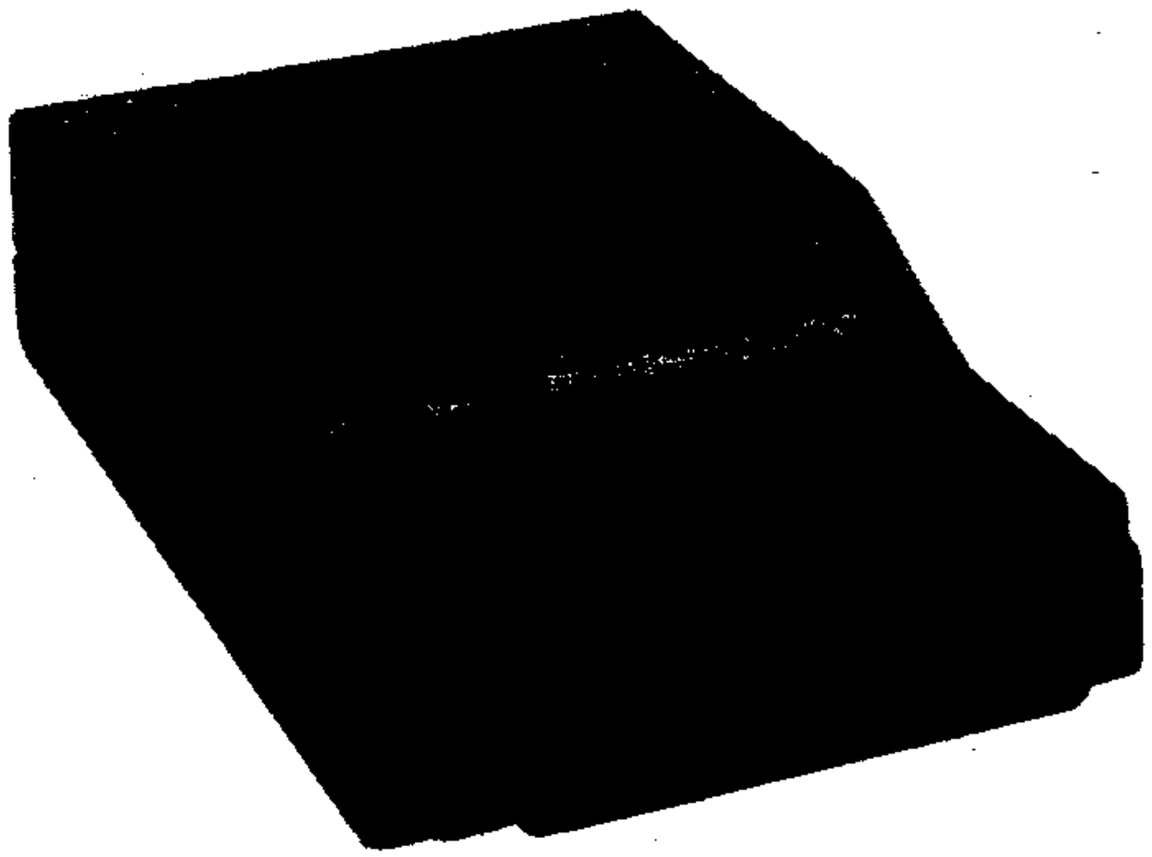


Fig. 3-14. Commodore Model 1660 Modem/300 modem (Courtesy Commodore Business Machines, Inc.).

All you need to install a modem is a modular phone (the kind with the little clips that snap in and out of the wall). The modem has its own modular outlets into which you connect the phone lines. The installation procedure, which is similar to connecting an answering machine to a phone, involves unplugging the telephone from the wall, replacing it with the modem, and then plugging the phone into a modular outlet on the modem. A switch on the modem lets you use the telephone to dial a number to contact another computer; it then deactivates the telephone so it cannot interfere with data transmission.

Modem Software: The Terminal Emulator

Modem use depends on a software product called a *Terminal Emulator*, which is a program that lets two computers communicate. When you link two computers together, one must be the master (or host) and the other the guest. The terminal emulator turns your computer into a mock terminal that is controlled by the host computer.

Terminal emulators are generally programmed onto cassettes or diskettes, which means you'll probably need a tape recorder or disk drive to use a modem. You can, however, type in a *minimal* terminal emulator. This type of program appears in the manuals that come with Commodore's modems. Typing the program into the Plus/4 every time you use the modem is awfully time-consuming, and frustrating too, if you make mistakes, so you should save the program onto a disk or cassette tape. Chapter 6, which discusses how to choose the software you will need, contains more information about terminal-emulator programs.

The Benefits of Owning a Modem

Even if you aren't interested in any of the types of information offered by computer information services, a modem is still a useful piece of hardware for your computer system. For one thing, telecommunications is expanding rapidly. Soon you'll be able to use your home computer to do even more tasks over the phone.

Computer information services offer a valuable chance to use free software. This opportunity is especially worthwhile when you only want the software for one problem, such as exploring the rates and the personal economic effects of mortgage payments. In addition, if you're wondering whether you should buy, for example, a word processor, you can try out one that's available from a computer information service. Usually, these public-domain programs are less sophisticated than what you can buy, but they're invaluable for giving you a chance to preview various types of software. You can also fulfill your urge to take an IQ or personality test without spending the money for the commercial program.

SPEECH SYNTHESIZERS

Many new software offerings contain simulated speech. To use the voice feature in software, speech must be programmed into the software, and you must have a speech synthesizer.

Software containing speech tends to be mostly games, educational programs, and a few of the simplest business and home management packages. However, if speech synthesizers become very popular, you can expect more types of talkative software.

Commodore's speech synthesizer, the Magic Voice, plugs into the back of the Plus/4 computer. No interface cables or other attachments are required. Once installed, the Magic Voice can utter whatever remarks are programmed into the software.

Programming Speech

You can program the Magic Voice to speak from a limited vocabulary. The programming commands are simple to use. The command SAY followed by a word in quotes tells the computer to say that word. For example, SAY "HELLO" does just that. The words you can program are restricted to the built-in vocabulary, but you can buy a disk with additional vocal repertoires.

Magic Voice's built-in vocabulary is composed of 235 words and word fragments. You can form many additional words by combining the words and the fragments. For example, the vocabulary contains the word TEEN and the fragment THIR, which you can combine for the word THIRTEEN. You can also add the fragment TH to make THIRTEENTH.

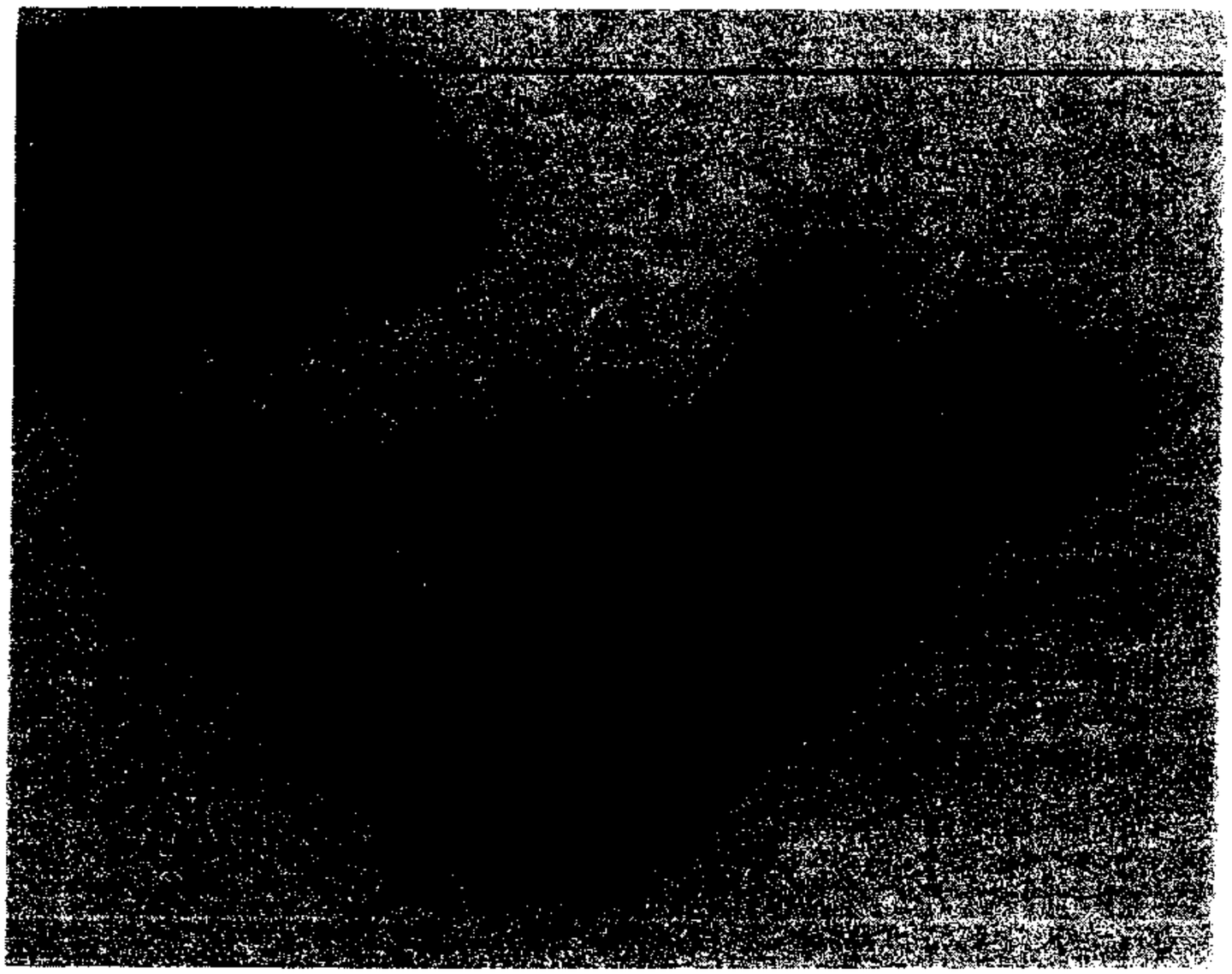


Fig. 3-15. Joysticks for the Plus/4 and Commodore 16 computers (Courtesy Commodore Business Machines, Inc.).

OTHER COMPUTING ACCESSORIES

You may wish to have some of the screen-control accessories, such as joysticks (Fig. 3-15), mice, and game paddles. Be careful when you shop for these. The Plus/4 computer is, unfortunately, not compatible with all brands, including the old ones made by Commodore. The joystick ports on the Commodore 64 and VIC 20 are NOT the same as those on the Plus/4 and the Commodore 16. Joysticks can be used for more than just game playing. For example, Commodore's Magic Desk series uses a joystick for moving a finger that selects options from pictures on the screen.

Electronics companies are also producing other accessories, such as graphic drawing tablets and music synthesizers. If you're interested in the graphic and sound capabilities of a home computer, be sure to investigate these devices. Look for reviews in software magazines. Again, make sure they work on the Plus/4 computer. Although many Commodore 64 peripherals work on the Plus/4 computer, some, as you've read, do not.

SETTING UP YOUR PLUS/4 SYSTEM

Unpacking and setting up your Plus/4 computer is really pretty easy; it shouldn't take more than a few minutes. Before you begin the setup, however, you should think about where you want to place your system and what you will need to complete the job. Some of the items you'll need are:

- A small screwdriver.
- The tv switchbox that came with your Plus/4 computer (Fig. 4-1).
- The power-supply box that came with your computer. This black box has a cord attached to each end.
- The thin rf cable that came with your Plus/4 (Fig. 4-2).
- Access to at least two power sockets: one for the tv and one for the computer. If you're attaching additional computing equipment, you'll need access to more sockets.

If you're connecting several additional pieces of computing equipment, you might want to consider purchasing a power strip. A power strip can alleviate the problem of overcrowded wall outlets.

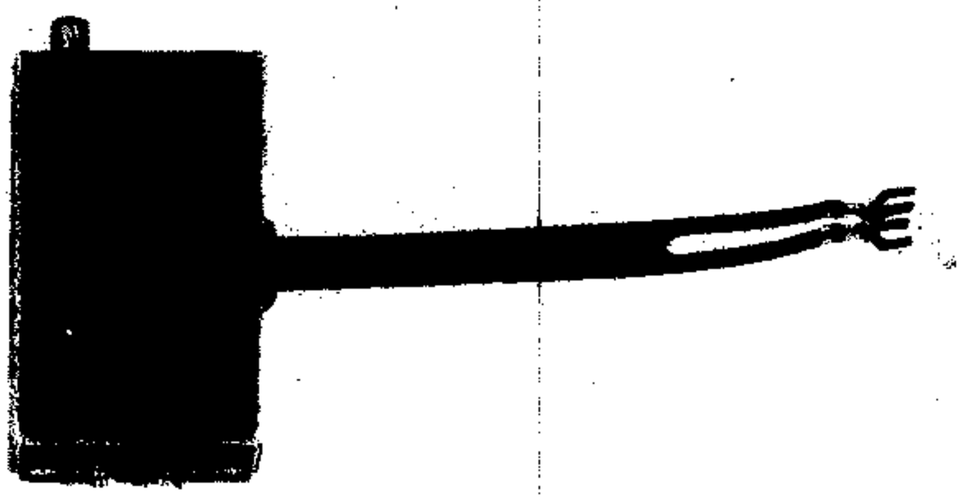


Fig. 4-1. A tv switchbox (Courtesy Commodore Business Machines, Inc.).

Fig. 4-2. An rf cable (Courtesy Commodore Business Machines, Inc.).

If you get a power strip with an ON/OFF switch, you'll be able to turn all your equipment on and off with one switch. Since the ON/OFF switch on most computing equipment is inconveniently located on the back of the machine, a power strip with a power switch is an advantage. Moreover, since some computing equipment tends to overheat, a power strip with an ON/OFF power switch gives you a simple way to make sure all the equipment is turned off.

WHERE TO SET UP YOUR PLUS/4

Before you begin to assemble your new Plus/4 system, you should make sure you know where you want to put the computer. There are several important considerations that can affect this decision. To set up a computer, you will need access to electricity, enough space to safely and comfortably station your equipment, and a comfortable place to sit. You will also need a place that isn't dusty, and a place where no one will trip over the cords that connect the computer system together. If you are connecting your computer to the family tv set, make sure you have a practical schedule for using the computer.

If you have the luxury of being able to set up your computer wherever you want it, choose a well-lit, quiet place in your home. Put the computer on a desk or table that's wide enough to permit some space between the screen of the tv set (or monitor) and the computer. A memory storage device, either a disk drive or a cassette recorder, should be placed close at hand. Remember to protect it from dust but still give it ventilation. Also, remember that you should NOT put disks or tapes on top of any computing equipment. Make sure you allow room for any additional equipment and have enough table space for manuals and other papers.

MAKING ROOM FOR A PRINTER

If you have a printer, it's a good idea to give it a small table of its own. The stack of continuous sheets of printing paper for your printer needs a place to sit. Usually, the paper has to sit behind the printer as it's fed into the printer. Then, the printed paper needs a place to go as it comes out of the printer. Make sure you have a

place where the paper can fall into a stack as it comes out of the printer.

If you're not careful about the way you set up your printer, you risk the great trauma that printers can cause: paper jam. The paper coming out of the printer can slip back into the paper-feeding parts. Once the printer starts eating the printed pages, you have to stop printing, rescue the trapped paper, and start over again.

The best solution is to put the printer on a small table that is a few inches from the wall. Place the paper on the floor under the printer, aligned with the paper-feeding mechanism. Then, just allow the paper-feed mechanism to pull the paper up from the floor and into the printer.

If you are printing more than a few pages, let the printed paper fall forward onto the floor into a neat stack, as illustrated in Fig. 4-3. You should carefully watch the paper until it starts to settle into a nice stack. You can also let the printed paper fall backward as long as you're sure it won't interfere with the movement of the paper that is feeding into the printer. The best way to ensure noninterference is to put the feed-in (blank) stack of paper in front of the feed-out (printed) stack. Practice printing to determine whether having the paper fall backward or forward works better with your printer.

SPECIAL COMPUTER FURNITURE

Even if you intend to use your computer for business or school work, it is not necessary to purchase a special computer desk. Although there are good computer desks available, some computer furniture is overpriced and poorly designed. You'll probably be more comfortable using a regular table or desk. You should consider using two tables if you have a complete system. You can use the second table for your printer and for other equipment you don't need to have close at hand. Fig. 4-3 shows a suggested arrangement for setting up a home computer system on tables.

If you do buy a computer desk, make sure it allows adequate ventilation and make sure it's designed to give you comfortable access to all your computing equipment. You can't assume that a piece of furniture is going to be a practical computing work area just because it claims to be made for computers. Remember that you don't want to sit too close to the video display, and you do need to be able to reach a disk drive or cassette recorder with ease. It's usually no problem to have a printer somewhat out of reach because you don't need to touch a printer to operate it. But you do need to put cassette tapes into cassette tape recorders and disks into disk drives, so make sure they are readily accessible.

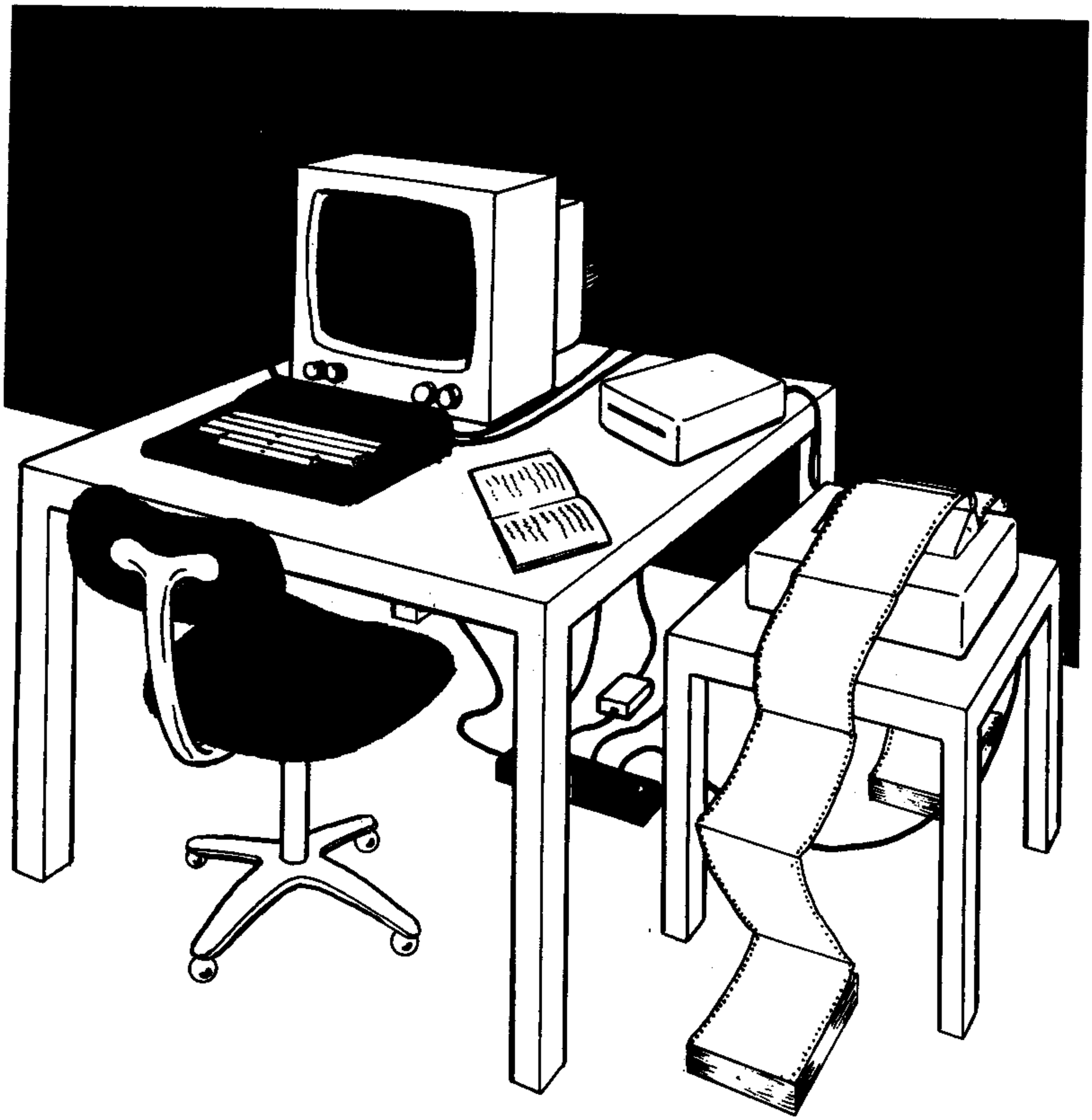


Fig. 4-3. Suggested arrangement for a home computer system.

CHOOSING A COMFORTABLE COMPUTING AREA

If you can freely choose the place to put your computer, give some thought to where you want it to be. You should be practical about your decision, but that doesn't mean you should abandon comfort or familiarity.

You'll probably want to use your computer in a quiet place. You'll certainly want to put it in a place that's not subject to dirt,

dampness, temperature extremes, and a lot of dust. You should also be careful to put your computing equipment in a place that provides some ventilation, yet is somewhat protected from dust. Computers and disk drives produce heat and they shouldn't be confined in tight quarters because the equipment may overheat. Also bear the following points in mind when you are considering where to set up your computer:

1. The monitor or tv set should be placed at an angle that won't subject it to glare from the sun.
2. Tables that hold computing equipment should be uncluttered.
3. Equipment should never be stacked.
4. Any shelving you use should be open-ended, spacious, and, especially if you have a printer, placed a sufficient distance away from the wall.

If you or someone in your family feels intimidated by computers (a fear we hope will be overcome by this book), try putting the computer in a place where you already feel secure. Demystify the computer by putting it on familiar furniture instead of on something that is high-tech.

Don't forget about the need for power outlets. However, if you get a power strip, you won't have to concern yourself with this. If you do intend to use a power strip or multiple-outlet extension cord, be certain that the electrical circuit you are using is not already overloaded with appliances, stereos, power tools, etc. A blown fuse or a broken circuit could damage disks and tapes if the system breaks down when they are in a drive or recorder. If you have questions about the electrical circuits in your home, consult an electrician.

SETUP REQUIREMENTS

Using a TV Set To Display the Computer Picture

Before you start connecting your computer to a tv set, you will need to know what kind of antenna connection your tv set has. If you've recently purchased a tv, you may have one equipped with video input plugs. If you have video plugs, you don't need to concern yourself with the tv antenna connection because the computer will plug into the video input jack, not into the antenna connector. If you have this type of tv set, consult the manual that came with it.

There are two basic types of tv antenna connections.

1. One type is a 2-lead flat wire that ends in two U-shaped ends (called spade lugs). This is 300-ohm twin-lead. The spade lugs (or terminals) are connected by two screws to the back of the tv set (see Fig. 4-4).
2. The other type is a round cable that terminates in a round threaded plug end that screws into the back of the tv set. This is called 75-ohm coaxial cable.

If you have the second type of tv antenna connection, the coaxial-cable type, the tv switchbox that comes with your computer won't connect to your tv set. You need to go to an electronics store, such as Radio Shack®, and get one of two items — a replacement 75-ohm switchbox or a 300-ohm to 75-ohm adapter.

Getting the replacement switchbox is the better idea because it will make connecting the computer easier. If you do decide to get the switchbox, take along the 300-ohm switchbox that came with the computer. The electronics store may be willing to exchange switchboxes at no charge.

Once you've gathered the items mentioned earlier (the screwdriver, the tv switchbox, the power box, and rf cable) at the beginning of the chapter, you're ready to begin. Of course, you also need the computer and a tv set. Turn the tv set so that you have complete access to the back of the set where the antenna input leads are located (Fig. 4-5).

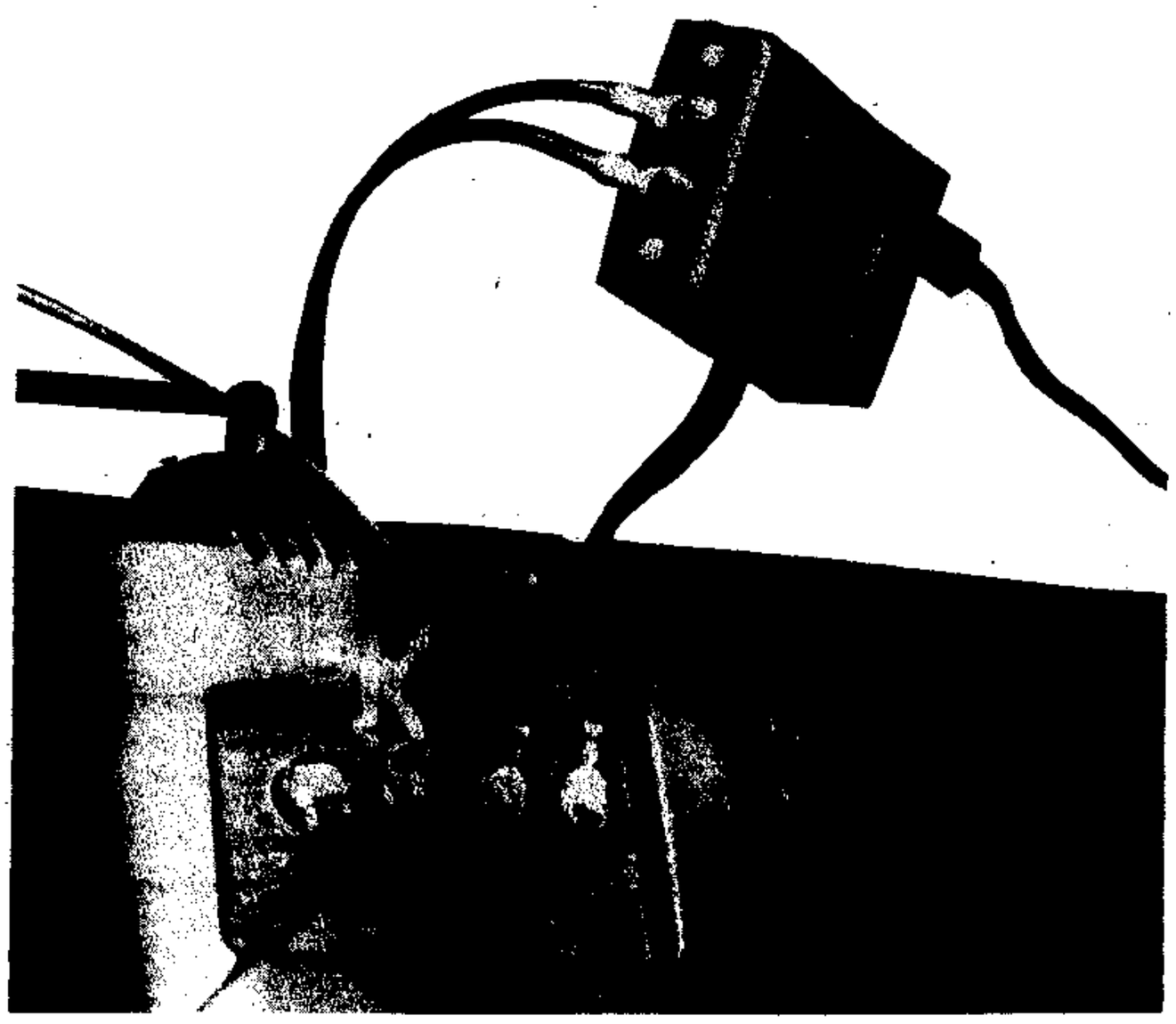


Fig. 4-4. Twin-lead antenna hook-up.

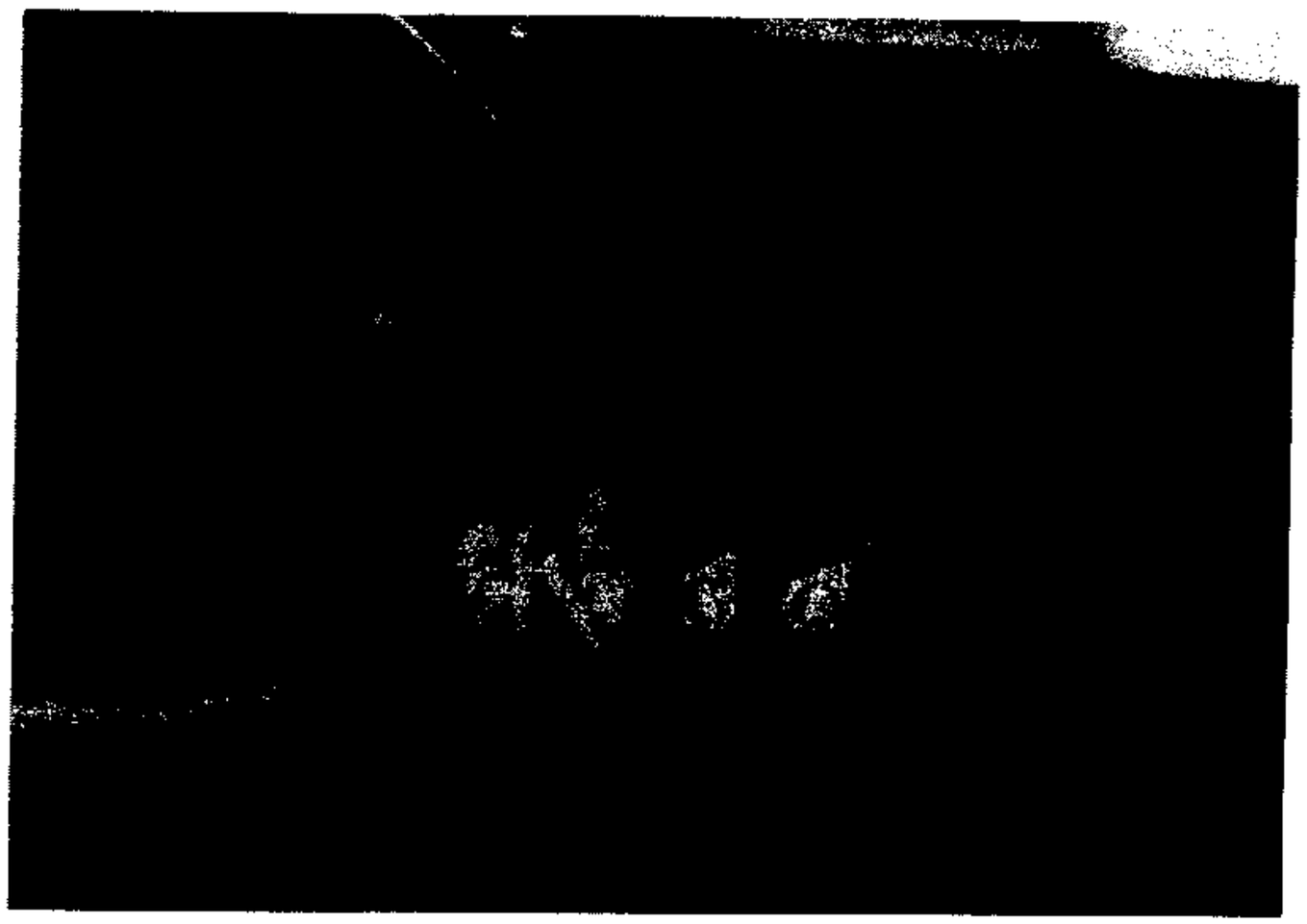


Fig. 4-5. Antenna connection point on the back of the tv set.

300-Ohm Antenna

If your tv set has the flat, twin-lead type of antenna wire, follow these steps:

STEP 1 Use the screwdriver to loosen the screws that hold the antenna lead-in wire to the vhf connectors on the back of the tv set (see Fig. 4-6). When the screws are loose, slide the C-shaped spade-lug terminals off the screws.

Fig. 4-6. Unscrewing the vhf antenna leads.

STEP 2 Take the terminals you just disconnected and insert them under the screws on the tv switchbox; tighten the screws until the terminals are firmly fastened.

STEP 3 Find the short double-ended wire that comes out of one side of the tv switchbox (Fig. 4-1). This wire looks exactly like the antenna wire that you just disconnected from the tv set and attached to the switchbox. Put the ends of this short wire under the screw heads on the back of the tv set from which you just disconnected the antenna-wire terminals. Just insert the C-shaped ends under the screw heads and tighten the screws until the wire is firmly connected, as shown in Fig. 4-7.

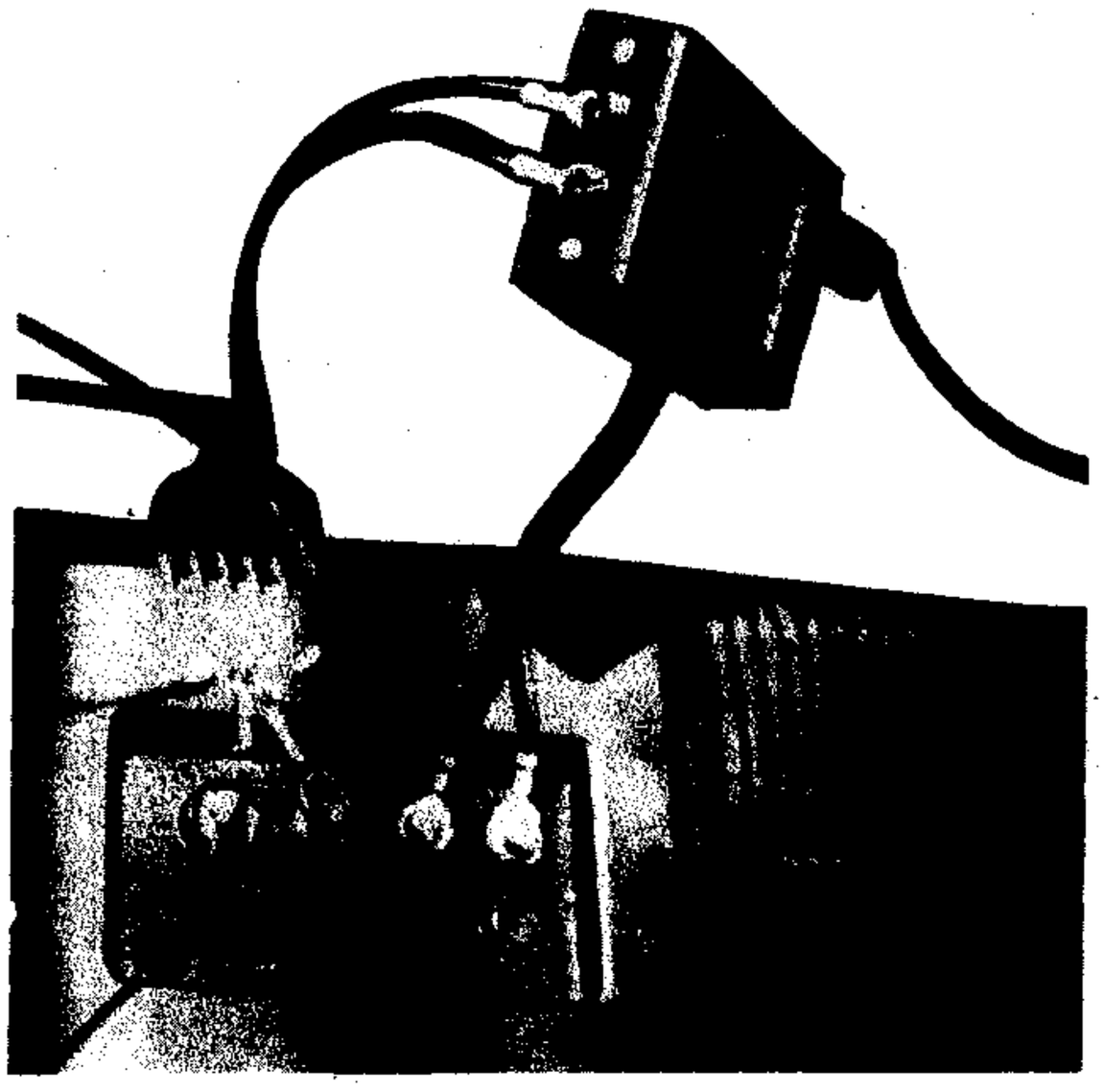


Fig. 4-7. Tv switchbox installed.

75-Ohm Antenna

If your tv set has the round coaxial-cable antenna wire, make sure you obtain a 75-ohm switchbox as a replacement for the switchbox that came with your computer, and follow these steps:

STEP 1 Unscrew the antenna cable from the back of your tv set. You should be able to unscrew it by hand.

STEP 2 Screw the antenna cable into the switchbox.

STEP 3 Take the short cable on the switchbox and screw it onto your tv antenna input post. This is the post from which you just unscrewed the antenna cable.

If you had to obtain a 75- to 300-ohm transformer, follow these steps:

STEP 1 Unscrew the antenna cable from the back of your tv set.

STEP 2 Screw the large threaded end of the transformer onto the antenna cable (the F connector).

STEP 3 Connect the C-shaped, double-ended wire on the transformer to the two screws on the switchbox. Just insert the wires under the screw heads and tighten the screws until the wire is firmly connected.

STEP 4 Connect the C-shaped ends of the short wire from the switchbox to the vhf antenna screw on the back of the tv set.

What you've just done is connect the tv switchbox in between the tv set and the antenna. The antenna is still connected to the tv set; the switchbox has been "spliced" into the antenna wire.

When you flick the switch on the tv switchbox to the TV side, the antenna and the tv set operate normally. There should be no difference in your tv reception. When you flick the switch on the switchbox to the COMPUTER side, the tv set works as your computer video display, not as a tv set.

Connecting the RF Cable

After the switchbox is connected, get the thin rf cable (Fig 4-2) that came with the computer. The cable has a single plug on each end. Plug one end into the socket on the top of the switchbox. Both ends are the same, so it doesn't matter which end you plug into the switchbox. Plug the other end into the rf jack on the left side of the computer, shown in Fig. 4-8. This jack is marked RF.

Connecting the Power-Supply Cable

Packed in with your Plus/4 computer is the power-supply cable; it is the black box with a cord on each end (Fig. 4-9). One cord has

Fig. 4-8. The left side of the computer showing the rf jack and the Hi/Low switch (Courtesy Commodore Business Machines, Inc.).

a standard 3-prong electrical plug and the other terminates in either a round or square plug. Plug the cord with the square end into the power port located on the back of the Plus/4 computer, as shown in Fig. 4-10. Then, plug the standard 3-prong plug into a power outlet. Now you're ready to turn on the computer and the tv set.

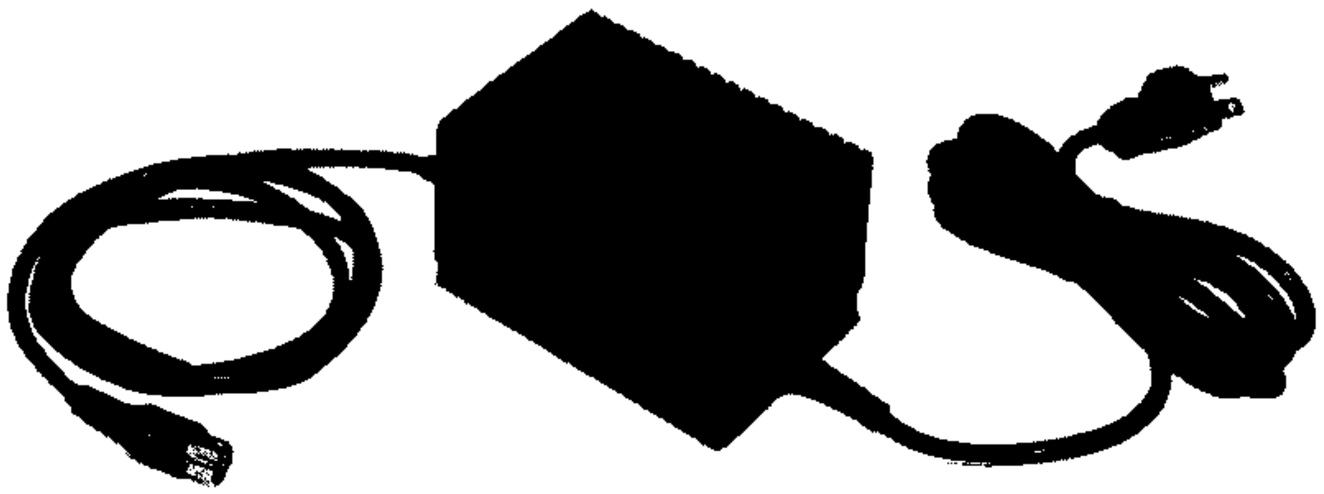


Fig. 4-9. Power supply (Courtesy Commodore Business Machines, Inc.).

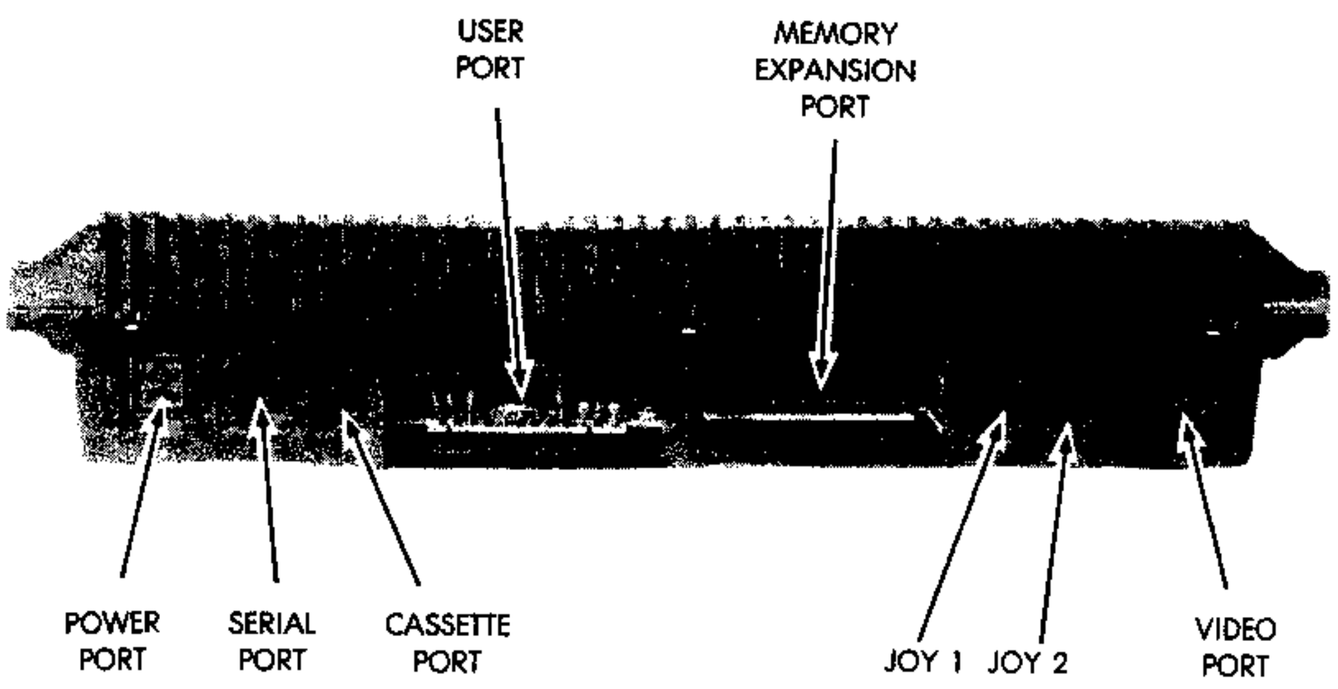


Fig. 4-10. The power port, the socket on the extreme left.

SELECTING A CHANNEL FOR VIDEO DISPLAY

The Plus/4 computer is designed to display computer video on either Channel 3 or 4. The other channels won't work. You can choose either of these channels to use, but don't use one that's already used by a local tv station. In other words, if there's a Channel 4 broadcast station in your area, use Channel 3 for your computer video.

You must select the channel by making two settings: tune the tv set to the channel you choose and then set the H-L (hi/low) switch on the left side of the computer (Fig. 4-8) to match your selection. Set the switch on H (high) if you use Channel 4, and L (low) if you select Channel 3. The picture won't be displayed if these settings don't match.

CONNECTING THE PLUS/4 TO A MONITOR

Connecting a monitor to your computer is simple. You don't need any tools, just the cable that comes with the monitor.

STEP 1 Plug one end of the monitor cable into the monitor.

If your monitor uses a thin cable with two single-pronged plugs on one end and one single-pronged plug on the other, insert one of the pair of plugs into the video outlet on the monitor and the other plug into the audio outlet.

If there is no marking to indicate which plug goes into which jack, you can experiment after you finish setting up the computer: if there is no sound or picture when the computer is set up, turn off all machines, switch the plugs, and turn on the machines. You should get both sound and picture now.

If you have a Commodore monitor, such as the Commodore 1802 monitor, the cable should have three single plugs on one end and a round DIN plug on the other end. The plugs go into the back of the monitor.

1. Insert the RED plug into the outlet marked CHROMA.
2. Insert the YELLOW plug into the outlet marked LUMA.
3. Insert the WHITE plug into the outlet marked AUDIO.
4. Move the FRONT/REAR signal switch, which is located on the back of the monitor below the three jacks (Fig. 4-11) to REAR.

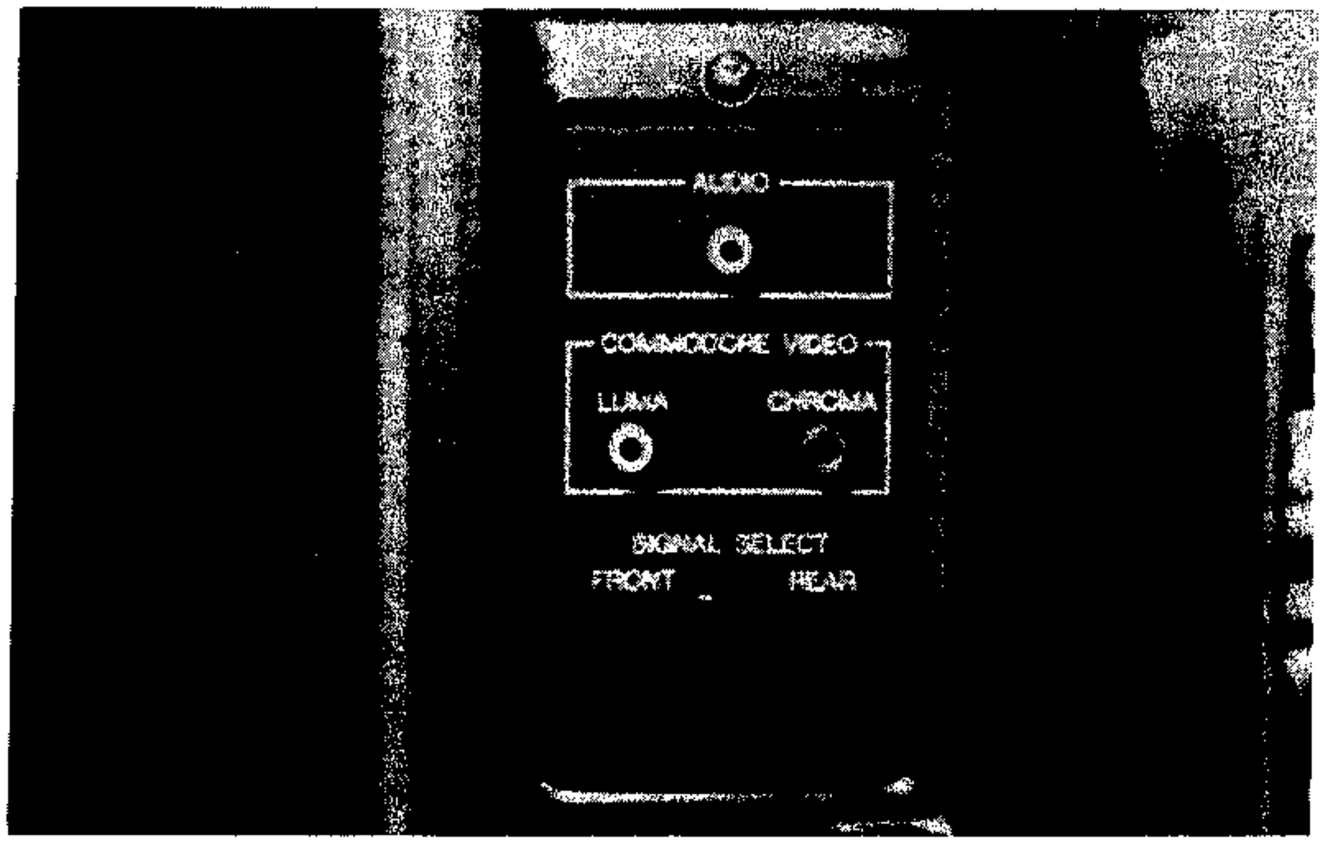


Fig. 4-11. Back of the Commodore 1701 Color Monitor showing the audio/video connection jacks.

STEP 2 Plug the other end of the monitor cable into the computer.

If your monitor uses the thin cable with two single-pronged plugs (one on each end), insert the free plug into the outlet marked RF on the left side of the computer. If your monitor has a large round plug on one end, plug this end into the outlet marked VIDEO on the back of the computer.

STEP 3 Plug the computer power-supply cord into the computer and into a power outlet.

Commodore makes several color monitors, including the 1701, 1702, and 1802 models. These monitors are essentially identical (internally anyway) and are compatible with the Plus/4 computer. When you read the manual packed with any of these monitors, note that the Plus/4 computer has an 8-pin video connector. Ignore any instructions for 5-pin video connectors.

Your monitor is now ready to display the computer video. If the monitor audio isn't working correctly after you follow the instructions, make sure that the volume is turned up. If you have a non-Commodore monitor that connects with a cable with single-pronged plugs, turn off the machines, switch the audio and video plugs, and see if the monitor works then.

If the monitor still doesn't work, and you've checked the manual that came with your monitor, hook your computer up to your tv set to see if the computer is malfunctioning. If the computer works with the tv set, something's wrong with either the monitor or the video outlet on your computer. Check with your dealer.

CONNECTING A 1531 DATASSETTE RECORDER TO THE PLUS/4

You'll notice when you unpack the Datassette recorder that it doesn't have a cord that plugs into a wall outlet. The Datassette is run by your computer without any additional power.

To connect your Datassette, turn off your computer and make sure none of the buttons are pushed down on the recorder. Then, just plug the Datassette cord into the outlet marked CASSETTE, shown in Fig. 4-12, on the back of the computer. Make sure the plug is firmly installed.

Test the Datassette installation by turning on the computer. The power light on the Datassette should be on. You can test further by loading a software cassette. (See the Software Commands Reference Chart at the end of Chapter 6 for the cassette loading command and instructions on how to use it.)

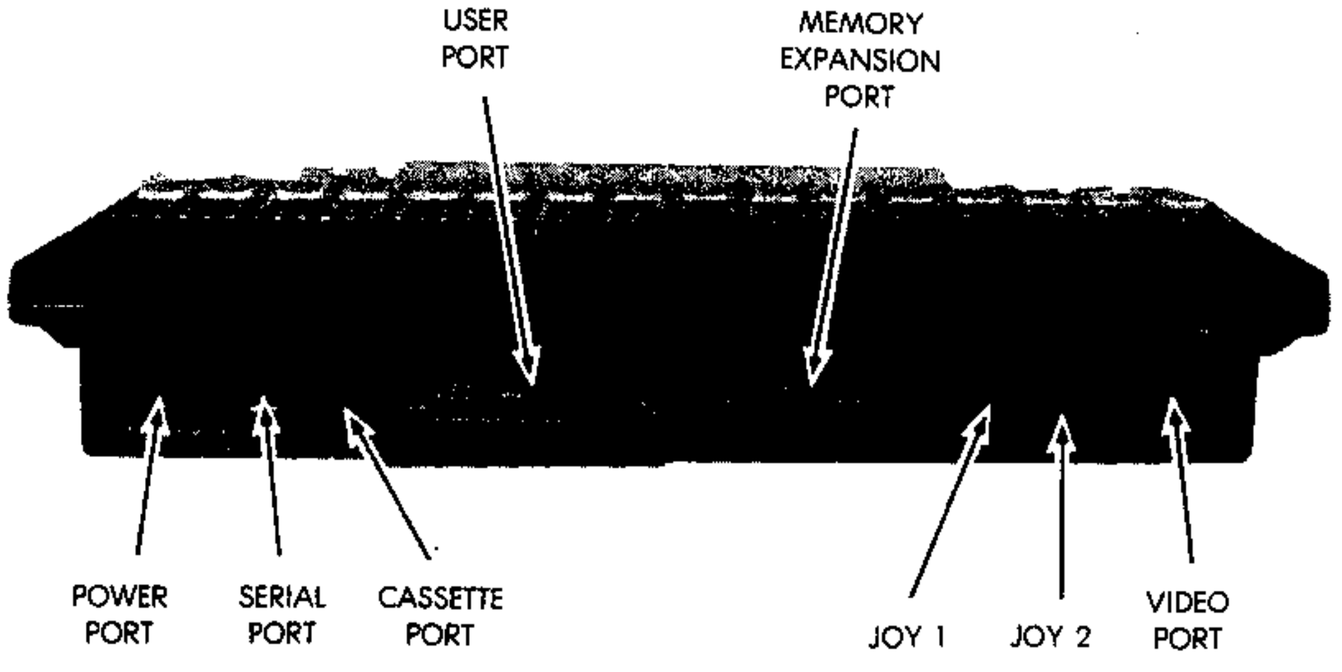


Fig. 4-12. Cassette port on the Plus/4 computer, third socket from left (Courtesy Commodore Business Machines, Inc.).

CONNECTING A DISK DRIVE TO THE PLUS/4 COMPUTER

Connecting a disk drive to the computer is also very simple. A cable and a power cord are packed with the disk drive. These cables are all you need to connect the disk drive to your computer.

STEP 1 Plug the power cord into the power outlet on the back of the disk drive (Fig. 4-13). Plug the other end of the cord into a power outlet.

STEP 2 Plug one end of the second cable into the round outlet on the back of the disk drive. Either end of the cable can go into the back of the drive.

STEP 3 Plug the other end of this cable into the outlet on the back of the computer marked SERIAL for Serial Bus.

Test the disk drive installation by turning on the disk drive. The power light should be on. You can further test the disk drive by loading a software disk. The disk loading command appears in the Software Commands Reference Chart located at the end of Chapter 6.

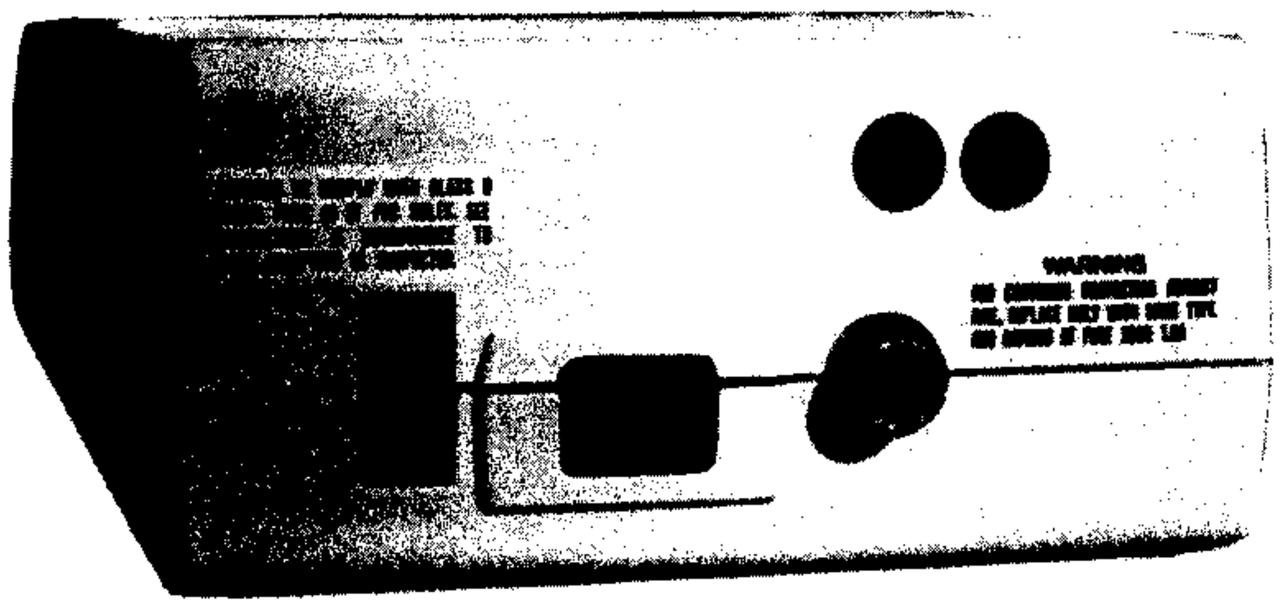


Fig. 4-13. Power outlet on the back of the 1541 Disk Drive.

CONNECTING A PRINTER TO THE PLUS/4 COMPUTER

Connecting a printer is also very simple. A cable and a power cord are packed with the printer. These cables (and an interface card, if necessary) are all you need to connect a printer to your computer.

STEP 1 Plug the power cord into the power outlet on the back of the printer. Then plug the other end of the cord into a power outlet.

STEP 2 If you are using a Commodore printer, plug one end of the second cable into the round outlet on the back of the printer.

If you are connecting a Commodore printer, but not a disk drive to your computer, plug the second end of the cable into the SERIAL socket on the back of the computer.

If your printer has an interface cable, plug the parallel plug of the cable into the parallel port on the printer. Then plug the other end of the cord into the Memory Expansion Port on the back of the Plus/4 computer. Follow any other instructions given.

STEP 3 If you are connecting both a disk drive and a Commodore printer, plug the second end of the printer cable into one of the round outlets on the back of the disk drive. *Note:* The printer is not connected to the computer if you have a disk drive. Instead, the printer is connected to the disk drive and the disk drive is connected to the computer. After you plug the printer into the disk drive, plug the disk drive cable into the SERIAL socket on the back of the computer.

Test the printer installation by turning on the printer. The power light should be on. You can further test the printer by turning the computer on and typing the following little program. If you have connected your printer via a disk drive, you must also turn the disk drive on for the printer to print. Be sure to type the program exactly as it appears:

```
10 OPEN 4,4,4
20 CMD 4
30 PRINT "PRINTER TEST"
40 PRINT "1234567890"
50 PRINT #4
60 CLOSE 4,4
```

The manual that comes with a printer contains much more information, of course, including a longer test.

SOME PROBLEM-SOLVING TIPS

There's not much you can do to adjust your computer, so if you have problems, look to the peripherals. The first thing to check is the cables and other connectors. Once you identify which peripheral is the possible source of trouble, try to isolate the cause. Until you've traced down all the possibilities, you shouldn't assume that your computer is broken.

Video Display

If you can't get a picture on your tv set or monitor, try the following approaches:

1. *Check the cable connections.* Are they correctly made? Are they firmly in place? It's a good idea to review the installation instructions.

2. *Check selectors.* If you're using a tv set, make sure that the channel selector button on your computer and the channel selector switch on the tv set are set to the same channel (either both on 3 or both on 4).

   Make sure the switchbox is set to COMPUTER, not to TV.

   If you're using a Commodore monitor, make sure the FRONT/REAR switch is set to REAR and the cable is plugged into the outlets on the back of the monitor.

3. *Check the picture control settings.* Make sure the brightness control is not set on total darkness. Adjust the other controls to make sure they aren't interfering with the picture.

   If the picture is hopelessly fuzzy and you can't read the characters, try adjusting the picture controls. If you're using a tv set, try using the other channel (remember to set the channel selector on both the tv set and the computer). You can also try using different character and screen background combinations. Chapter 6 explains how to select new character colors.

Cassette Recorder Difficulties

If you can't access a tape in the cassette tape recorder, try the following suggestions:

1. Make sure the recorder is plugged in completely.
2. Make sure the tape cassette is inserted all the way into the recorder and the protective door is shut.
3. Make sure you pressed the right button (PLAY, RECORD, etc.), and that it is pressed all the way down.

4. Make sure you used the correct commands (e.g., LOAD and SAVE, not DLOAD and DSAVE).
5. Look up the explanations for error messages in the User's Manual if a message is displayed on the screen.

Cartridges

About the only problem that can arise with a cartridge is that the program will not come up. The problem is almost certainly with the cartridge, although rough treatment can damage the memory expansion port where the cartridges are plugged in.

If the program won't come up on the screen, and you've ascertained that the computer and tv set or monitor are properly connected, turn off the computer and remove and insert the cartridge again. Make sure the cartridge is firmly and evenly in place. Then turn the computer back on.

If the program still won't come up and you're sure the cartridge is properly inserted, try loading a different cartridge. If this works, then you can conclude that the cartridge itself is bad. If this isn't the first time that you have loaded the cartridge, you probably damaged it yourself.

Remember, the worst thing you can do to a cartridge (well, there's probably something worse) is install or remove it while the computer is on. Be sure to turn off the computer before you insert, adjust, or remove a cartridge. This may be hard to remember at first, but it's important.

Disk Drives

The most common problems with disk drives are related to overheating and mishandling. As you read in Chapter 3, disk drives must be handled carefully. They also must not be overheated.

You can tell that a disk drive is too hot just by touching it. If you've had the drive on for more than four or five hours, take its temperature by feeling along its top and sides. Even if it doesn't feel too hot, you should probably turn it off for awhile.

If the disk drive won't load a program, check the cable connections first. Make sure the disk is properly inserted and the drive latch is secure. If these measures don't uncover the problem source, check the temperature of the drive. If it's hot, turn it off and try loading the program again later. If it's not hot, remove the disk, turn off the drive, and then restart the loading procedure again. If this doesn't work, try loading a different program from the same disk. If this doesn't work, try loading a program from a different disk. If this doesn't work, try saving a program onto a headered disk. If this doesn't work, something is wrong with the communication channel to the drive. If you're sure the problem is not with the cable, there's probably something wrong with the drive. If this is the case, you need professional help.

Disks

If you accidentally turn off the disk drive while a disk is in the drive, remove the disk BEFORE you turn the drive back on again. Turning the drive back on while the disk is still in the drive is the worst thing you can do. It may destroy the data stored on the disk.

Occasionally, a disk goes bad after you've used it for awhile. To protect yourself from a loss worse than the price of a disk, be sure to make back-up copies of all disks, including your disks containing commercial software. Some commerical software is copy-protected, however, which means you can't make a back-up copy. Try to avoid buying copy-protected software. If software is write-protected, that's good. Write-protection on software media prevents you or anyone from saving anything onto the disk and writing over what is already on the disk. For a variety of reasons, write-protection is generally desirable.

Printers

As you read in Chapter 3, some printers are prone to paper-feeding problems. In short, some printers manage to lure already printed pages back into the hungry mouth of the tractor feed (this device isn't called a "feed" for no reason). Once this happens, you have to interrupt the printout, duel with the printer for possession of your now mangled pages, and start over.

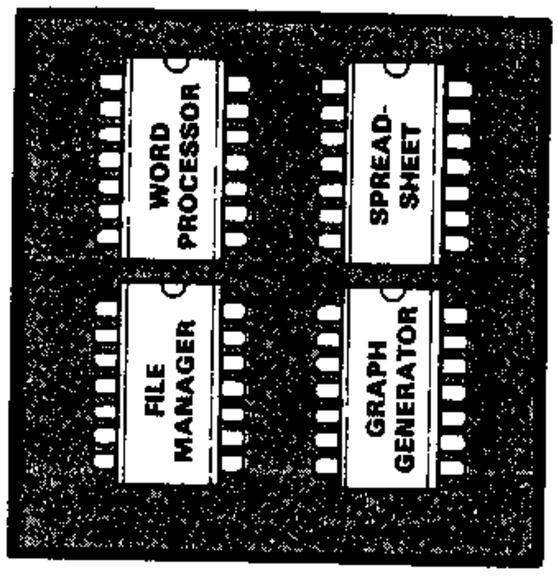
The best solution is to set up the printer in a place where the paper can be fed smoothly and the printed pages can drop freely into a stack. The printer shouldn't be crowded or set against a wall. The best setup feeds the paper up from the floor (or a shelf) behind the printer and forces the printed paper to fall forward into a tidy pile. You may find, however, that your printer just doesn't do well in this type of setup.

If you must set up the printer so that it takes in and spits out paper from the back of the printer, make absolutely and positively sure that the exiting paper won't fall back on top of the entering paper. You may want to construct a bracket of some sort that forces the printed pages to fall behind the stack of blank pages.

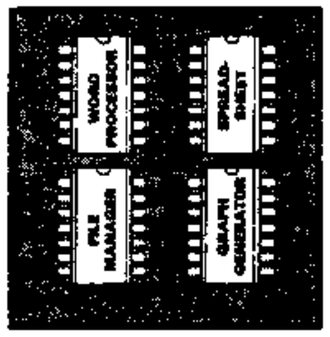
Another fairly common printer problem is the printing of crazy characters. If your printer suffers such an attack, try the catch-all tactic first. Turn off all the equipment. Have the machines been on for quite a while? If so, overheating is most likely the culprit. Wait a little while and try again. If you are sure overheating isn't the problem, turn off the equipment anyway. Then, turn it all back on and try again. Unscientific though this clearing "technique" may seem, it often does work and should be your first line of defense.

Join a Club

If you intend to use your computer quite often and for a variety of activities, you should seriously consider joining a Commodore users' club. You can find out about these local groups in *Commodore: The Microcomputer Magazine*, which is available in book stores and by subscription. This magazine is published by Commodore, but the users' groups are independent. Group members can provide you with much help and information. There are hundreds of clubs nation-wide, and you can get help in forming your own if your area is without a club.



USING THE BUILT-IN SOFTWARE



As you learned in Chapter 1, the Commodore Plus/4 computer comes with a built-in software package that includes four programs: a word processor, a spreadsheet, a file manager, and a graphics generator. You don't need any additional equipment to load the built-in programs; they are ready for your use as soon as you press a Function key.

The built-in programs work both separately and interactively, which means you can transfer work and information from one program to another. For example, you can update an inventory with the spreadsheet program, draw a graph showing which products sold the best, and then use the word processor program to write a report of your findings.

In this chapter, we will describe the features of each of the built-in programs. We will also demonstrate how the programs work, both separately and together. Then, in Chapter 6, you'll read the descriptions of some other available versions of the same types of programs that are built into the Plus/4 computer. For example, you can buy a separate word processor, such as Script/Plus.

THE BUILT-IN WORD PROCESSOR

A word processor simplifies writing. Everything you type with the word processor is instantly correctable, rearrangeable, and reusable. You can change the document as much as you want before you actually print it on paper. You can print as many copies as you need. If you want to make a change after you print a copy, you just make changes on the screen and then print out the text again.

You can perform the following operations just by typing short commands:

- Insert and delete letters, words, sentences, paragraphs, and pages.
- Move blocks of text around on the screen.
- Incorporate work from the other built-in programs.
- Center or left- or right-justify text.
- Highlight and underline text.
- Tell the computer how to format the output.
- Store and retrieve documents on tape or disk.
- Print copies of your work.

Fig. 5-1 shows the screen display of a letter written with the built-in word processor.

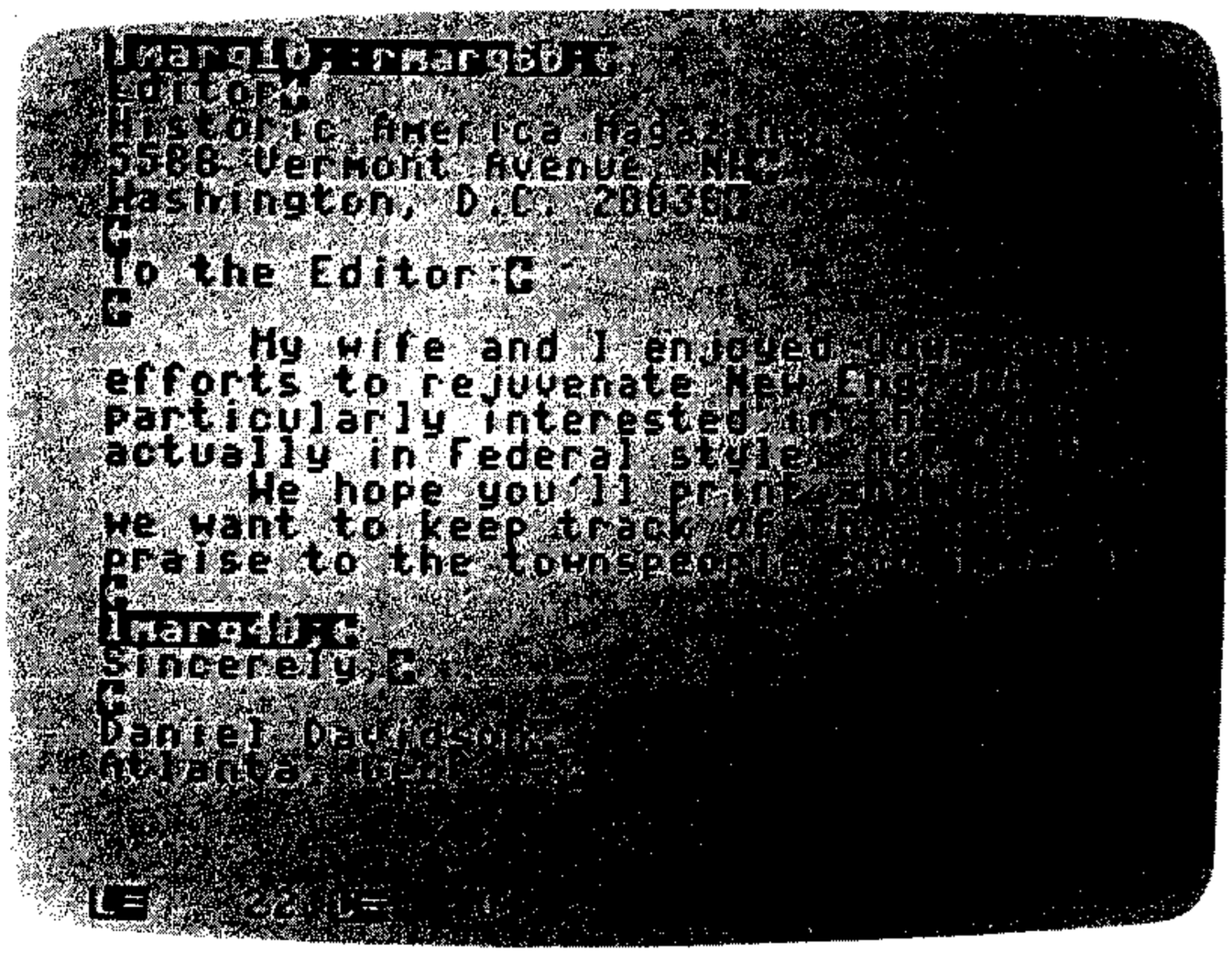


Fig. 5-1. Screen print of a letter written with the built-in word processor.

THE BUILT-IN SPREADSHEET

A spreadsheet program is basically a cross between a calculator and a ledger page. You can record any type of tabular (row and column) data on the spreadsheet. As Fig. 5-2 shows, the data can be either numbers or letters. You can keep track of budgets, inventories, expenses, payrolls, etc., and you can compare projected and actual figures. You can also enter mathematical formulas, such as the one shown on the bottom line in Fig. 5-2.

A spreadsheet can also be used to perform calculations. You can use simple arithmetic or more complex formulas. You can add all

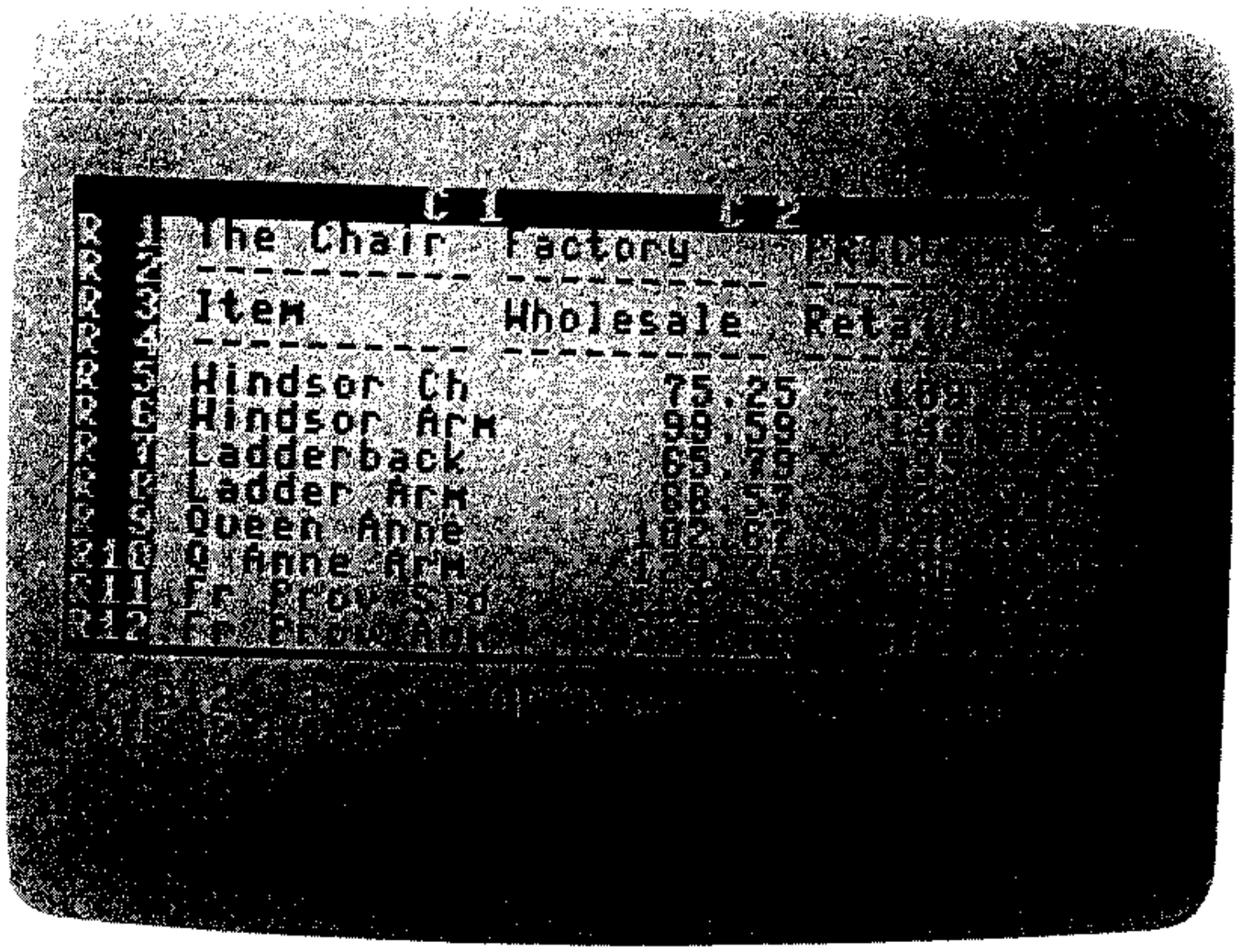


Fig. 5-2. A price list compiled using the built-in spreadsheet.

the values in a row or a column. Even better, when you make a change, any other figure on the spreadsheet affected by that change will be automatically changed as well. This feature lets you pose "what-if" questions about finances and inventories. For example, you can perform just one calculation and see how your finances would be affected if you received a 9% raise.

THE BUILT-IN GRAPH GENERATOR

The graph generator works with the spreadsheet to create a graphic illustration of a set of numbers. You supply the numbers you want depicted and the program draws a bar graph. Fig. 5-3 shows a sample bar graph drawn using this program. You can transfer a graph to the word-processor program and then print it out as part or parts of a report.

THE BUILT-IN FILE MANAGER

A file-management program, which is also called a database manager, can help you organize and reuse groups of information for a variety of purposes. A data base is an organized collection of data records, like a file cabinet of information. Compared to a file cabinet, a file manager offers these advantages:

- You can design your own file system for each file use.

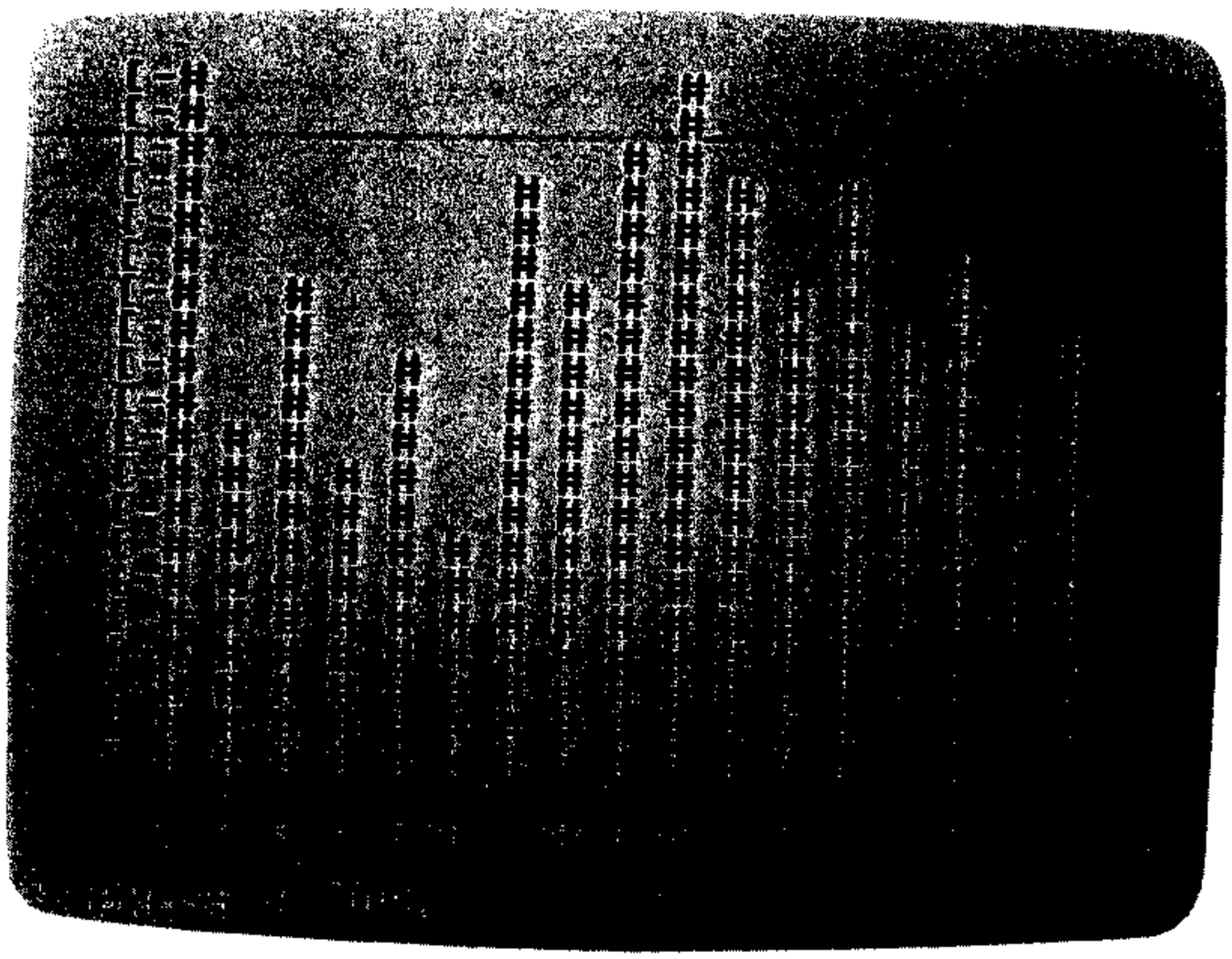


Fig. 5-3. A bar graph drawn using the built-in graph generator.

- You can sort and resort the data any way you like.
- You can make changes easily.
- You can use the word processor to write customized form letters and, then, can get names and addresses from the computerized files.
- You can print address labels and other lists.

Each stored record can be accessed by any number of categories which you define. For example, if you have addresses stored by the file manager, you can look them up by last name, by state, by zip code, and so on. Fig. 5-4 illustrates how you can design your own data records using the file-manager program.

TURNING ON THE SOFTWARE

Turning on the built-in software is simple. Just follow these steps:

STEP 1 Turn on the computer. (Of course, you can access the built-in programs any time, not just when the computer's first turned on.)

STEP 2 Press Function key **f1** . The following message is displayed on the screen:

```
SYS1525: 3-PLUS-1
```

STEP 3 Press the **RETURN** key.

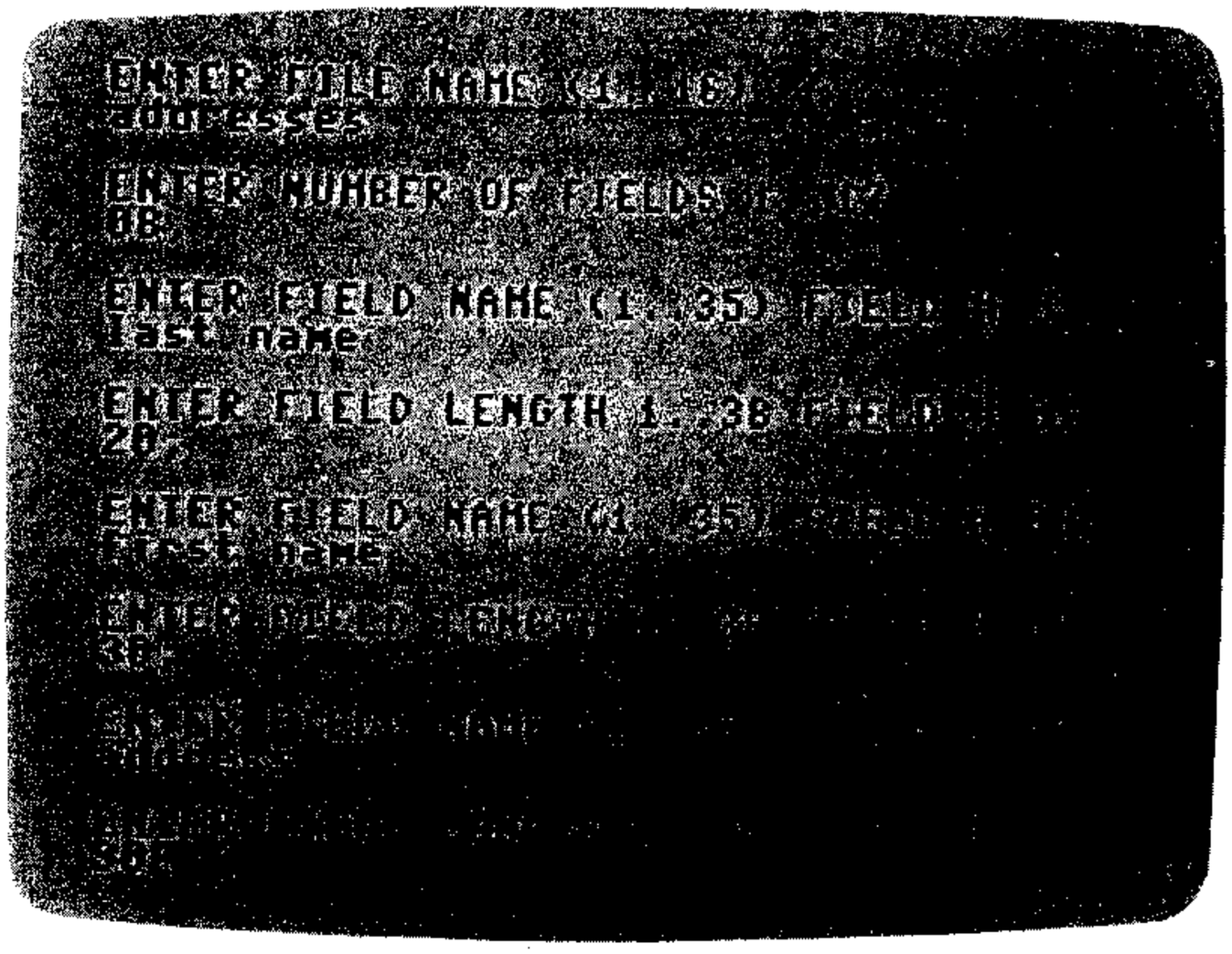


Fig. 5-4. Record fields created with the built-in file-manager program.

As soon as you press the F1 and RETURN keys, a title screen appears for a few seconds. Then, the black word-processor screen appears. The L and C legends at the bottom of the screen show the Line and Column number of the cursor's current position. As you read earlier, the cursor points to your place on the screen. The L and C values are automatically updated as you type to show you where you are on the screen.

Switching Between Programs

When you first turn on the built-in software, you always enter the word-processor program. If you want to go to one of the other programs instead, press the C= key and the F1 key at the same time. Then, just issue one of the commands shown in Table 5-1.

Table 5-1. Commands for Switching Between the Built-in Programs

Destination	Command	Meaning
Word Processor	tw	To word processing
File Manager	tf	To file
Spreadsheet	tc	To calculations
Graph Generator*	gr	To graphics

*Entered via the spreadsheet only.

Each command takes you from one of the built-in programs to the program you've selected. You can switch between programs any time you like. Note, however, that to switch from the graph generator, you must press the RETURN key. This moves you into the spreadsheet. This is the only way that you can get out of the graph generator.

The Word-Processing Work Area

The word-processing work area is 77 columns across the screen and 99 lines down. Naturally, the computer can't display all those columns and lines at once. Instead, you see only a 37-column by 22-line section at a time. As you type into the word processor, the screen segment you see will be the area around the current location of the cursor. As you work with the word processor more, you'll quickly learn how to move easily around the 77-by-99 screen.

The Spreadsheet Work Area

The spreadsheet work area is 17 columns across by 50 rows down on the screen. You will be able to see only three columns and twelve rows at a time, but you can have values in those parts of the screen that you can't see. The columns are labeled C1 through C17, and rows are labeled R1 through R50. You can refer to each position on the spreadsheet by its row and column numbers. Each position is called a *cell*; this is illustrated in Fig. 5-5. For example, the top left-hand cell is row 1, column 1.

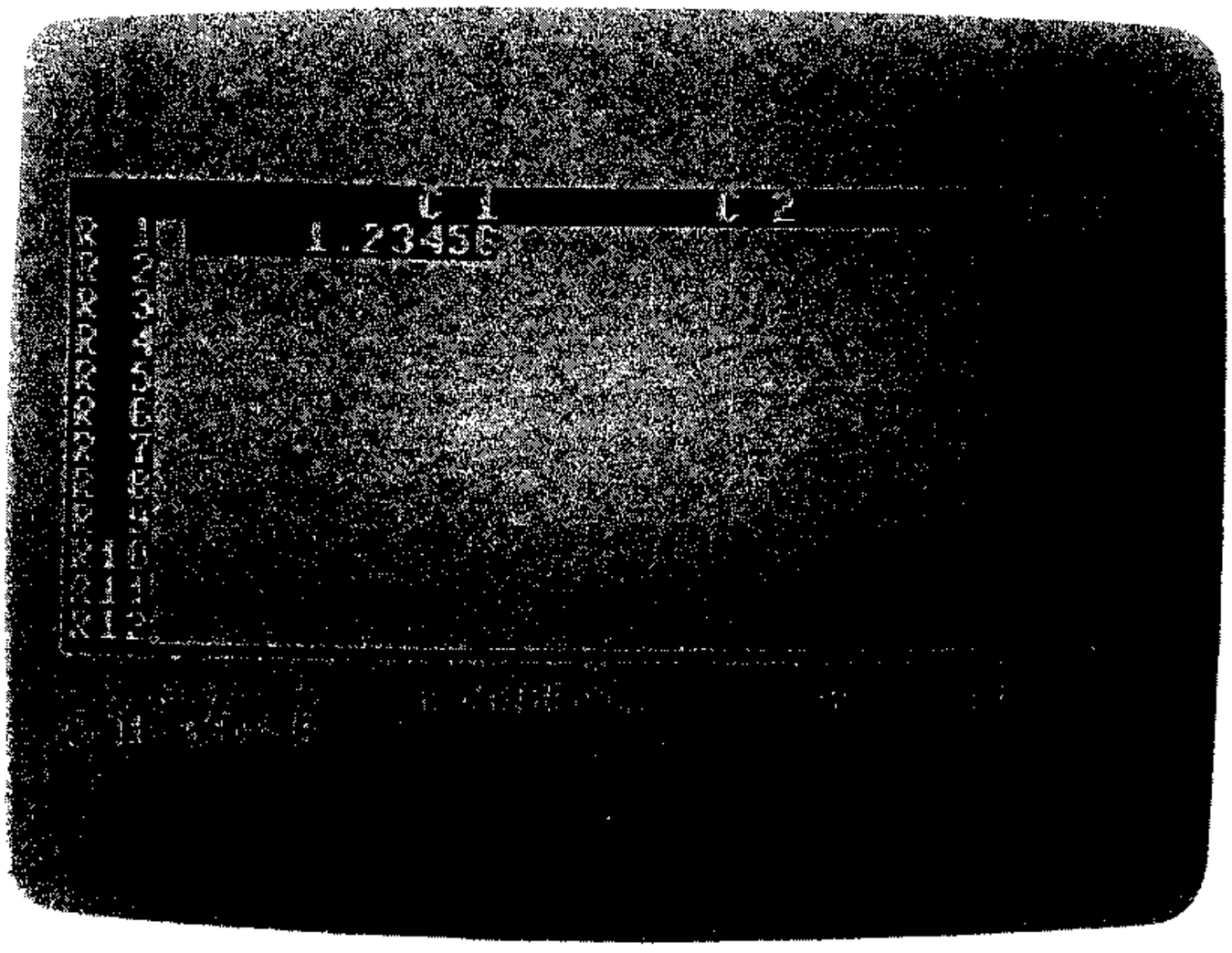


Fig. 5-5. The spreadsheet work area.

The File-Manager Work Area

The file manager has more than one work area. When you are defining the records in a file, the file manager prompts you for the names and lengths for each item in the file records. These parts of the records are called *fields*; they are the smallest unit of a *file*. You can sort and look up information according to any field that you name.

When you are entering data into the records you've defined, the file manager prompts you to fill each field with the type of information that goes in each field. When you are sorting, updating, searching, or performing some other task with the file manager, the work area is adapted to that particular job.

The Graph-Generator Work Area

The graph generator is a simple program; it has only one screen. You type in the numbers you want to graph while you're in the spreadsheet program. Then, you switch to the graph generator program, which automatically draws the graph. If you want to, you can transfer the graph to the word-processor program and use it in a letter or report.

A DEMONSTRATION OF THE BUILT-IN SOFTWARE

The following demonstration will show how each built-in program works, both by itself and in combination with the other programs. In the example, we'll do the following tasks:

- Write a letter.
- Prepare a budget.
- Compare the budget to actual expenses.
- Draw a bar graph to illustrate the differences in the budget.
- Place the budgetary information in the letter.
- Print the letter and store a copy of it on a disk.

The first step in composing the letter is turning on the word processor. As you read earlier, starting up the word-processor program is simple. After you turn on the computer, just press the F1 key and then the RETURN key. The blank word-processor screen will appear in a few seconds. Now you're ready to begin typing the letter.

If you've never used a computer before, you should read Chapter 7 before you proceed. You should read the sections on how to use the cursor arrow, RETURN , INST (INSERT), and DEL

(DELETE) keys, especially. These brief sections will show you how these keys work. Once you're familiar with the special operations of these keys, you'll have an easier time using the word processor.

Typing a Letter

Now that the word processor is turned on, you're ready to begin typing. Type in the following paragraph. If you make mistakes, use the cursor arrow keys and the INST and DEL keys to make corrections. Don't press RETURN until you get to the end of the paragraph.

Dear Mom and Dad,
  How's everything back home? I miss you both every day. Does Fido miss me? Please give him a hug for me. The semester is off to such a fast pace that I can hardly believe it's been three weeks since I was home.

When you finish typing the paragraph, press the RETURN key. As soon as you press RETURN, a reversed-image arrow is displayed on the screen, and the cursor moves automatically to the beginning of the next line. This symbol just tells you at what point you pressed the RETURN key. The RETURN key symbol marks the end of a paragraph.

Moving Around the Work Area

When you typed in the first sentence of the preceding letter paragraph, the screen began to scroll from side to side while you typed. Though the word-processing work area is 77 columns by 99 lines, the part of the screen that you can see at any one time is only 37 columns by 22 lines wide.

You can use the cursor keys to move around the work area; however, several other keys will let you move around more quickly. For example, Function key F1 moves the cursor to column 1 of the next line, and F2 moves the cursor to column 41 of the current line. The HOME key moves the cursor to line 1 in the current column. The CLEAR key moves the cursor to the last line of the current document. You'll learn more about moving quickly around the word-processing work area as you use the program.

Making Corrections as You Process Words

Just typing with a word processor is simple. Correcting mistakes is simple, too. If you've already read the sections in Chapter 7 about the special computer keys, you have learned how to use the INST key to insert letters and words in the midst of what you've already typed. Just move the cursor to the space where you want to add some letters. Then hold down the SHIFT and INST

keys until you've opened up enough space. The cursor doesn't move when you insert space, so just begin typing what you want to insert. If you just want to add a blank space, simply press the space bar or cursor key and continue from where you left off. Use the DEL key to close extra spaces if necessary.

In Chapter 7, you will learn how to use the DEL key to erase mistakes. This key works the same way when you are using the word processor. Just use the cursor arrow keys to move the cursor one space to the right of the letter you want to erase. Then press the DEL key until you've erased all the letters you want to get rid of.

Setting a Tab

You can indent a paragraph by moving the cursor five spaces to the right of the left margin until the cursor is in Column 6 (C = Ø6). You can simplify the indenting by setting a tab. To set a tab, just move the cursor to the column where you want a tab. Then press the CONTROL and ≡ keys at the same time. An * appears in that column on the dotted line at the bottom of the screen. This * shows where the tab is set.

To cancel a tab, move the cursor to the column where a tab has been set. Then press CONTROL and ≡ again. This releases the tab and removes the * from the dotted line at the bottom of the screen.

Continuing the Letter

Now that you've set a tab, you can move instantly to the beginning of the second paragraph. Do this by pressing both SHIFT and ≡ together. This key combination works like a tab key on a typewriter. If you have set more than one tab, SHIFT and ≡ will move you to the next tab column. Now you're ready to continue typing. Remember to press the RETURN key at the end of each paragraph.

When I was last home I told you I'd send an account of my finances from last semester. I believe you'll both agree that the information I'm enclosing supports my argument that I need more money.

Last summer when the three of us sat down to compose a budget for the coming fall term, we agreed upon the figures shown in the following table.

Unfortunately, my actual expenses were consistently higher than those projected in our budget. The second half of the table shows my actual expenses for September through December.

To demonstrate my straits, the following graph illustrates the discrepancies between the proposed and actual budgets.

I'll be home next month to discuss this budget. I look forward to seeing everyone and once again tasting noninstitutional food.

Love, Emily

ENTERING THE SPREADSHEET PROGRAM

In the letter, Emily promises a table of her old budget. To prepare this information, we need to go to the spreadsheet program. To switch from the word processor to the spreadsheet, press the C= and ⇧C= keys together. An uppercase W and a > sign will replace the dotted line at the bottom of the screen. This is the prompt that tells you you're in *Command mode.*

Command mode lets you tell the computer to do something with the software. You enter the Command mode from any of the built-in programs by pressing C= and ⇧C= . When the Command mode prompt appears, issue the command and press ⇧RETURN. In this case, we want to go to the spreadsheet. The command is **tc**, which stands for *To Calculating*, so type in **tc** in lowercase letters and press ⇧RETURN .

As you read earlier in this chapter, the spreadsheet work-area screen is arranged in table form, with 17 columns across and 50 rows down. You can see 3 columns (C1 through C3) and 12 rows (R1 through R12). Each position on the spreadsheet, called a *cell*, is identified by its row and column numbers. For example, the top left-hand cell is row 1, column 1, and is referred to in the form of 1;1.

Note the yellow bar in cell 1;1. This bar is the cell cursor, which shows you which cell is the current cell. You have to move the cell cursor yourself; when you type in a value and press ⇧RETURN , the cell cursor, unlike the regular cursor, stays where it is. To move the cell cursor up and down, use the cursor-up and cursor-down arrow keys. To move the cell cursor from side to side, you must use the ⇧F1 and ⇧F2 keys; the cursor-left and cursor-right arrow keys do not affect the cell cursor. ⇧F1 moves the cell cursor to the left and ⇧F2 moves it to the right.

Entering Text Items on the Spreadsheet

To prepare Emily's budget, we will need to post budget items and amounts in the spreadsheet cells. First we'll type in the names of the months in Column 1. The spreadsheet expects numeric input, so, to type a word, you must tell the computer you are entering something besides a number.

Before you prepare for text input, note the word "numeric" in the line at the bottom of the screen. Now press the C= and ⇧T keys together (T stands for text). You'll notice that the word

NUMERIC has been replaced by the word TEXT. The spreadsheet displays this information to tell you what kind of input it expects. Note that if you should move the cell cursor after you switch from numeric input, the switch is cancelled, as you can tell when the word NUMERIC reappears on the screen. Just repeat the switch to text by pressing both C= and ⇶ again after you move the cell cursor.

Give the column a heading by typing: months. Press RETURN and the word **months** appears in the cell located at column 1, row 1 (cell 1;1). The cell beneath 1;1 is 2;1. The row number is always named first when you refer to a cell. As you saw in Fig. 5-5, the cell number for the current cell is displayed in a line at the bottom of the screen: R;C 1 1.

To enter the first month name, press the cursor-down arrow key once. This moves the yellow bar down to cell 2;1. With the cell cursor in cell 2;1, press C= and ⇶ again. You must repeat this key sequence each time you want to enter a text item. Now type **sept** and press RETURN to enter "sept" into cell 2;1.

Enter the rest of the months from Table 5-2, which shows Emily's projected budget figures. If you make a mistake, just enter the month again. The spreadsheet automatically replaces old entries. Just make sure that the cell cursor is on the correct cell. If you forget to move the cell cursor before you type the next entry, just reenter the old month, move the cell cursor, and type in the next month. If you forget to press C= and ⇶ before you enter a text item, the computer just enters a 0 in the cell. Try again.

Table 5-2. Emily's Projected Budget Figures

month	books	food	clothes	entertainment	misc.
sept	200	40	50	50	75
oct	50	40	25	40	75
nov	35	40	50	40	75
dec	35	40	25	60	75

Next we need to enter the names of the budget items across row 1. Just use the cursor-up arrow key and the ⇶ key to move the cell cursor to the cell at row 1; column 2. Press C= and ⇶ for text input and then type in the first budget item, **books**. Then, move the cell cursor to the following cell locations and type in the names of all the budget items. As soon as you finish cell 1;3 and move the cell cursor to cell 1;4, the work area moves to the right, just as it does when you type past Column 37 in the word processor.

Entering Numeric Values on the Spreadsheet

The entering of numeric items is similar to the entering of text items, but you don't have to identify the value type before you enter the value. Just move the cell cursor to the cell and enter the number. Enter all the cell values using the numbers from Table 5-2.

Calculating on the Spreadsheet

Now that all the budget items have been entered, we need to total all the monthly expenses for each item. We'll do this by adding all the values in each column. To do this, we will need to enter a formula that will perform this tabulation. Just as you had to inform the computer when you were entering a text value, you will also have to tell the computer when you are entering a formula. To do this, press the C= and ☰ keys together. The word NUMERIC at the bottom of the screen now reads FORMULA.

To enter a formula that will add all the values in column 2, move the cell cursor to cell 6;2, which is beneath the last value in column 2. Then press C= and ☰ and type in the formula: sum 2;2 to 5;2. Press ☰RETURN☰. The sum formula lets you add a row or a column. You just give the first and last cell locations of the group of cells you want to add.

Move the cell cursor to the bottom of each column of expenses and repeat the formula, substituting the column numbers so that they match the column you are tabulating. For example, add Column 3 expenses with the formula: sum 2;3 to 5;3.

COMPARING THE BUDGET AND THE ACTUAL EXPENSES

We need to enter the figures for the actual expenses now so we we can compare them to the projected amounts. To do this, we'll just move farther down the spreadsheet work area and enter some figures under the same item headings.

Skip a row below the item tallies and use the cursor-down arrow and ☰F1☰ keys to move the cell cursor to cell 8;1. Enter the month headings again in cells 8;1 through 11;1. Remember to use the cursor-down arrow key to move the cell cursor to the next cell and, then, press C= and ☰ to tell the computer you'll be entering text, not a number. Then, type in each month just as you typed them earlier at the top of the spreadsheet.

You are now ready to enter the actual budget amounts. Use the figures from Table 5-3. Use the cursor arrow keys and ☰F1☰ and ☰F2☰ to move the cell cursor to the correct cell; then type in the value, and press ☰RETURN☰.

Table 5-3. Emily's Actual Expenses

month	books	food	clothes	entertainment	misc.
sept	25Ø	75	8Ø	6Ø	85
oct	3Ø	6Ø	55	5Ø	75
nov	15	45	35	4Ø	75
dec	35	5Ø	5Ø	45	9Ø

To figure the totals for each item of actual expenses, we'll use a formula similar to the one we used to total each projected expense item in the budget. As you'll recall, you move the cell cursor to the cell beneath each column of expenses and then you tell the computer you'll be entering a formula by pressing the C= and ≡ keys together. With the cell cursor in cell 12;2, use this formula to add the actual expense items in the first column: sum 8;2 to 11;2. Then, use the ≡F2≡ key to move the cell cursor over beneath the next column of items (cell 12;3) and change the column numbers in the formula to 3. Repeat until all columns are tabulated.

Now you have expense totals for each item on both the projected and actual budgets. We're now ready to prepare a graph that will show the differences between the projected and actual expenses. First, we will need to subtract each projected item total from each actual total.

To subtract item totals, use the cursor-down arrow and ≡F1≡ keys to move the cell cursor to 14;1. Press the C= and ≡ keys to tell the computer you'll be entering a text heading in this cell. Then type "comparison" and press ≡RETURN≡.

Next, use ≡F2≡ to move the cell cursor over to cell 14;2. To subtract the projected-budget total in cell 6;2 from the actual-budget total in cell 12;2, tell the computer you'll be entering a formula by pressing the C= and ≡ keys. Then enter the following formula: 12;2 – 6;2 and press ≡RETURN≡. The answer, 10, is displayed in cell 14;2. Move the cell cursor to cell 14;3, press C= and ≡ to enter a formula, and type 12;3 – 6;3. Repeat for the totals in Columns 4, 5, and 6. Your spreadsheet work area should now contain the values shown in Table 5-4.

DRAWING A GRAPH

We are now ready to draw a graph depicting the differences between the projected and actual expenses. This takes a bit of maneuvering because we must have an empty word-processing work area and an empty spreadsheet work area. Since we don't want to lose the work we've done, we'll save the letter we typed and the budget chart we compiled.

To save the budgetary figures, you need a disk drive and a formatted disk. The summary to Chapter 6 tells you how to format

Table 5-4. Spreadsheet Entries

	C 1	C 2	C 3	C 4	C 5	C 6
R 1	month	books	food	clothes	entertainment	misc.
R 2	sept	2Ø0	4Ø	5Ø	5Ø	75
R 3	oct	5Ø	4Ø	25	4Ø	75
R 4	nov	35	4Ø	5Ø	4Ø	75
R 5	dec	35	4Ø	25	6Ø	75
R 6		32Ø	16Ø	15Ø	19Ø	3Ø0
R 7						
R 8	sept	25Ø	75	8Ø	6Ø	85
R 9	oct	3Ø	6Ø	55	5Ø	75
R10	nov	15	45	35	4Ø	75
R11	dec	35	5Ø	5Ø	45	9Ø
R12		33Ø	23Ø	22Ø	195	325
R13						
R14	comparison	1Ø	7Ø	7Ø	5	25

a disk. Once the disk drive is connected (see Chapter 4) and turned on, insert the formatted disk. Hold the disk at the label and insert the disk. The small write-protect notch should be on the left as you are facing the disk drive. Close the drive latch.

To save a file from the spreadsheet, press the C= and ☰ keys to enter the Command mode. Then type **sf** and press RETURN. The message SAVE FILE: is displayed at the bottom of the screen. You must give the file a name; we'll type in the name **budget**. Press RETURN again. After a moment, the file called **budget** is saved on the disk.

If you want to verify that the file is saved, which is a good idea, press C= and ☰, and then type **ca**, which stands for catalog. This command displays a list of the files on the disk. When you save a spreadsheet file, the computer automatically adds **.c** to the end of the file name. This suffix identifies the file as a spreadsheet (calculations) file. However the **.c** is not really part of the file name; you don't add it when you retrieve the file.

To save the letter, go back to the word-processor program by pressing C= and ☰ and then typing **tw** (To Word processing). Saving a word-processing file is just like saving a spreadsheet file: press C= and ☰ and then type **sf** and press RETURN. Type the file name and press RETURN. We'll give the file the name **letter**.

Now that the files are saved, we can clear the work areas. While you're still in the word processor, press C= and ☰ to enter the Command mode. Then type **cm**, which stands for Clear Memory. Press RETURN and, then, in response to the question CLEAR ALL Y/N?, press **y** (for Yes). The **cm** command erases the work area.

Now switch to the spreadsheet program by pressing C= and C=.Then type in **tc** and press RETURN. Before you clear the memory, jot down the numbers in cells 14;2 through 14;6 in the comparison row. Now clear the work area the same way you did in the word processor: press C= and C= . Then type **cm** and press RETURN. Press **y** in response to ARE YOU SURE Y/N.

We're now ready to draw the graph. While you're still in the spreadsheet, you'll type the values to be graphed. Before you type the values you jotted down, type 1ØØ in cell 1;1. The graph compares each of the values it depicts in comparison to the highest value. To make the graph easier to understand, we add the 1ØØ so that all values are compared to 1ØØ instead of to 7Ø, the highest value taken from the comparison chart. You'll see why we did this when we finish combining the graph, the spreadsheet work, and the letter.

Next, type in the values of the comparison totals that you just jotted down. Type the first value into 1;2, the second into 1;3, and so on. You must type in these values for graphing in a row, not down a column. Use the F2 key to move the cell cursor to the next column.

We want to incorporate the graph into the letter that we wrote in the word processor. Now, BEFORE we actually draw the graph, is the time to tell the computer we'll want to do this. Press C= and C= to enter the Command mode. Then, type in **map** and press RETURN. The MAP command tells the computer to send the graph to the word processor. However, we still haven't drawn the graph on the graph-generator screen yet; we're just telling the computer where the graph's eventual destination is.

At this time, make sure that the cell cursor is somewhere on row 1. We're ready at last to draw the graph. To switch to the graph generator, press C= and C= to enter the Command mode. Then type in **gr** and press RETURN. The graph, as shown in Fig. 5-6, is automatically drawn. We'll make a few changes, however, when we move the graph to the word processor.

COMBINING WORK FROM THE SPREADSHEET, GRAPH GENERATOR, AND WORD PROCESSOR

After you look at the graph, press the RETURN key, which sends you back to the spreadsheet. Then press C= C= and type **tw** and press RETURN to go to the word processor. When the word processor comes up, the graph is there waiting at the top of the screen.

Now we'll combine the three projects we've done — the letter, the budget, and the graph. The graph is already on the screen, so we'll get the letter and the budget from disk; then we will have all three jobs in the same work area.

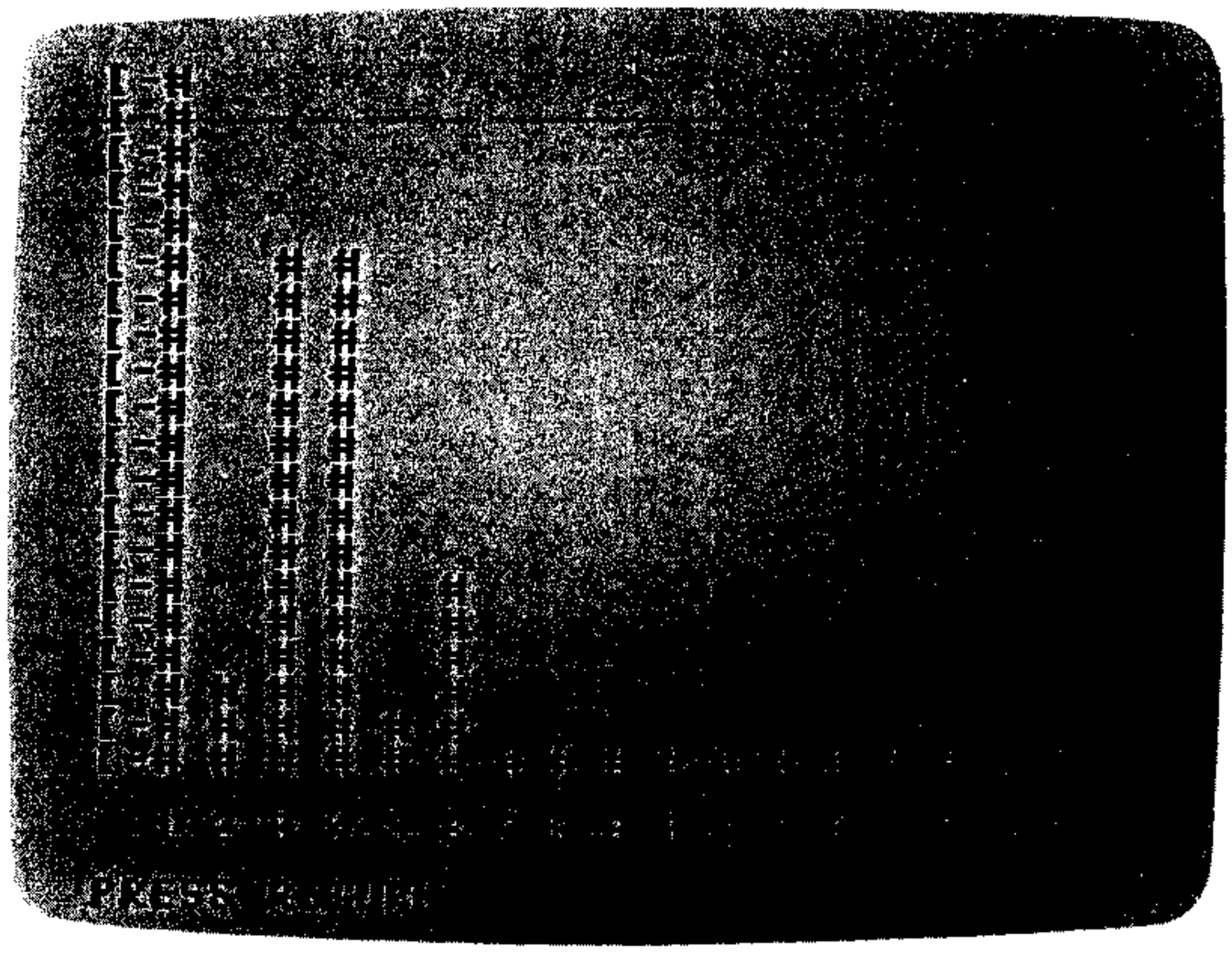


Fig. 5-6. The graph created for Emily's letter.

When you want to keep the current work in the work area and load another file from disk, you use the MERGE FILE command. MERGE loads the disk file into the work area beneath the work already on the screen. To merge the letter file with the graph, first move the cursor to the line beneath the graph — line 23. It's important that the cursor be moved past the work in the work area before another file is merged.

To merge the letter file, press C= and ☰ to enter the Command mode. Then type **mf** and press RETURN. The message LOAD FILE: is printed at the bottom of the screen. Type the name of the file you want to load, which is **letter**. Press RETURN. After a moment, the file "letter" is displayed beneath the graph. Fig. 5-7 shows how part of the screen should look now.

MERGING A SPREADSHEET FILE INTO THE WORD PROCESSOR

Next, we will need to move the budget file material to the word processor. To do this, we'll learn another command, BLKMAP. Make sure you're in the word processor (C= and ☰, then **tw**, and RETURN). We can move spreadsheet material into the middle of the text right where we want it to be.

Since we want to display the two parts of the spreadsheet material in different places in the letter, we'll move the parts separately. We want to put the first six lines of the spreadsheet material right after the third paragraph. Move the cursor to line 34, column 1, which is where we want the chart to be printed. At the bottom of the screen, the status line should read L= 34 C= Ø1.

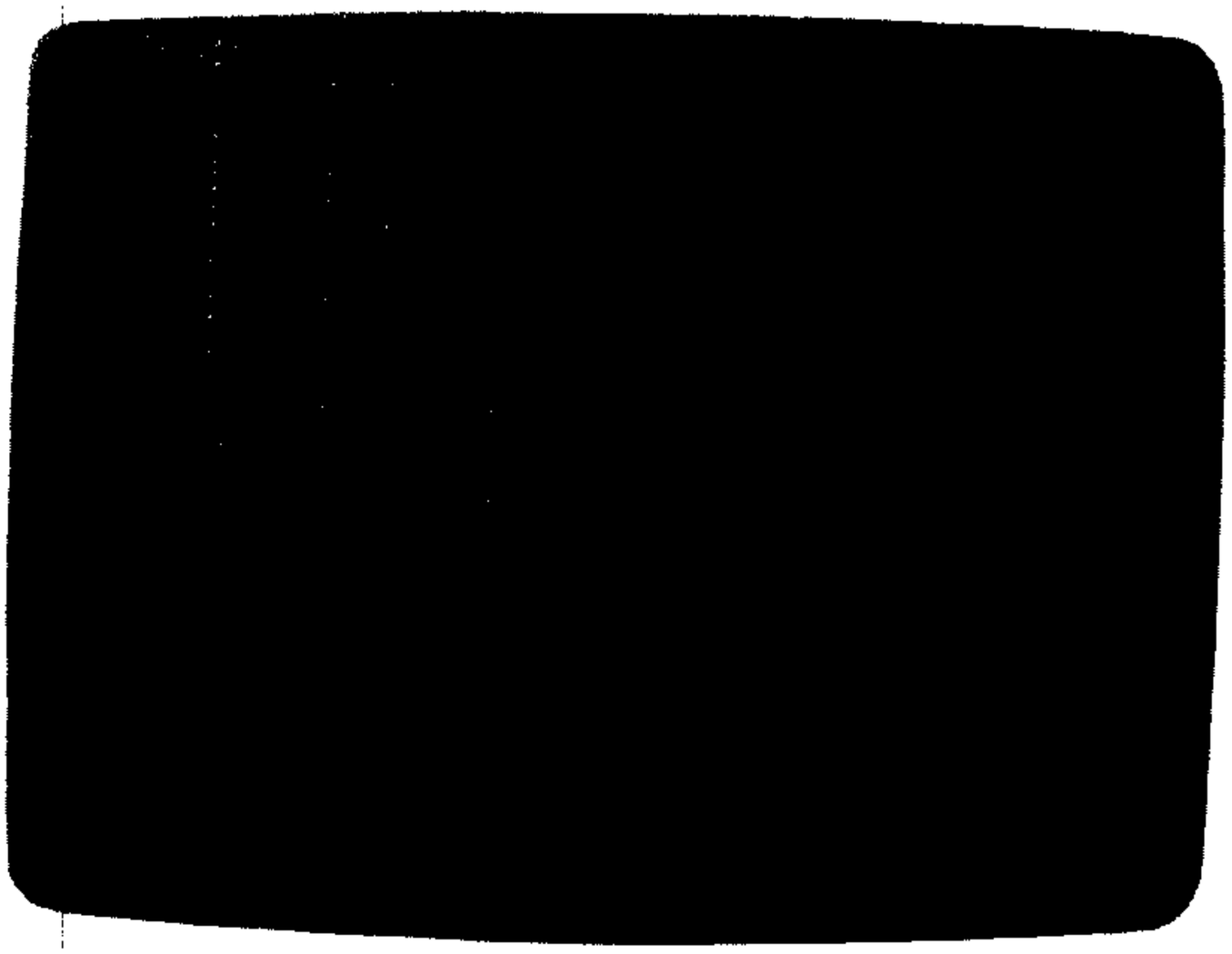


Fig. 5-7. The graph and letter merged into one screen in the word-processor work area.

The IL (Insert Line) Command

Since we'll be moving the spreadsheet material into the middle of the text, we will need to create some space for it. If we tried to move the spreadsheet data without creating an opening, the data would be printed on top of the letter and we'd lose some of what we've written. To open up some space after line 33, press ⌘ and ⌘. Then, type **il** and press RETURN. The IL command opens one blank line without deleting any text. We'll want to move six lines from the spreadsheet material and, for the sake of readability, we'll want a blank line above the data.

Repeating a Command

We've already inserted one blank line. To insert the other six, you can either repeat the IL command or you can use a shortcut. To repeat the execution of any command from the Command mode, just press ⌘ and ⌘ after you have issued the command once. Repeat ⌘ ⌘ as many times as you want to repeat the original command. In other words, after you issue one IL command, press ⌘ and ⌘ six times to open up seven blank lines. Now press RETURN once to leave a blank line above where we want the spreadsheet data. The cursor status line should read L= 35. Leave the cursor there.

The BLKMAP Command

Now switch back to the spreadsheet (C= ≡, then tc, and RETURN). When you are in the spreadsheet, load the budget file. Loading a file while you're in the spreadsheet is just like loading a file while you're in the word processor. Press C= and ≡, type **lf**, and press RETURN. Type in the file name BUDGET when the message LOAD FILE: is displayed. The spreadsheet file called **budget** is displayed in the work area.

Next, we'll move the first six lines of the spreadsheet data as a block of text. We need to tell the computer the location of the top left-hand corner and the bottom right-hand corner of the block that we want to move. To identify the top left-hand corner, move the cell cursor to cell 1;1. A quick way to do this is to issue a HOME command: press C= ≡, then type **home**, and press RETURN.

Press C= ≡ again. Issue the block map command, which includes the location of the bottom right-hand cell, which is 6;6. Type **blkmap 6;6** and press RETURN. Switch back to the word processor (C= and ≡, then **tw**, and RETURN). The material from the budget file is now at line 35 of the word-processor screen. (You'll have to move the cursor down to see it.) Move the cursor to the line below the chart to see how the spreadsheet material looks on the screen.

Now we're ready to move the second half of the spreadsheet material, which we want to place after the fourth paragraph. Move the cursor to line 44, where we'll put the second chart. Open up 9 spaces with the IL command and C= ≡. Press RETURN once after you open the space so that a blank line will be above the chart after we move it. The cursor should be on line 45.

Move back to the spreadsheet (C= ≡ and tc and RETURN). Move the cell cursor to cell 8;1, which is the beginning of the block we want to move. Then, enter Command mode (C= ≡) and type **blkmap 14;6**, which identifies the end of the block. Return to the word processor (C= ≡ and **tw** and RETURN). The spreadsheet material should be at lines 45 through 51. Move to line 52 and press RETURN to create a blank line. The screen should look like what is illustrated in Fig. 5-8.

Rearranging the Material

All we have left to do now is move the graph so it's where we want it — at the end of the fifth paragraph. To rearrange the blocks of text in the work area, you must learn how to use the Create Block and Insert Block commands.

First, move the cursor to line 16. A block can be only 16 lines long and the graph is 22 lines, so we'll have to move the graph in two parts. At line 16, set a pointer to mark the end of the block. Press C= and ≡, type **sp**, and then press RETURN. A less-than sign (<) appears on the line at the right margin of the screen.

Fig. 5-8. The spreadsheet data is transferred to the word-processor work area.

The Create Block Command

Identify the beginning of the block by moving the cursor back to line 1. To create the block, press C= and ⇶, type in **cb**, and press RETURN. The computer creates a text block starting at the current cursor position and ending at the pointer we just set.

The Insert Block Command

To move the block we just created, move the cursor to line 55. Create a blank line (C= ⇶ and **il**, and then press RETURN). Then, on line 56, press C= and ⇶, type in **ib**, and press RETURN. The IB command inserts the block at the current location of the cursor.

The block of text is now inserted, but the block also remains in its original location. We must go back and delete it. To delete the original block, move the cursor back to line 1 by pressing the HOME key. Press C= and ⇶, type **db**, and press RETURN. The DB command erases the text from the current cursor position to the pointer we set at line 16. Now the block only appears where we want it to be.

The top of the graph has moved, but we still have to go back and move the bottom six graph lines. Move the cursor to line 6 (the bottom of the rest of the graph) and set a pointer. Move the cursor to line 1 and create a block (C= ⇶ and **cb**, and then press RETURN). Move the cursor to line 56, the bottom of the first part of the graph. Insert the block (C= ⇶ and **ib**, then RETURN). Create another blank line under the graph. Then go back to the top of the screen and delete the block (C= ⇶ and **db**, then press RETURN).

Final Editing

Before we print a copy of this document, we'll fix up the graph by deleting the graph columns we don't need. Then we'll add some numbers to the left column to make the graph more self-explanatory.

First, erase the unnecessary graph columns we don't need. Move the cursor to the # sign in column 13 on the bottom row of the graph, just above the numbers. Then, press [RETURN]. The rest of the row of # signs is erased.

Now we'll change the numbered row at the bottom of the graph. These numbers don't mean much, so we'll replace them with the first letters of the budget items represented in the graph. Move the cursor to the 1 in the numbered row on line 55. Type a **b** over the 1. Then type an **f** over the 2, a **c** over the 3, an **e** over the 4, and an **m** over the 5. Press [RETURN] to get rid of the other numbers.

As you'll recall, when we created the graph, we added 100 to the chart so the other values would be compared to 100. The graph represents 100 with twenty # signs, so each # sign equals 5. Use the cursor keys to move the cursor to the *bottom bracket* on the left side of the graph, on line 53. Type a **Ø** over the bracket. Then move the cursor to the next bracket above and replace it with a 5. Continue this until all the brackets on the left-hand side of the graph are replaced with numbers, Ø through 95.

You may also want to clean up the budget charts so that the spacing looks better. To move the columns on each line, first set a pointer ([C=], **sp**, and [RETURN]) on each line. The pointer makes sure that only the current line moves. Without the pointer, all the text below the current line moves when you press the [DEL] or [INST] keys. Then, use the [DEL] key to move each of the columns of numbers to the right so they're under their headings. To release all of the pointers when you finish, press [C=] and [SHIFT], type in **cp**, and press [RETURN].

Printing a Copy of the Letter

Now that the letter is finished, we're ready to print a copy on the printer. Turn on the printer and make sure that paper is inserted. Now enter the Command mode by pressing [C=] and [SHIFT], and print Emily's letter by typing **>p**. Press [RETURN]. The final product should look similar to the printout shown in Fig. 5-9.

MORE ABOUT THE FILE MANAGER

Now that you've had some practice using the other three programs, we'll turn our attention to the file-manager program. You can use the file manager to store any type of information that you would put in a file folder, an address book, index cards, or standard

Dear Mom and Dad,

How's everything back home? I miss you both every day. Does Fido miss me? Please give him a hug for me. The semester is off to such a fast pace that I can hardly believe it's been three weeks since I was home.

When I was last home I told you I'd send an account of my finances from last semester. I believe you'll both agree that the information I'm enclosing supports my argument that I need more money.

Last summer when the three of us sat down to compose a budget for the coming fall term, we agreed upon the figures shown in the following table.

month	books	food	clothes	entertainment	misc.
sept	200	40	50	50	75
oct	50	40	25	40	75
nov	35	40	50	40	75
dec	35	40	25	60	75
	320	160	150	190	300

Unfortunately, my actual expenses were consistently higher than those projected in our budget. The second half of the table shows my actual expenses for September through December.

sept	250	75	80	60	85
oct	30	60	55	50	75
nov	15	45	35	40	75
dec	35	50	50	45	90
	330	230	220	195	325
comparison	10	70	70	5	25

To demonstrate my straits, the following graph illustrates the discrepancies between the proposed and actual budgets.

```
95   #
90   #
85   #
80   #
75   #
70   #   # #
65   #   # #
60   #   # #
55   #   # #
50   #   # #
45   #   # #
40   #   # #
35   #   # #
30   #   # #
25   #   # #   #
20   #   # #   #
15   #   # #   #
10   # # # #   #
5    # # # # # #
0    # # # # # #
       b f c e m
```

I'll be home next month to discuss this budget. I look forward to seeing everyone and once again tasting noninstitutional food.

Love, Emily

Fig. 5-9. A printout of Emily's letter.

forms. In fact, when you use the file manager, you are designing your own forms on which to store information. The file manager helps you design the forms, and it helps you enter the information.

One of the advantages of putting such records into a computer file is that you can easily perform the following tasks:

- Reorganizing the records.
- Searching records by fields, such as name, state, product, etc.
- Storing records permanently without taking up much space.
- Using the information in various other applications, such as ordering materials.
- Monitoring expenses.

You can also transfer information stored in file-manager records to documents that are prepared with the word processor.

DESIGNING THE FILE

The first part of file management is the designing of the file. Each file is broken down into **records**, and each record is broken down into **fields**. For example, suppose you have a file folder full of bills. The folder is the same as the computer file, each bill is like a computer record, and each item on the bill (such as the amount due, the creditor, the due date, the item for which you are being charged, and so on) is like a computer field. To show you how easy it is to design a file, enter records, and use the records, we'll create a short sample file. This example will create a bibliography file to keep track of books used in a report.

Before you turn on your equipment and start typing, you should write down your requirements for the file. Designing a file is similar to designing a standard form, such as an insurance claim form, a credit card application, etc. Think about the purpose of your file form. What sort of information do you want to store? How do you want it organized? What kinds of fields do you want for each record?

The purpose of this preliminary work is to name the fields and decide how long each field should be. Your design must include a field for each possible entry. For example, if you're designing an address file, you'll want to include a separate field for the individual's name, street address, city, state, zip code, and perhaps their business and home telephone numbers. You won't use all the fields for every entry, but if you will need each of the fields sometimes, you must include them.

Once you've written down the field names and field lengths, you're ready to turn on the computer and design the file. As soon as the file design is finished and stored on a disk, you're ready to enter data records in the form of your file design. Entering records

is easy because the computer tells you what to enter based on the file that you designed.

To create the file, turn on your disk drive and insert a new blank disk. Each file you create with the file manager should be on a separate disk that doesn't contain anything else. You must be sure the disk does not contain any information you want to keep. When the file manager saves your file design, it also *formats* the disk especially for your design. *Formatting* erases any information already on a disk.

Turn on the computer and enter the word processor (press [redacted] and [redacted]). To go straight to the file manager, press the [redacted] and [redacted] keys; then type in **tf** and press [redacted]. The file manager displays this message:

```
INSERT A 3-PLUS-1 FILE DATA DISK
AND TYPE TF OR NEWTF
```

We'll be creating a new file, so type **newtf** and press [redacted]. The file manager displays the following message:

```
ENTER FILE NAME (1..16)
```

This prompt asks you to give your file a name that is 1 to 16 characters long. Enter the file name and then press [redacted]. You can use any name you like, but you should use a name that identifies the file contents. For example, since our sample file stores a bibliography, we'll name our file **bibliography**. Next, this message appears:

```
ENTER NUMBER OF FIELDS 1..17
Ø1;
```

This prompt tells you to enter the total number of fields (up to 17) you want for each record. The Ø1; tells you that the computer assumes you want 1 field if you don't type a different answer. We'll use 11 fields in our sample file. If you use only one digit, type in a zero first, just as the computer displays Ø1;. Make sure the semicolon remains at the end of your response. The next message appears after you enter the number of fields:

```
ENTER FIELD NAME (1..35) FIELD # Ø1:
```

This prompt tells you to type in the name of the first field (FIELD # Ø1). The field name can be from 1 to 35 characters long. Our first field is: **author last name**. The next prompt appears after you press [redacted]:

```
ENTER FIELD LENGTH 1..38 FIELD # Ø1;
Ø1;
```

The prompt tells you to enter the length (number of characters) for field 1. We'll use 20. Note again that the default value is Ø1. Press RETURN to display the next prompt:

```
ENTER FIELD NAME (1..35) FIELD # Ø2;
```

Now you're ready to enter the second field. Our second field is: **author first name**. Press RETURN.

```
ENTER FIELD LENGTH 1..38 FIELD # Ø2;
Ø1;
```

Our length for field 2 is 15.

```
ENTER FIELD NAME (1..35) FIELD # Ø3;
```

Field 3 will be called: **coauthors**.

```
ENTER FIELD LENGTH 1..38 FIELD # Ø3;
Ø1;
```

Field 3 will be 30 characters long.

At this point, your screen should look like Fig. 5-10. If you've made typing errors, don't worry. You can go back and edit later. For

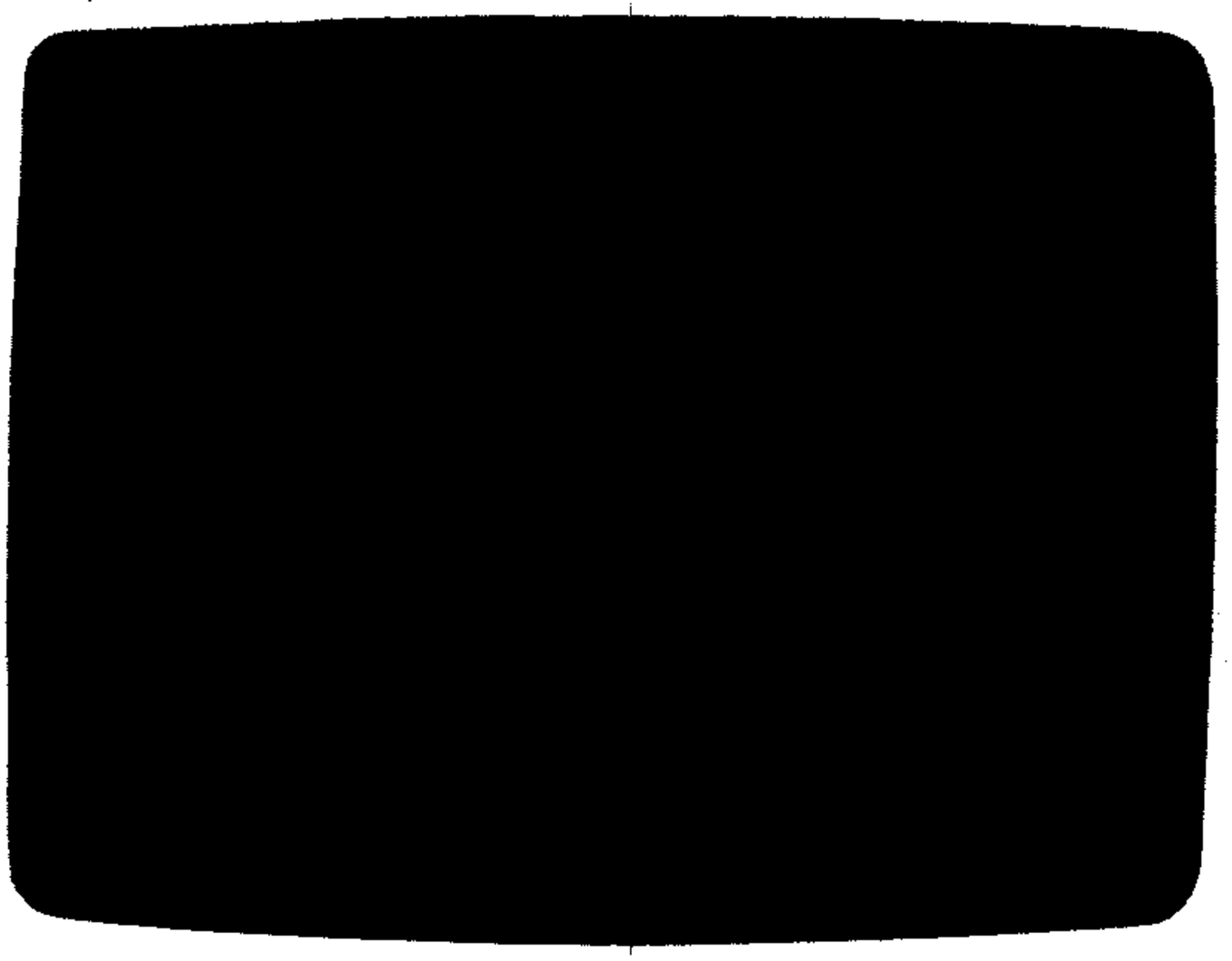


Fig. 5-10. Three fields created using the bibliography file design.

now, just concentrate on how the file manager works. Enter the remaining fields using the information in Table 5-5.

Table 5-5. Fields for Bibliography File

Field Number	Field Name	Field Length
Ø4	title	38
05	subject	15
Ø6	publisher	2Ø
Ø7	place	2Ø
Ø8	date	Ø4
Ø9	periodical	2Ø
1Ø	volume no.	1Ø
11	page nos.	Ø9

When you have entered the last field, the file manager displays a list of field names and lengths for your file. Fig. 5-11 shows how the screen looks after you have entered all the sample fields.

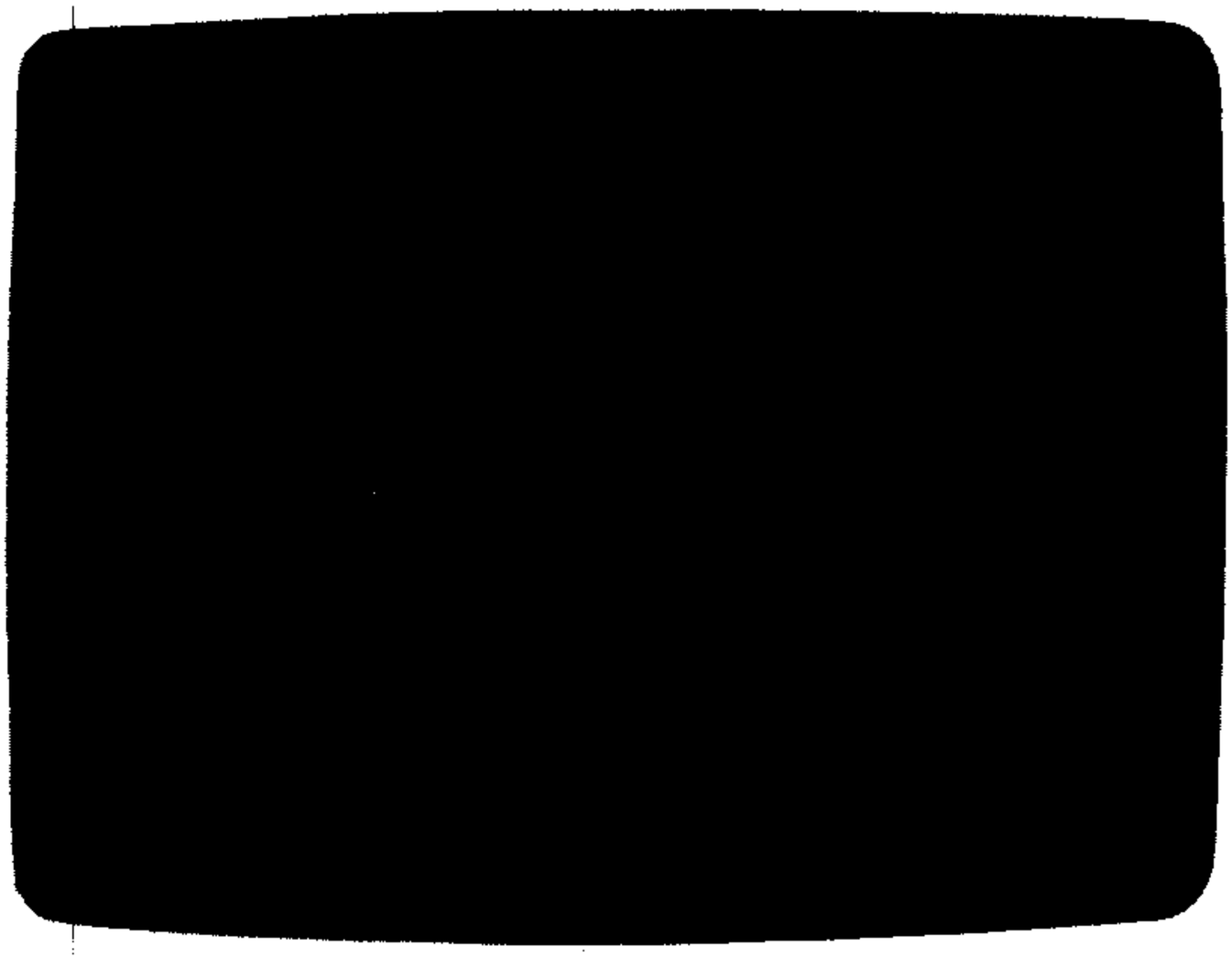


Fig. 5-11. File-manager screen showing all fields entered for the bibliography file.

```
OK TO FORMAT DISK? Y/N
```

This message is displayed beneath the fields list. If you want to change some of the fields, type **N**. The computer displays each field you entered, one at a time. Just type over your previous

entries if you want to edit them. If you don't want to make changes to a particular entry, just press RETURN. As soon as you press RETURN, whether or not you made changes, the computer displays the next field name or field length entry. When you are finished, the **OK TO FORMAT DISK? Y/N** question reappears, and you are ready to resume operations.

The **OK TO FORMAT DISK?** prompt means you're ready to store the file form on disk. Just type **Y**. When the message **ARE YOU SURE Y/N?** appears, type **Y** again. The file manager formats the disk and stores the file design. This takes about a minute.

NOTE: *IF YOU HAVE A PROBLEM* and want to abort the file-defining process, just press RETURN repeatedly until you get to the last field-length prompt. This gets you out of file defining and displays the question **OK TO FORMAT DISK? Y/N.** If you want to start the file definition over again, type **N**.

If you want to do something different, including leaving the file manager, the quickest way out of file defining is to type **Y** to the **OK TO FORMAT DISK** question, and then type **N** to the next question, **ARE YOU SURE Y/N?** Typing **N** this time will return you to the first file manager screen where you get the **F>** prompt. At the **F>** prompt, you can type **tw** and press RETURN to get to the word processor, or **tc** to get to the spreadsheet program.

Entering Records

When the file is stored on the disk, the computer displays a directory of the disk and, then, the **F>** prompt. We want to enter some records, so type **TF** to go to the file you just designed. The computer displays the file name (BIBLIOGRAPHY), how many records you can file, and the record number of the last record you entered. The LAST RC record number should be ØØ1 since we haven't entered any records yet.

The RC Command

One way to enter records is to use the RC command. RC lets you enter records by record number. To enter the first record, type **rcl;** and press RETURN. Be sure to type the semicolon at the end of the RC command.

After you issue the **rcl;** command, the bottom of the screen tells you the name of the file and the current record number: BIBLIOGRAPHY ØØ1. Beneath this line is the name of the first field: AUTHOR LAST NAME. As you enter fields into the record, the bottom line always tells which field you are supposed to enter, so you can always tell where you are in the record.

To enter a value for the first field, just type the author's last name and press RETURN. For the first record, we'll use the data under RECORD 1 in Table 5-6. Just enter fields as you are prompted by the bottom line on the screen. When there is a blank

line in the table, that means there is no data for that field. For example, there is no Periodical field or Page Nos. field in Record 1. Just press the [redacted] key when the file manager prompts you for those fields. A blank line will appear on the screen where that field would normally be entered.

Table 5-6. Record Entries for Bibliography File

Field Name	Record 1	Record 2	Record 3
Author last name	Johnson	Adams	Matthews
Author first name	Martin	Gail	James
Coauthors	R. J. Robertson	Carol Wilson	
Title	Curing Computer Phobias	Computers in the Social Sciences	Cognitive Test-Resistance
Subject	Computers	Computers	Psychology
Publisher	Computomes	SocSci Press	SocSci Press
Place	Mauldin, SC	Ames, IA	Ames, IA
Date	1853	1978	1976
Periodical			Psychology News
Volume no.	II		V 29, No 2
Page nos.		136–218	129–144

When you press [redacted] after the last field prompt (PAGE NOS.), the cursor remains in this last field. You are ready to store the data record you just entered.

The UD Command

The Update Data command stores the record on the same disk that contains the file design. The storage procedure takes just a few seconds. Storing the record is simple:

STEP 1. Press [redacted] *and* [redacted]. The F> prompt appears.
STEP 2. Type **ud** and press [redacted].

Entering the Next Records

When Record 1 is stored on disk, enter the second record by issuing the command **rc2;**. Remember to type the semicolon at the end of the command. Use the data from Table 5-6 for Record 2. Then save Record 2 with the UD command. Finally, issue the command **rc3;** to enter the third record. Save Record 3 with the UD command.

After the records are stored on disk, you can use the records for a variety of tasks. Looking up information from the records is quick and easy because you can have the file manager search the records for any field you name. For example, if you want to find all

the books that are about computers in the bibliography, just tell the file manager to search for books with a field that contains the entry COMPUTERS.

Searching the File

To search the records, make sure that the disk drive is on and the bibliography file is inserted in the drive. Press C= and ☰ to enter the Command mode. Then type **sr** (which stands for Search Record) and press RETURN. The prompt SEARCH: is displayed. The file manager is asking for the word(s) we want to find in the records, so type in COMPUTERS and press RETURN. Note that you can search for any word, partial word (e.g., COMP), or other characters (e.g., 1976), but the word you're searching for must be contained in one field, not spanning two fields. For example, you can search for MATTHEWS or for JAMES, but not JAMES MATTHEWS or MATTHEWS JAMES because that would span two fields.

As soon as you type in COMPUTERS and press RETURN, the computer searches all the records on the disk, beginning with Record 1. As soon as a record containing the word COMPUTERS is found, it is displayed on the screen. Record 1 contains COMPUTERS in its subject field, so Record 1 is displayed. The computer asks you if you want to search for more records containing the word COMPUTERS. Type **Y** to continue; typing **N** sends you to the Command mode.

Record 2 also contains the word COMPUTERS, in both the title and the subject fields, so Record 2 is displayed. Again, tell the computer to continue the search. Since Record 3 doesn't contain the word COMPUTERS, Record 3 is not displayed. Since there are no more records, the search ends and you are returned to the Command mode.

Searching records for a word is only one operation you can perform on file manager records. You can also tell the file manager to sort the records. For example, you can tell the file manager to put the records in alphabetical order. You can also tell the computer to sort for more than one field. For example, you can tell the computer to sort first by subject, and then sort each record in that subject into alphabetical order.

TRANSFERRING FILES TO THE WORD PROCESSOR

You can transfer any fields from any records to the word processor. Suppose we were writing a report and want to use Record 3 in a footnote.

STEP 1 Go to the word processor (C= ☰, type **tw**, and press RETURN). Clear the word-processor

screen. (Press [C=] and [SHIFT], type in **cm**, press [RETURN], and type **Y** when the question CLEAR ALL Y/N? is displayed.)

STEP 2 Insert the file-manager disk. Stay in the word processor. Move the cursor to L= Ø1 C= Ø1. A quick way to do this is to press the [CLR] key and then press the [HOME] key. These two key commands send the cursor to the top left-hand corner.

STEP 3 To tell the word processor which records and fields you want to get from the file, you must type in instructions in reversed-image mode. Turn on the reverse mode by pressing [CONTROL] and the [9] key. Type **rc3;** and press [RETURN]. Type **tf;:rc;** and press [RETURN]. This tells the word processor you want information from the file manager. The **rc3** tells the word processor you want information from Record 3.

STEP 4 Now you are ready to tell the word processor exactly which fields you want to print. We'll type all the fields on one line. You are still in reverse mode, so just type in **fld1;** (stands for field 1) and turn off the reverse mode (press [CONTROL] and the [9] key).

STEP 5 We want a comma and a blank space to be printed between field 1, which has the author's last name, and field 2, which contains the author's first name. We have to include this punctuation on the **fld** command line. The comma and blank must be typed in normal mode, which is why we turned off the reverse mode. Type the comma and press the [SPACE] bar for the blank space. Don't press [RETURN].

STEP 6 Turn on the reverse mode again ([CONTROL] and [9]). Type in **fld2;** (AUTHOR'S FIRST NAME) and turn off the reverse mode ([CONTROL] and [9]). Type in a period and a blank space. Don't press [RETURN].

STEP 7 Turn on the reverse mode again and type in **fld4;** (TITLE) and don't press [RETURN]. Record 3 doesn't have an entry for field 3 (COAUTHORS) so we'll skip it. We'll also skip fields 6, 7, and 8 since they aren't part of required footnote information.

STEP 8 Turn off the reverse mode and press the [SPACE] bar once. Turn the reverse mode back on and type in **fld9;** (PERIODICAL). Don't press [RETURN].

Turn off the reverse mode, press the [SPACE] bar, and turn the reverse mode back on. Type in **fld1Ø;** (VOLUME NO.) and turn off the reverse image. Type in a colon and turn the reverse mode back on. Type in **fld11;** (DATE). Turn off the reverse mode and press [RETURN].

The screen shows the following two lines, but with the **fld** commands in reverse image (black characters on a white background), and the spaces and punctuation (a comma, a period, and a colon) in normal image:

```
tf;:rc3;
fldl;:fld2;:fld4;:fld9;:fld10;:fld11;
```

STEP 9 Remove the file-manager disk and insert the word-processor disk. You would then either write a report or load one from disk with the **MF** (merge file) command. Whether you write or merge a report, leave the field commands where they are until you're ready to move them into place.

Since we haven't written a report, we'll just put the footnote at the end of Emily's letter so we can see how this works. To load the letter, put the cursor on line 3 and press [C=] [E]. Type in **mf** and press [RETURN]. When the message LOAD FILE: is displayed, type in **letter** (the file name) and press [RETURN]. After a moment, Emily's letter is displayed under the field commands.

STEP 10 Use the **cb** (create block) and **ib** (insert block) commands to relocate the two file-manager command lines you just typed. Put them at the end of Emily's letter. Then use the **db** (delete block) command to erase the lines where you originally typed them. The use of these commands was explained in the section, Rearranging the Material, earlier in this chapter.

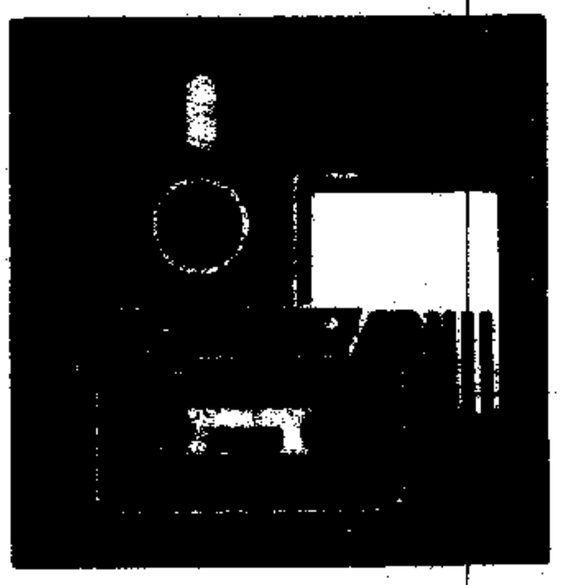
STEP 11 Turn on your printer and tell the word processor to print the report ([C=] and [E], and then *****p and press [RETURN]). The fields are printed just the way you formatted them in the command lines.

MORE ABOUT FEATURES OF THE BUILT-IN PROGRAMS

This demonstration has shown only some of the features of the built-in software. Many other commands let you perform more complex tasks. Some commands let you do work more quickly and

eliminate repetitious tasks. For example, the Copy command in the spreadsheet spares you from typing identical items in cells. The Fit command takes the mathematical formula from one cell and automatically adapts it to work for another cell.

As you learn more commands in each of the programs, you'll find more uses for the software. For now, it's best to learn the rudiments of each program and, then, gradually add more commands to your repertoire. Appendix C contains a brief description of all the commands for the built-in programs.



HOW TO CHOOSE THE SOFTWARE YOU NEED

In Chapter 3, you were given some information about the types of software and the computing devices that run them. This chapter will give you more specific information about the kinds of software that are available for the Commodore Plus/4, such as word processors, electronic spreadsheets, terminal emulators, and educational games. After you read this chapter, you should be better able to choose the software you need.

For quick reference, a review of the commands for running software and saving your own programs appears at the end of the chapter.

SOFTWARE BUILT INTO THE PLUS/4

As you read previously, the Plus/4 comes with a built-in software package that includes four programs: a word processor, a spreadsheet, a file manager, and a graph generator. Chapter 5 explained how these four interactive programs worked.

Later in this chapter, you'll read the descriptions of some independent versions of three of the four built-in programs (a word processor, a spreadsheet, and a file manager).

TYPES OF SOFTWARE MEDIA

A program is like a recipe; it is a set of instructions that makes something special. Programs are also called *software*, just as computers and computing equipment are also called *hardware*.

You can learn how to use instructions in BASIC and can type in your own programs. Or, you can buy software already written and recorded for your use. Three types of recordings, or media, are listed in Table 6-1.

Table 6-1. Software Media Types

Software Media	Where To Load	Extra Equipment Needed	Can You Record Your Programs?
Cartridge	Cartridge slot, on the back of the computer.	None	No.
Cassette Tape	In Datassette recorder.	Model 1531 Datassette recorder.	Yes, using blank cassette tapes.
Diskette	In disk drive.	Model 1541 disk drive.	Yes, using blank diskettes.

SOFTWARE COMPATIBILITY PROBLEMS

Perhaps you've wondered why all software doesn't run on all home computers. After all, music recorded on cassette tape plays on any brand of tape player, so it seems logical that the same compatibility should exist for software on cassette tape. It would indeed be a simpler world if software were as versatile as taped music. However, computers are a lot more complex than stereo systems.

One reason that all software doesn't work on every computer is that computers use different kinds of memory chips. This is important because each computer memory chip has a more or less minutely detailed map of the computer memory areas. Each area has a set of addresses, and each piece of the area has an address within that set. With different memory chips, individual computers have different locations for various memory areas. For example, the Commodore 64 screen memory begins at memory location 1024, which is the address for the top left-hand corner of the screen, and ends at location 2023, which is the bottom right-hand corner of the screen. The Plus/4 screen memory begins at memory location 3072 and ends at location 4071.

If a software program refers to a screen memory location, which is common in commercial software, you would not be able to use the software on both the Commodore 64 and Plus/4 computers because the location would be wrong on one of the computers. This should give you an idea of why software compatibility is a problem.

Commodore 64 Software

Commercial software that runs on the Commodore 64 will almost certainly NOT run on the Plus/4 computer. Versions of many popular programs will appear for both computers, but the versions are not compatible. When you buy software, make sure that the package indicates that the software will run on the Commodore 16 or the Plus/4. The same disk drive works with both the Commodore 64 and the Plus/4 computers, but the software runs in the computer, not in the disk drive.

Compatibility of BASIC Programs

Software written in BASIC language may run on both the Plus/4 and Commodore 64 machines, but in many cases, you'll have to make some conversions. The Plus/4 and Commodore 64 computers have different versions of BASIC built into the machine. Commodore calls the BASIC language used on the Commodore 64 its Version 2.0, and the BASIC used on the Plus/4 its Version 3.5. Those version numbers don't really mean anything except that the two BASIC languages aren't the same.

In general, BASIC programs might run on both computers if the software contains no POKE and PEEK commands (which always contain memory addresses and would therefore present an incompatibility) and uses no other commands that are unique to just one computer. Generally speaking, the version of BASIC used on the Plus/4 contains all the commands from the version used for the Commodore 64, but not vice versa. The Plus/4 contains a significantly expanded version of BASIC with about twice the number of commands. You should be able to convert programs from the Commodore 64 without too much difficulty.

BUYING SOFTWARE: LET THE BUYER BEWARE!

In the last year, software offerings have expanded so rapidly and so haphazardly that selecting the right product can be a trial for the consumer. The number and variety of available programs compound the problem; consumers often don't know what to expect from a program or how to compare similar offerings. Comparison shopping is important because not all software is of the same quality or designed for the same level of user. Moreover, your store may carry only one word-processing program or one investment package, but since others are probably available, you can't be sure that the one in the store is the best for you. Here are some suggestions for investigating software:

1. Read software reviews in computer magazines.
2. Ask other users for recommendations.
3. Ask your computer dealer to order products that you've heard are good.
4. Ask the dealer to demonstrate the software.
5. Ask about a return policy.

Read Software Reviews

Home computer magazines can help you understand the features of many programs. Commodore publishes two user

magazines, *Commodore: The Microcomputer Magazine* and *Power/Play*, but the magazines won't help with non-Commodore software. Other magazines, such as Compute's *Gazette* and *RUN*, devote most or all of their pages to Commodore products. These magazines are not affiliated with Commodore, so you should be able to expect some objectivity and the coverage of non-Commodore products.

Unfortunately, home computer software review is far from a science. The review is only as good as the reviewer, who may or may not have a broad enough experience with software to judge properly, or who may be too much of a "computer expert" to evaluate the kinds of features that are "best" for new users.

Be critical when you read a review. Try to perceive the reviewer's biases. Is the reviewer attuned to your needs? For example, a reviewer may pan a stock analysis program because its graphics are inferior, or its speed below par, but your only concern may be the thoroughness of the stock analyses.

Ask for Recommendations

Ask other users for recommendations but, again, listen critically to the advice. The computer-crazed guy down the street may not know what software is best for a 13-year-old who wants to write a first program, or what is best for a 30-year-old who wants to write a newsletter on a computer. Remember to ask WHY that person thinks a program is good or bad. If speed matters to you, ask about speed. If you prefer software presented in easy-to-use menus, ask about the program format.

Another possibility for guidance is with a Commodore Users' Club. A list of Users' Club addresses appears in every issue of *Commodore: The Microcomputer Magazine*. There are over 200 clubs in the United States, about a dozen in Canada, and a few in some other countries. There are two in Puerto Rico, and there's even one in Finland.

Perhaps the best sources of informal information are the bulletin boards that are part of various computer information services, such as CompuServe™ and The Source℠. The *Commodore Information Network*, available through CompuServe™, is probably the best source. If you have a modem and subscribe to CompuServe™, you can type in questions and receive answers from other users. This informal product information is another reason why you should consider purchasing a modem.

Ask Your Dealer

Ask your computer dealer to order products that you've heard are good. Developing, producing, and getting a new software package to market can easily take a year. You may hear or read about a program for the Plus/4 computer, but find only aged VIC 20

software at your computer store. So even if you know about a good product, you may have a hard time getting it. Furthermore, some excellent software is manufactured by very small companies, but these companies may be unable to get their programs distributed to many stores. Be patient and be assertive. Look for a dealer who's willing to order products for you.

Ask for a Demonstration

Ask the dealer to demonstrate the software. Even if you don't feel confident about your ability to judge software, this can be one of the most conclusive approaches. You may not always get the most out of this service for several reasons. First, the person behind the counter is not likely an expert on all software; however, he or she may be able to tell you how popular the software is, what people say about it, etc. It's possible the clerk has never seen the program you're investigating, much less know how to demonstrate it, so ask if you can try it yourself. Don't be too surprised if the dealer is reluctant to give a demonstration because this requires training; it also means that each kind of system for which they sell software must be set up and ready for use; and software can vanish or be damaged once it's out of the box. You're more likely to find a cooperative and well-informed retailer at a computer store than at a discount department store.

Check the Return Policy

Make sure you really want the software because you probably won't be able to return it. Ask about the store's return policy before you buy. Don't expect one, though.

SOFTWARE CATEGORIES

This section of the chapter explores the types of software presently available for the Plus/4 computer. There are at least six types of software available: business, personal productivity, life style and personal growth, entertainment, educational, and programming aids. The types overlap somewhat, so many programs are a combination of two or more of these types. For example, some of the best personal productivity programs are also useful in some small businesses, and some of the best educational programs are also games. Some of the best programs, such as word processors and database managers, have so many potential uses that every family member can put them to work.

BUSINESS AND PERSONAL PRODUCTIVITY SOFTWARE

Commodore has introduced the Plus/4 as "The Productivity Computer with Software Built-In." The built-in software is designed to increase personal and business productivity. Other software available in the future for the Plus/4 will also stress productivity.

The Plus/4 Built-in Package

As you've read previously, the software built into the Plus/4 is an *integrated package* that combines four programs: word processor, file manager, spreadsheet, and graph generator. Basically, integrated software is software that combines two or more types of programs, such as a database manager and a word processor, so you can use complementary programs at the same time. For example, if you are using a word processor to write a report, you can press a key and bring up the database manager to get some information stored there, and then quickly switch back to the word processor again without losing anything that you typed into the report.

Integrated packages offer versatility and convenience, but you should be aware that there are, of course, some drawbacks. A computer program can take up only so much of the computer memory. The left-over memory is reserved for your workspace. A word-processing program on a 64K computer takes up more than half of the computer memory. So do a database program and an electronic spreadsheet. When these long complex programs are combined in an integrated package, each program, naturally, can't take up as much memory as it would by itself.

In short, each program in an integrated package is bound to be less powerful and have fewer features than what the same type of program would contain alone. This isn't necessarily a disadvantage. Few people use every feature of a word processor. And if you need the combined package more than the single program, the integrated software can be a tremendous product for you.

If you need a more powerful version of one or more of the built-in programs, you can buy a separate word processor (such as Script/Plus), a separate spreadsheet (such as Easy Calc), a separate file manager (the Manager), or a separate graph generator (B-Graph).

Other Personal-Productivity and Business Software

Home computers can help save both homeowners and small business owners time and frustration. The database program that organizes your stamp collection, Christmas list, address files, bowling team, and recipe files can also organize personnel records, tax forms, product information, customer lists, and any other

information that you might keep in files for a small business, civic group, social club, sports team, etc. (Fig. 6-1). Of course, word processors and mail list programs are also welcome tools for home, business, and school.

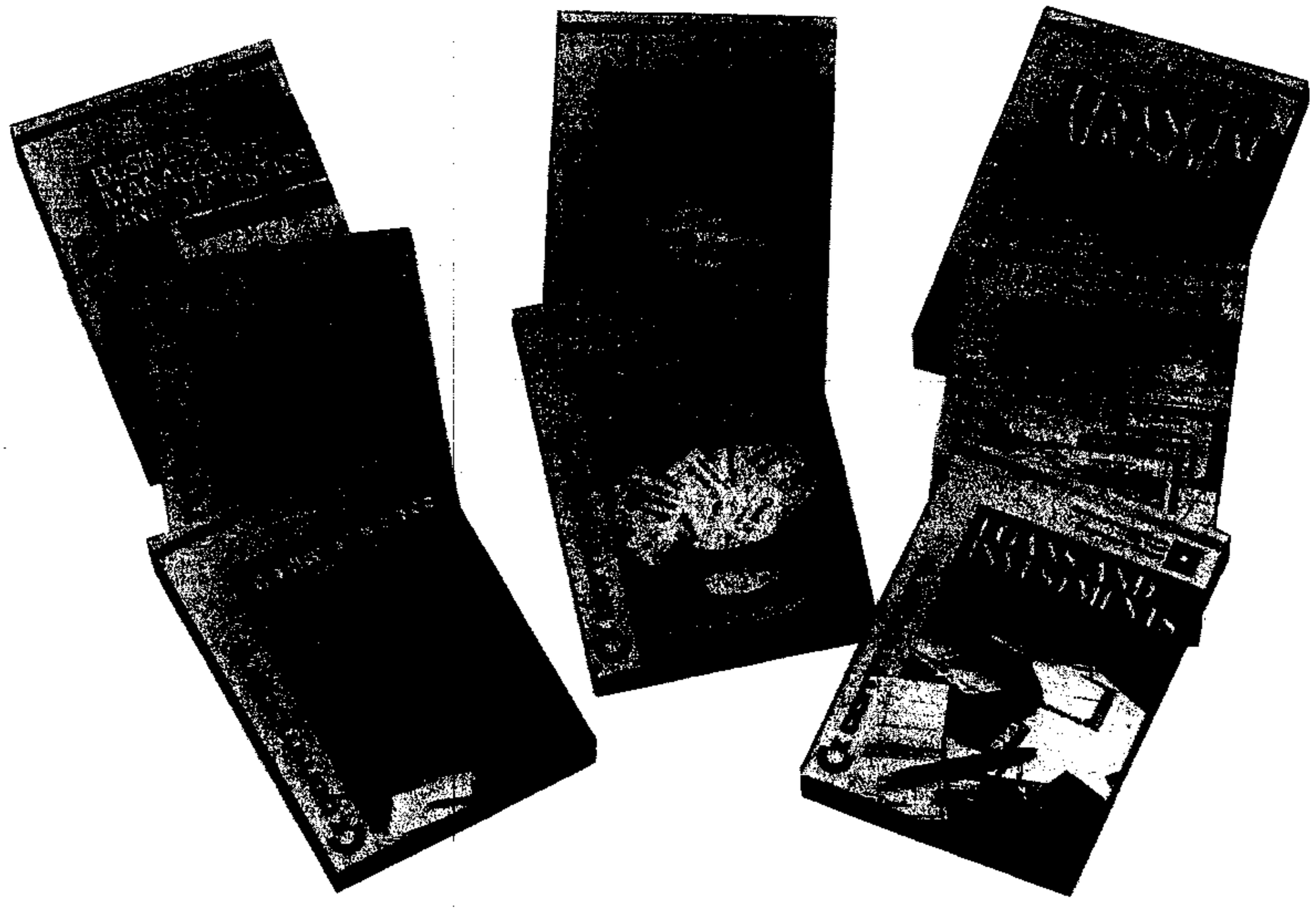


Fig. 6-1. Database programs.

Your home-management and small business needs may require special software (Fig. 6-2). Software developers are offering a growing variety of packages that perform general tasks (such as database management) and specialized jobs (such as programs for the construction and restaurant industries). Don't forget that many software companies develop excellent software for Commodore computers. You aren't by any means dependent on Commodore to supply the software.

Database Management Programs

Database management programs help you organize and reuse groups of information for a variety of purposes (Fig. 6-3). A database is an organized collection of data records, like an

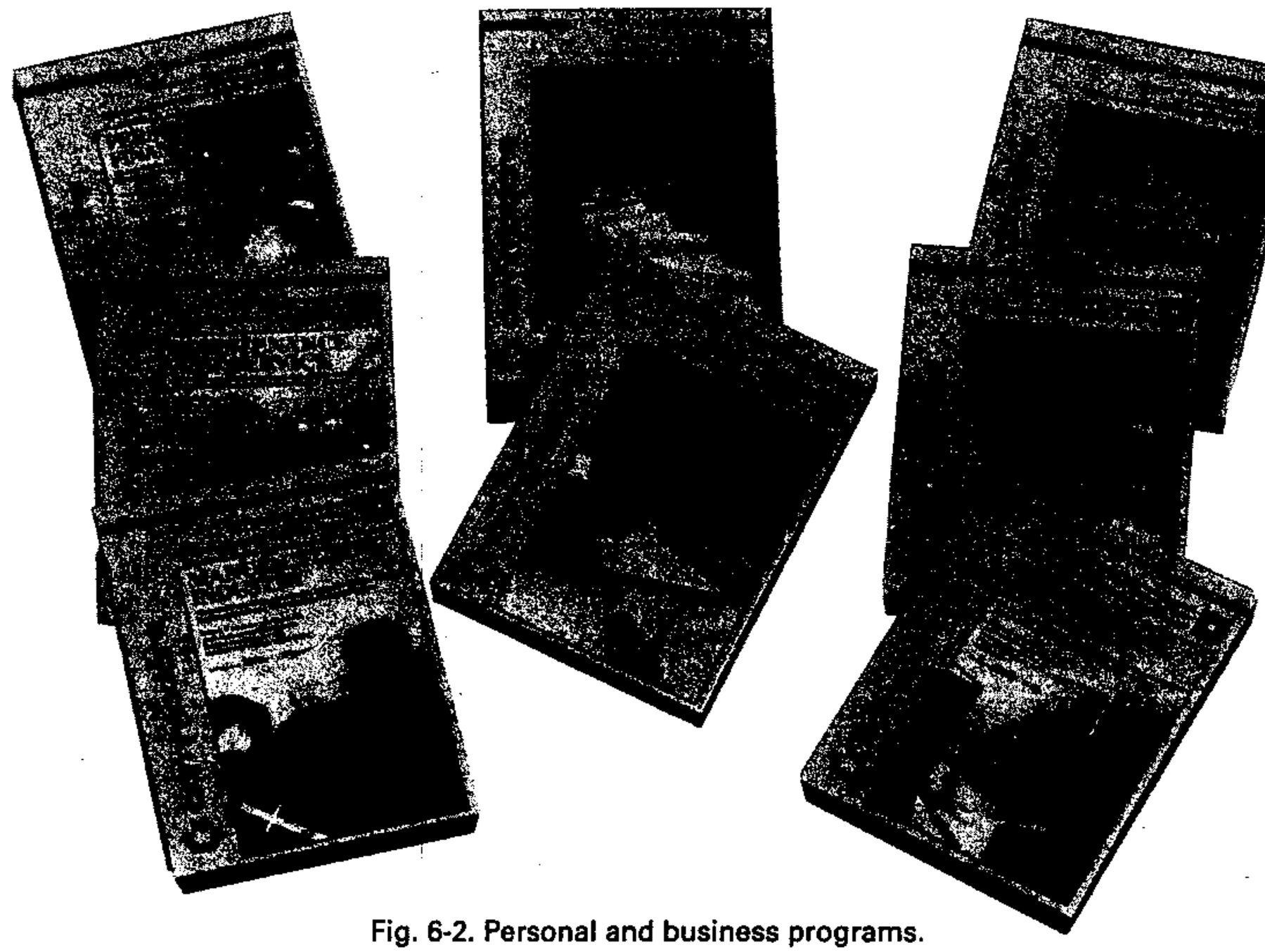


Fig. 6-2. Personal and business programs.

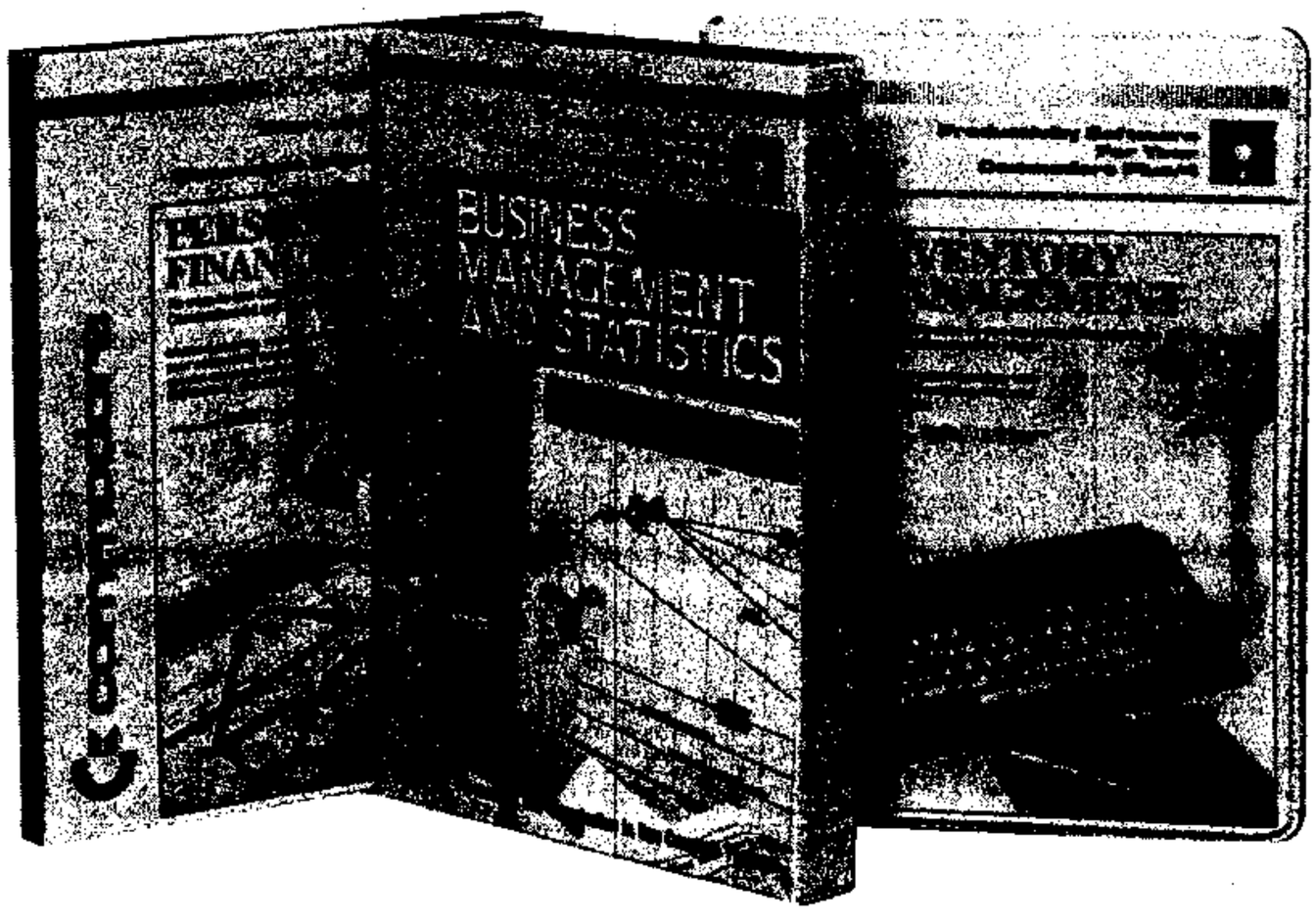


Fig. 6-3. Database management programs.

electronic file cabinet of information that is accessible by a number of data categories — categories that you define.

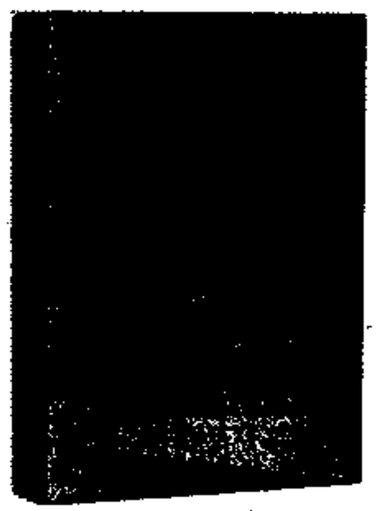
For example, if you run a crafts business from your home, you can use a database management program to enter the names, addresses, and monthly orders of your customers. You can then use these records to produce lists that are organized by location, alphabetical last names, stores that order over $200 worth of merchandise per month, or whatever you like.

If you collect coins or comic books, you can use a database manager to inventory your holdings, update their current market values, list them by year, by mint or publisher, or by face value or superhero.

Word Processors

A word processor (Fig. 6-4) is a program that lets you use the computer to write any type of document. A word processor turns your computer into a super typewriter with an erasable, rearrangeable screen as your paper. Word processors offer different features, but all let you make instant corrections. You can change the document as much as you want before you print it out on paper. And, if you change your mind after you print out a copy, you just make changes on the computer and print it out again.

Fig. 6-4. Word processor.



In addition, most word processors let you perform the following operations just by pressing a few keys:

- Insert and delete letters, words, sentences, paragraphs, and pages.
- Move blocks of text around on the screen.
- Center, left-justify and right-justify text.
- Highlight or underline text.
- Copy and backup files.
- Tell the computer how to format the output.

- Store documents on tape or disk.

Word processors simplify any kind of writing. Once you learn to use a word processor, you'll wonder how you ever managed without its versatility. If you or your children are students who need to write papers, a word processor alone is ample justification for buying a home computer.

Electronic Spreadsheets

A spreadsheet program is basically a large ledger page on which you can record any type of two-dimensional (row and column) data. You can keep track of budgets, inventories, expenses, accounts payable and receivable, payrolls, etc. You can easily compare projected and actual figures. The strength of a spreadsheet is in its capacity to give solutions to "what-if" questions (Fig. 6-5).

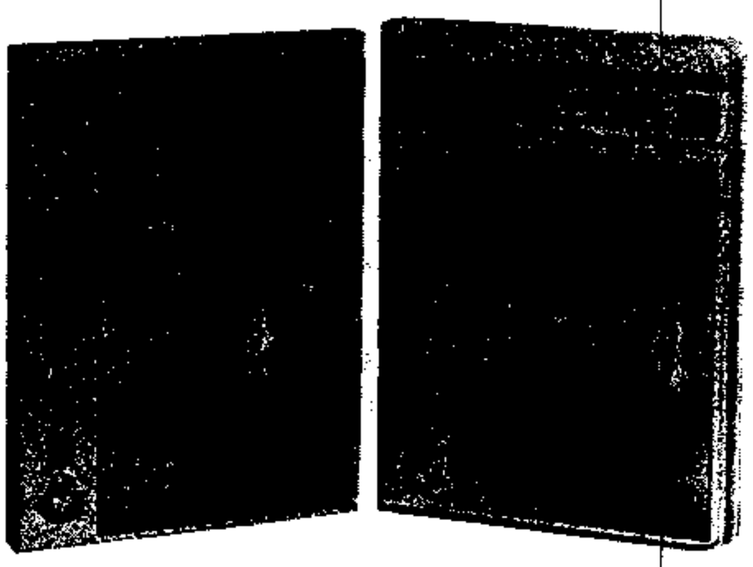


Fig. 6-5. Spreadsheet programs.

A spreadsheet also performs calculations for you. Even better, when you make a change, any other figure on the spreadsheet that is affected by that change is automatically changed as well. This feature lets you pose "what-if" questions about finances and inventories. For example, you could perform just one calculation to see how all your expenses and profits would be affected if you were to lower your heating bill by 5%.

Spreadsheets are great for home budgets, too. Not only can you track your expenses, but you can also see how the whole picture would change if your salary increased by 9%. You can then see how this increase would affect your expense payments.

A spreadsheet could be a most indispensable program for your family. Other practical software packages can also simplify your business and household tasks.

COMMODORE'S MAGIC DESK SERIES

Recently a lot of software and hardware developers have introduced products that attempt to simplify computing by letting you make choices from pictures on a screen. You use a mouse or joystick or your finger or anything but the keyboard to point to the picture of what you want to do. The picture, which is called an "icon" — after all, we must have jargon — is supposed to depict a task so clearly that you don't need any additional explanation. Commodore's *Magic Desk Series* is one of these software pioneers.

Look for reviews that can tell you what to expect from this kind of software. Some programs are not helpful or powerful enough to be truly worth your money if you're willing to learn a little about computers. If you like the idea of having pictorial software and not having to learn a few commands, you may love these programs. You should note, though, that Commodore's *Magic Desk II* contains all the features of *Magic Desk I* and then some.

TERMINAL EMULATORS: PROGRAMS FOR MODEMS

Modems are the hardware devices that let you use your telephone to connect your home computer to large data banks and to other computers. Modems transform the digital signals from computers so that the signals can be transmitted and received over telephone lines (Fig. 6-6).

Fig. 6-6. The Commodore Modem 300.

When you link two computers, one must be the master (or host) and the other the guest. To complete the link between your computer and the computer you call on the phone (called the Host Computer), you need software called a *Terminal Emulator*. This program turns your computer into a terminal that is controlled by the host computer while you are on-line (connected).

Commodore's modems come with a terminal emulator program. This program performs the minimal duties of a terminal emulator: it lets the two computers communicate. You can type messages and

view programs and information from the host computer, but you cannot send programs or make copies of the programs you view.

Terminal emulators can let you transfer programs between the computers. To do this with a Commodore modem, you need a more powerful terminal emulator than the program that comes with the modem. Chances are good that you'll want program transfer capabilities.

When you shop for a terminal emulator program, look for one that is user friendly. Terminal emulators tend to use alien technical terms, such as parity, stop bits, and baud rate. A good terminal emulator makes it easy for you to select the settings for the terminal options.

SPECIAL BUSINESS APPLICATIONS SOFTWARE

If you want to use the Plus/4 computer for keeping records for a small business, you may want at least some of the following programs:

- Accounts Receivable
- Accounts Payable
- Federal and State Income Tax Reports
- Payroll
- Sales Entry
- Inventory
- Professional Services
- Clerical Aids

There are also programs for specific industries, such as construction, maintenance and service, and manufacturing (Fig. 6-7).

Some of the programs may be too specialized for your purposes. If your business is small and doesn't include more than a few dozen customers and suppliers, often a spreadsheet, a word processor, and a database manager can do everything that you would want from most of these. Try the built-in software first, and then decide whether you need other programs.

Checkbook Balancers

Early in the development of software for home computers, checkbook balancing programs were among the most heralded applications. However, these programs have not turned out to be very useful. Unless you're completely overwhelmed by balancing

your checkbook, you're better off using a calculator for this tedious task. Since a Plus/4 computer has calculator features, you can, of course, use it to do your calculating job without buying any software. You can also use the built-in spreadsheet program.

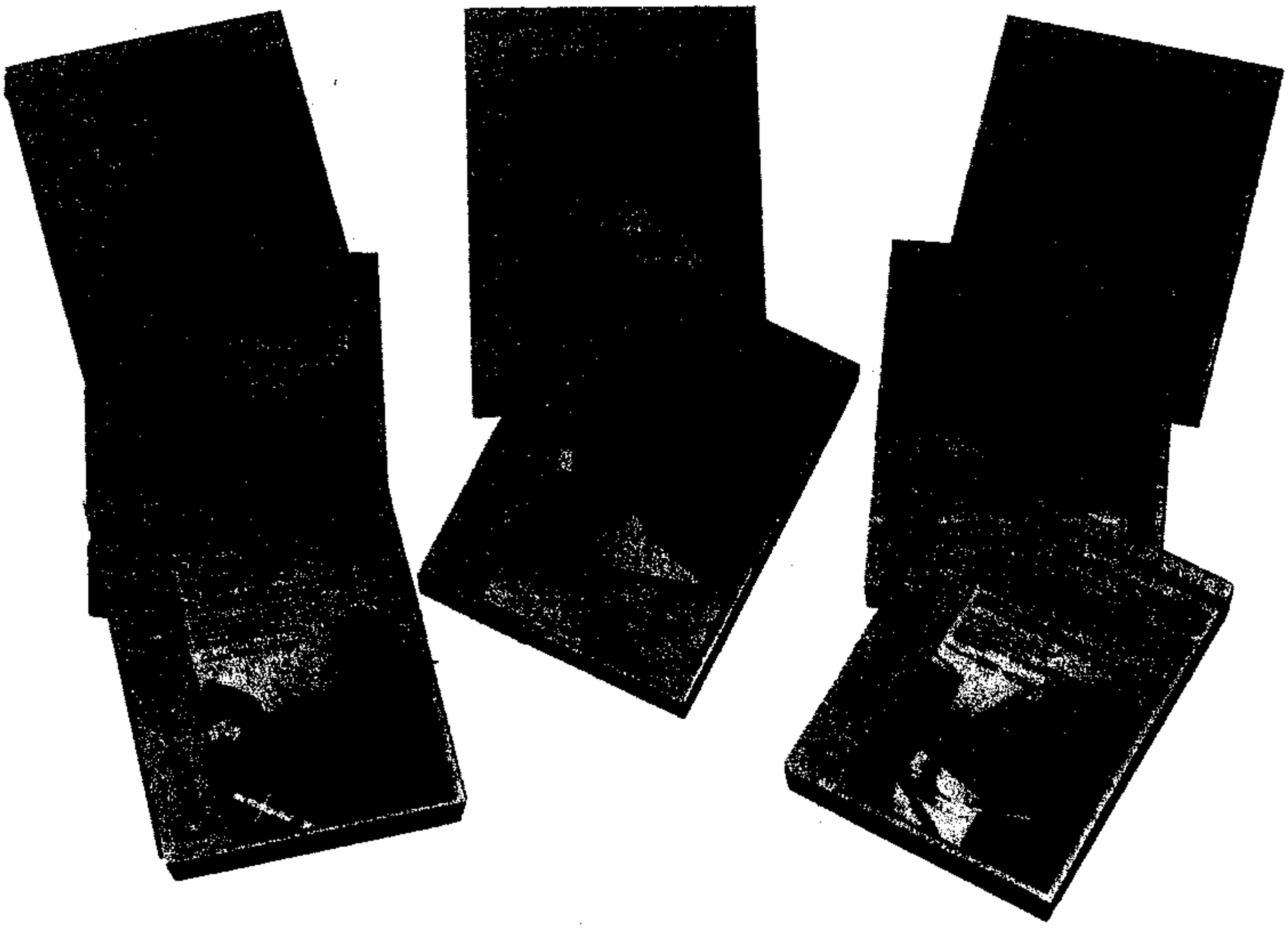


Fig. 6-7. Business applications software.

Loan and Investment Analysis

Another common program in the financial arena is a loan and investment analyzer. This type of program can be both useful and illuminating (Fig. 6-8). For example, you can horrify yourself by discovering how much money the bank makes on your mortgage. You can also find out how much you'll have in fifteen years if you start an education fund for your kids. You can compare the future returns on zero-coupon bonds and on regular bonds.

Using software for some of these applications is less practical than for others. Don't rush out to buy a loan program just to find out how much the monthly mortgage payments will be on a house that you want. You can get easy-to-read mortgage payment charts from a realtor. But if you need to know how much of a monthly

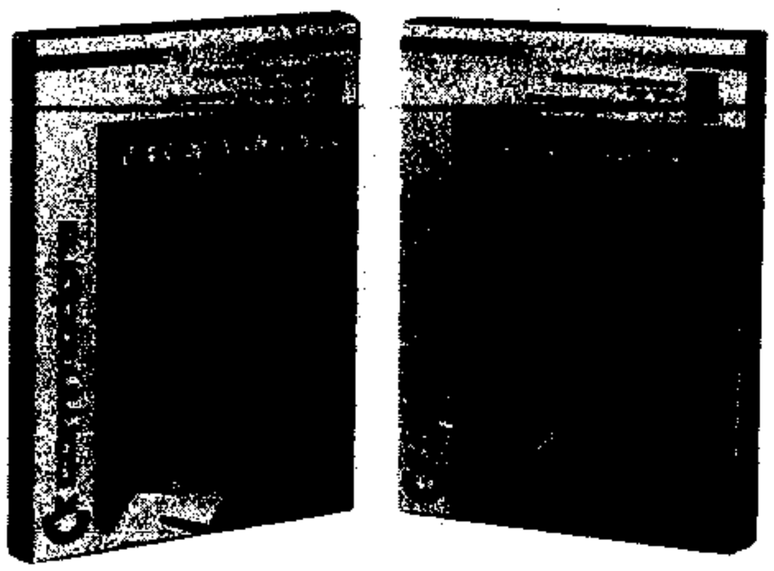


Fig. 6-8. Financial programs.

withdrawal you can make from savings when you retire, or how much you need to put in the bank each month to accumulate a down payment, or whether your stock holdings are growing at a respectable rate, then an investment program can be very worthwhile. If you decide this type of program is worth your money, be sure to compare carefully the features of each program available. They can differ significantly.

If a program promises to do everything from projecting your future earnings on stock to calculating your loan payments, you should be a little suspicious. Either the program does not go into depth in any one area, or it may not guide you in its use — it can't because it uses too much memory just for the program. The latter shortcoming can be overlooked if you're willing to read the manual and spend some time learning how to use the program.

On the other hand, if the program answers questions only on a limited range of financial matters, you may not care how user friendly it is because it doesn't help with all your questions. You may be stuck buying an entire series of programs to deal with a relatively simple range of financial matters.

Before you buy, ask yourself honestly if you are willing to make some effort in learning a program or if you'd rather be walked through it. There's nothing wrong with not wanting to know more than you must about computers. If this is how you feel, be sure you buy programs that are tailored to your preferences.

Stock Evaluators

Stock analysis comes either bundled with other investment programs, or as a program by itself. These programs can be helpful if you have a lot of stock; especially, if you follow the market closely. Since some general investment packages include fairly good stock sections, you should check these before you buy a program that is solely devoted to stock.

Furthermore, before you buy a program solely for this use, you should check out the offerings available on computer information services, such as Dow Jones News/Retrieval™ or CompuServe™.

These subscription services are accessible through the telephone lines if you have a modem. The services offer useful analysis just as the programs do and they also list prices for current stocks, bonds, commodities, and other securities. This may or may not be appropriate for your uses. Chapter 3 explains the advantages of modems and computer information banks.

LIFE STYLE PROGRAMS

IQ Tests

These types of programs (Fig. 6-9) aren't usually the greatest of programs, and you can find versions of them listed on computer information services such as CompuServe™. Wherever you find them, don't take them too seriously. Their range of questions is limited to what works well on a computer. Generally, the questions are repetitious. For example, there are lots of the following types of questions: What's the next number in this series?, What shape doesn't belong?, Can you unscramble these letters?, etc. If you're good at those types of questions, the program will tell you that you're a genius.

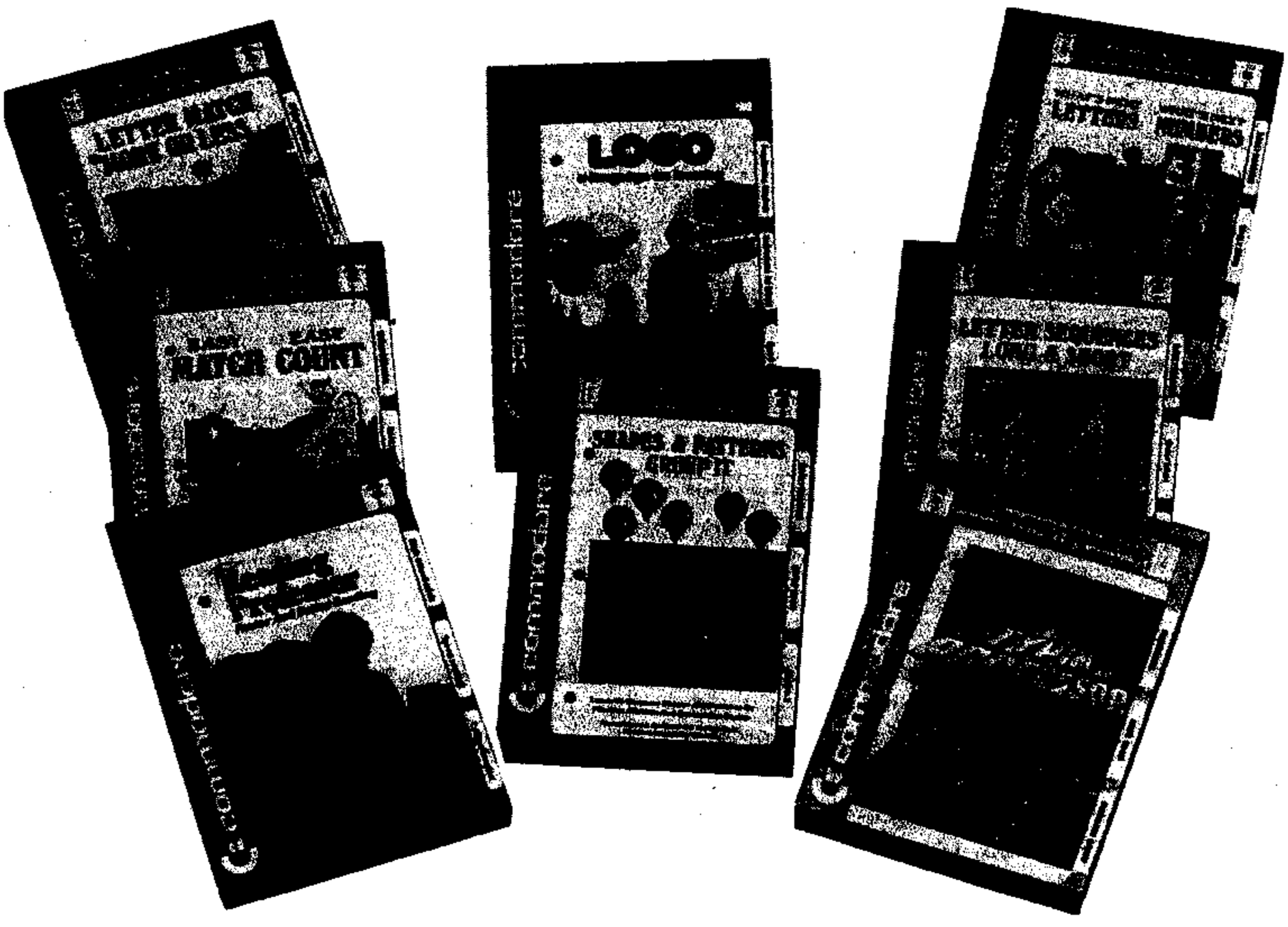


Fig. 6-9. Life style programs.

Personality Tests

These programs are generally typical personality questionnaires. At the end, they display a graphic depiction of your personality across several scales. For example, the test will rank you on an introvert-extrovert scale, a passive-aggressive scale, an intuitive-cognitive scale, etc.

Like the IQ tests, these programs are limited to the criteria that can be tested in regular questionnaires. If you enjoy these questionnaires, the programs are fun. If you expect more, you'll be disappointed. Your computer can't tell any more about your personality or intelligence than a test written on paper can.

Trivia Quizzes

These types of programs may more properly be called games because they keep score and almost always allow two players to compete. If you enjoy trivia questions, these are fun. They are usually in multiple choice or true-false form. This is necessary because a computer would almost always state that an answer was wrong if you misspelled it, entered it in a different form, or called it a different correct name.

Trivia quizzes emphasize different trivia topics; some may be too hard or too easy for you. Again, look for reviews before you buy.

Recipe and Diet Programs

This is another area where computers don't necessarily add much. Some of the programs keep track of calories, but you can do that on paper, too. Still, if you're interested in cooking and diet, look for reviews of this type of software to see if one has some features that would be useful to you. Some of these programs, such as Commodore's *Micro Cookbook*, are popular.

If you just want to use the computer to store recipes, get a database manager. Database managers are very versatile, have indexing capabilities, and are much more practical for this use.

GAMES

To many of us, computer games mean *Space Invaders* and *Pac Man*, but there are different types of games as well (Fig. 6-10). Of course, you can buy versions of most popular games, such as *Wizard of Wor* and *Gorf*, for the Plus/4 computer.

You can also buy adventure games such as *Zork* and the *Scott Adams Adventure Series*. These games don't involve shooting down objects; instead they are *text games*, which means that they don't rely on dazzling graphics or visual effects to entertain you. These games ask questions and give you clues to solve a mystery,

recover treasure, save a planet, etc.

There are also other intellectually challenging computer games. These include educational games (for different age levels) and trivia quizzes. Again, look for reviews before you buy. Sometimes it's easier to find game reviews than other software reviews. I suspect this is because there are more game addicts than there are spreadsheet experts.

Fig. 6-10. Game programs.

One note of caution about game reviews; make sure the version of the game being reviewed is one that will work on the Plus/4. Because home computer software usually only works on one type of computer, different versions of the game are made for separate computers. Often the versions are developed and marketed by different companies. In short, you can't trust the version of *Gorf* for the Plus/4 computer to be great just because the version for another computer is well reviewed. Nor can you assume that all "Gorfs" are second rate because one version received an unfavorable review.

Arcade-Type Games

You may have read articles detailing the sorry state of the video game industry. Though many video game companies are in financial trouble, you need not fear that video games are on the verge of extinction. More games are being made for computers, fewer for plain video game machines.

Many companies, including Commodore, make games for the Plus/4 computer. Remember that the Commodore 64 versions of games won't work on the Plus/4. Fortunately, you can trust that the better games will be among the first converted for the Plus/4. Some games were available when the Plus/4 computer was initially offered on the market.

Commodore Plus/4 Graphics

Finally, the graphic characteristics of the Plus/4 computer are not the same as those of the Commodore 64. The Commodore 64 has *Sprite Graphics*; the Plus/4 does not. Most people think that the Commodore 64 has superior game graphic features. You may or may not notice the difference. If game playing is the main reason you're buying a home computer, be sure to evaluate the differences in graphic display between the Commodore 64 and the Plus/4. If game playing is only one reason for your purchase, be sure to weigh all the features of the two computers before you decide.

Talking Games

One of the new twists in computer games is *speech*. Though games have always had music and sound effects, they have only recently acquired the ability to address you in English. To use the voice feature, there are two requirements: the game must have speech programmed into it and you must have a voice synthesizer. Note, however, that you can still play talking games without a speech synthesizer; they just won't talk.

The features of Commodore's voice synthesizer, the *Magic Voice*, are described in Chapter 3. Many educational programs also have speech, and you can easily program speech yourself, so this may be a worthwhile investment if you're interested in listening to your computer talk.

Adventure Games

Some of the most entertaining games are the ones that should appeal to the whole family: adventure games (Fig. 6-11). Unlike the arcade-style games, these don't require a quick trigger finger. Instead, games such as *Zork, Suspended,* and the *Scott Adams Series* require careful strategy, logic, deduction, and a memory for

details. For example, in *Deadline*, you have a limited time to solve a murder. You can inspect the crime scene, question witnesses, order lab work, and snoop for clues. These games have enough variations, twists, convolutions, and dead ends that you can play them repeatedly without boredom.

Fig. 6-11. Adventure-type programs.

EDUCATIONAL PROGRAMS

One of the most practical reasons for buying a Plus/4 computer is providing your children with an important educational tool. Besides educational software, the BASIC language built into the Plus/4 is a learning tool that can teach your children a great deal about logic, language, geometry, and problem-solving. With educational software, children can teach themselves. Computers are patient, encouraging, and thorough.

Educational software can't teach all of the important concepts that are part of a child's education, but it can be an integral part of education in both the school and at home. There are many educational programs available and, as usual, they aren't all good.

Besides looking for reviews, you should ask several teachers for recommendations. The best programs are those that are more than computerized flash cards. Look for programs that teach concepts as well as details.

Many software companies write educational software for the Commodore computers. Make sure the software is designed for the Plus/4 computer or the Commodore 16, because the Commodore 64 and VIC 20 software does not work on the Plus/4 computer. However, software designed for the Commodore 16 does work on the Plus/4.

LOGO: A PROGRAMMING LANGUAGE FOR KIDS

One of the most popular educational tools available on a computer is LOGO, an easy-to-use computer language designed for children (Fig. 6-12). In LOGO, the screen cursor is replaced by a movable triangle called a *turtle*. As you move the turtle around the screen, you can draw a variety of intricate shapes. LOGO also lets the user manipulate words and lists of information and work with mathematical concepts.

Fig. 6-12. LOGO, a language for learning.

LOGO is a procedural language, which means that the user writes small procedures that are used (and reused) for accomplishing related tasks. The goal of a procedural language is to develop a structured approach to problem-solving. With LOGO, the user gradually puts together procedural modules to build a solution.

LOGO is being taught in many schools because educators believe it is a useful tool for teaching concepts and structured thinking. There are also several books available for self-teaching, including the extensive manual that comes with the software.

Along with the graphic commands built into the Plus/4 computer, LOGO makes this computer a wonderful learning device for children.

PROGRAMMING AIDS: WRITING YOUR OWN SOFTWARE

If you are interested in learning to program in BASIC or in using the built-in machine-language monitor, you can purchase software that helps you learn to do this. In addition, you can buy programmer's aid software that contains time-saving utility programs and routines.

The programming aids range from introductory tutorials for teaching BASIC to sophisticated program-design utilities.

Chart 6-1. Software Commands Reference Chart — *LOADING SOFTWARE*

Type	Procedure
Built-in	Press Function key [redacted] and [redacted] to load the word processor from BASIC. Only the word processor is accessed directly from BASIC. To switch between the word processor, the spreadsheet, and the file manager, first press [redacted] and [redacted], and then type one of these commands and press RETURN: DESTINATION — COMMAND — MEANING Word Processor — tw — To Word Processing File Manager — tf — To File Spreadsheet — tc — To Calculations Enter and exit the graph generator via the spreadsheet only. To go to the graph generator from the spreadsheet, press [redacted] and [redacted], then type gr and press [redacted]. To leave the graph generator, press [redacted].
Cartridge	1. Turn the computer OFF. 2. Insert cartridge into Memory Expansion Port. Be sure it is snug and evenly inserted. 3. Turn the computer ON. If software does not start automatically, consult instruction manual for key to press.
Cassette Tape	1. Put the cassette into the cassette recorder. 2. Rewind the tape (if necessary) by pressing the REWIND button on the cassette recorder. 3. Type LOAD "program name" (you supply the program name). 4. Press the [redacted] key. The message PRESS PLAY ON TAPE appears on the screen. 5. Press the PLAY button on the recorder when the tape finishes rewinding. FOUND program name is displayed when the loading is finished. 6. Press the [redacted] key if you want to load the program. Press the [redacted] key if you decide not to load the program. If the tape contains more than one program, and you want a program stored after the one that has been found, press the [redacted] bar to tell the computer to go to the next program. Repeat if necessary. 7. Type RUN to execute or LIST to display the program lines. Press the [redacted] key.

Diskette	1. Put the diskette into the disk drive and close the drive latch. The drive should be ON before you put in the disk. Hold the diskette by the label so that the disk label side is up and towards you. The labeled end of the diskette should be last into the drive. 2. Type DLOAD "program name" (you supply the program name). 3. Press [redacted]. At first, this message appears: SEARCHING FOR program name LOADING After a moment, the READY prompt and the cursor appear to show that the software is ready to use. 4. Type RUN to execute LIST to display the program lines. Press the [redacted] key.

Chart 6-2. Software Commands Reference Chart — *SAVING PROGRAMS*

Type	Procedure
Cassette Tape	1. Put the cassette tape into the cassette recorder. Use REWIND or FAST FORWARD to position the tape, if necessary. (You can also use the VERIFY command to position the tape.) Make sure the tape is positioned past the tape leader, which is a different-colored strip at the beginning of most tapes. Data can't be stored on the leader. 2. Type SAVE "program name" (you supply the program name, which can be up to 16 characters long). 3. Press the [redacted] key. This message appears: PRESS RECORD AND PLAY ON TAPE 4. Press the [redacted] and [redacted] buttons on the recorder. The screen is blank while the program is being saved. Both the word READY and the cursor should appear on the screen when the saving procedure is completed.
Diskette	1. Put the diskette into the disk drive and close the drive latch. The drive should be ON before you put in the disk. Put in the disk with the label side up and towards you. The labeled end should be last into the drive. 2. Type DSAVE "program name". 3. Press [redacted]. At first, this message appears: SAVING program name After a moment, the word OK, the READY prompt, and the cursor appear, indicating the program is saved.

HEADER Command

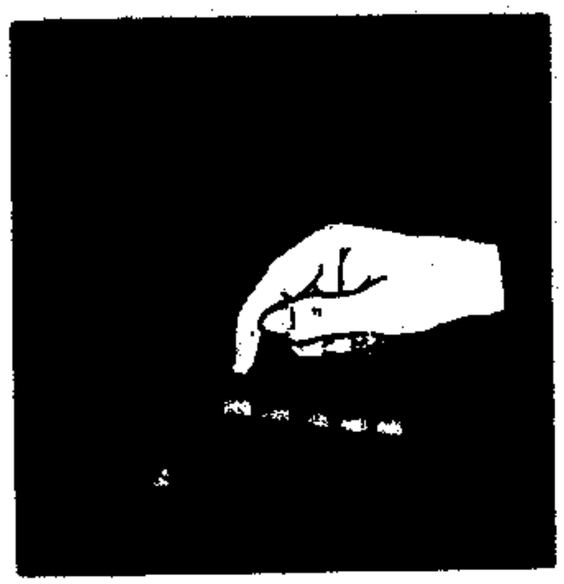
To prepare a new blank diskette for first-time use, type in the HEADER command and press the [redacted] key. *NEVER* use this command on commercial software or disks that contain information you want to keep. The HEADER command erases and formats a disk.

HEADER "disk name",DØ,I## (## is a 2-character id code; use any two characters, e.g., I33.)

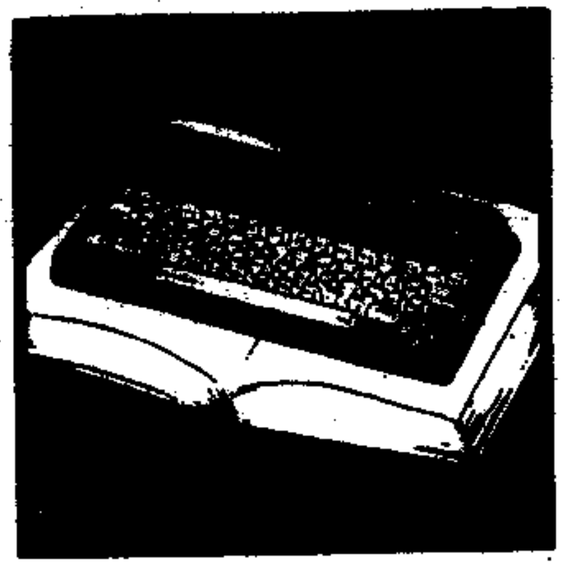
DIRECTORY Command

To view a list of programs contained on a disk, type in the following command and press [redacted]:

DIRECTORY



TEACHING YOURSELF HOW TO USE THE KEYBOARD



INTRODUCTION TO THE KEYBOARD

The Plus/4 keyboard looks and feels like a typewriter keyboard and the Plus/4 keyboard can do what a typewriter can — print letters, numbers, and other symbols. The Plus/4 keyboard can also do what a typewriter can't do. It can tell your computer to process words, give counsel on investments, answer questions to a quiz, load and run software, write and run programs, draw pictures, change the color of the characters, control the screen, and so on.

On a typewriter keyboard, most of the keys do two tasks: print an uppercase character and print a lowercase character. On the Plus/4 keyboard, shown in Fig. 7-1, most of the keys do at least four tasks: besides printing an uppercase and a lowercase character, each key can also print the symbols displayed on the fronts of the keys.

On a typewriter keyboard, the [redacted] key works only as a partner to other keys. On the Plus/4 keyboard, several keys work as partners to other keys: the [redacted] key, the Commodore logo key (C=), and the [redacted] key. The Plus/4 keyboard has other keys, such as the [redacted] key, the [redacted] key, and the [redacted] key, that are unique to computers. This chapter will explain the multiple functions of each key and show you how to use them.

TWO EXERCISES TO INTRODUCE THE KEYBOARD

Exercise 1. Greetings

This simple 1-line exercise shows you how to display words on your computer screen. Type the exercise exactly as it's printed here and press the key marked [redacted] when you finish typing. The result is shown in Fig. 7-2.

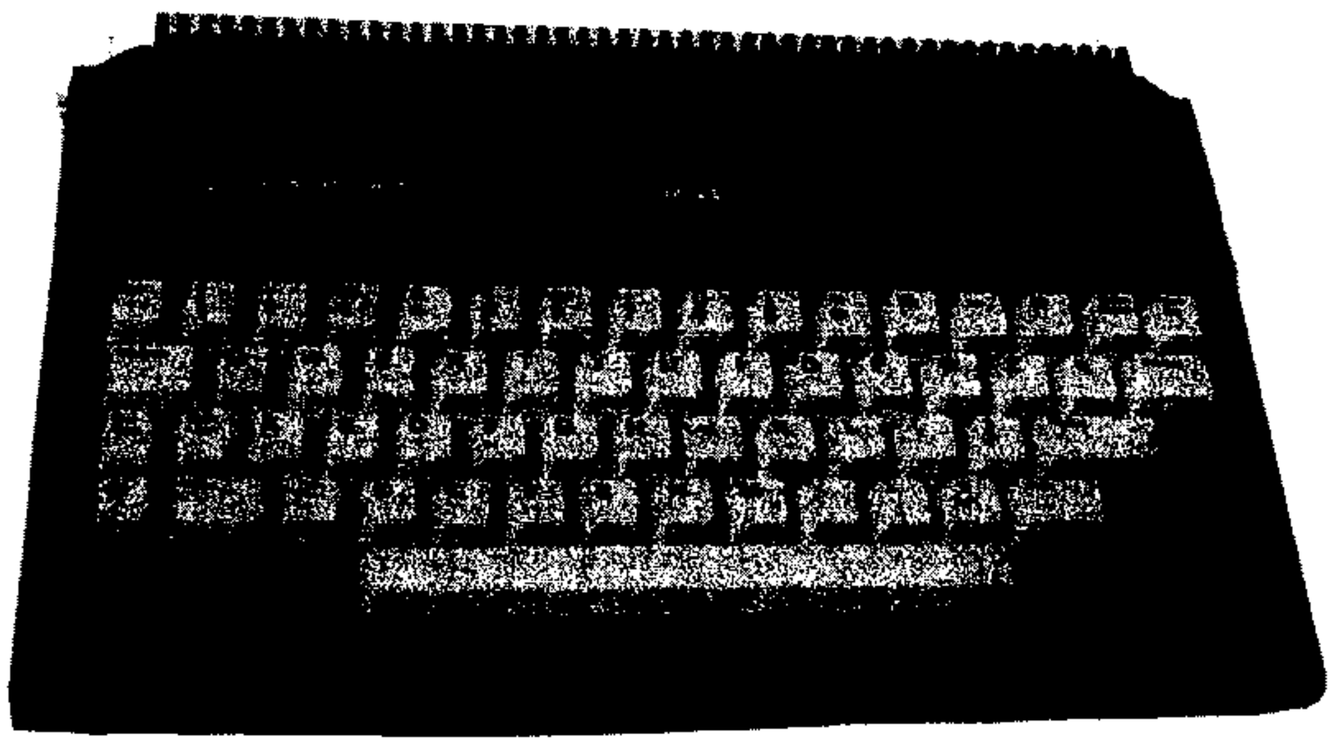


Fig. 7-1. The Plus/4 keyboard.

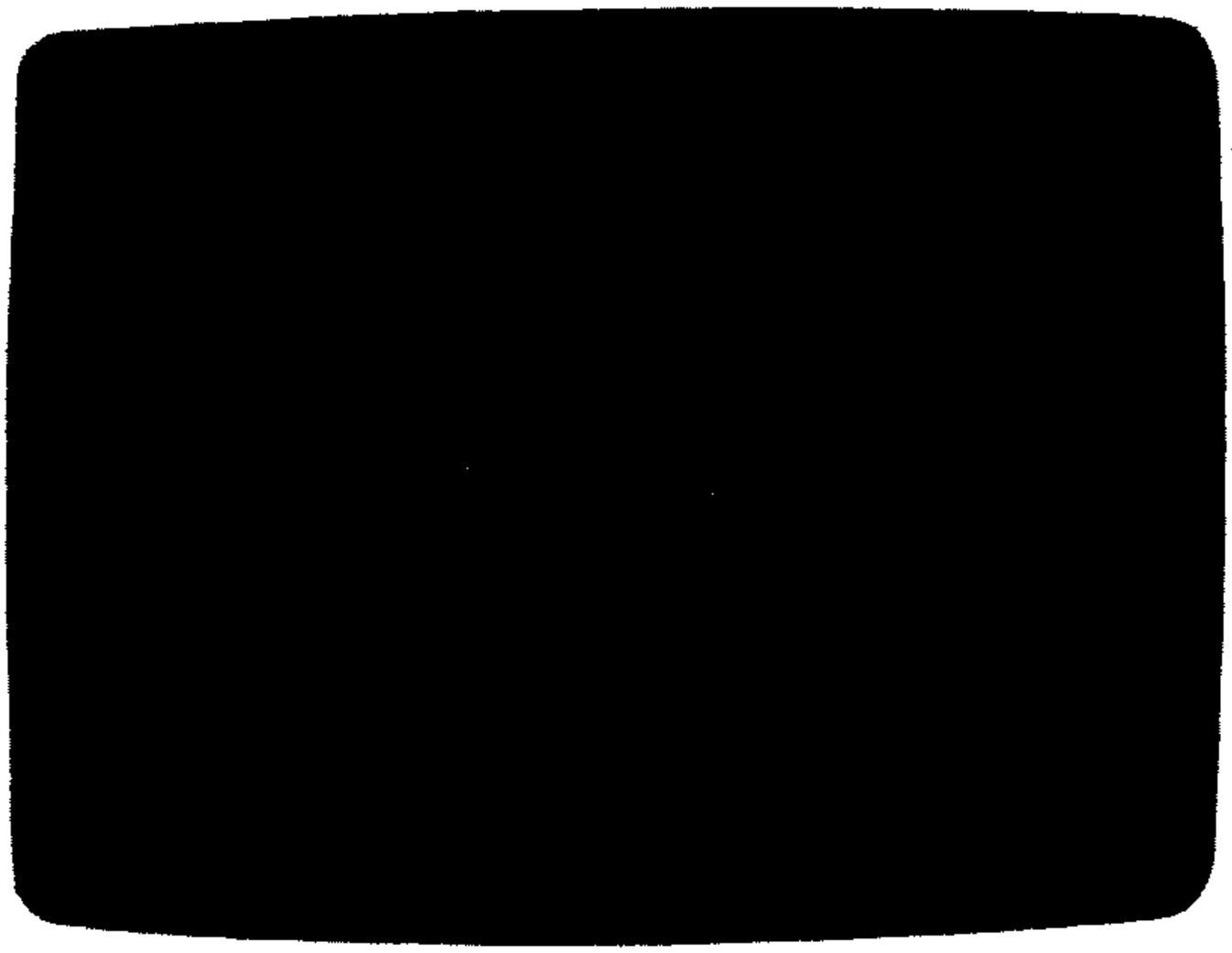


Fig. 7-2. Screen display for the Greetings exercise.

Be sure to type the word PRINT. You must hold down the SHIFT key when you type the quotation marks and the exclamation point. You do not need to use the SHIFT key to type the letters.

```
PRINT "HELLO, MOM!"
```

Now press the RETURN key. Your greeting should be printed underneath the line you just typed.

If you make a mistake, just press the RETURN key and start over. When you press the RETURN key after an error, the screen may display a message such as SYNTAX ERROR. Just ignore this and retype the line.

Exercise 2. Railroad Tracks

The second exercise shows you just a few of the features of the Plus/4 keyboard. Press the keys in the order they appear here:

1. Hold down CONTROL and press the 1 key. The cursor is now red.
2. Type in PRINT "HELLO, DAD!" and press the RETURN key. The characters should all be red.
3. Hold down CONTROL and press the 2 key. The cursor is now purple.
4. Hold down the C= key while you press the following keys to draw the purple railroad tracks, shown in Fig. 7-3. You'll notice immediately that E's and R's don't appear when you type these keys with the C= key held down. Just keep typing.

ERERERERERER Hold down SHIFT and press RETURN.
RERERERERERE Hold down SHIFT and press RETURN.

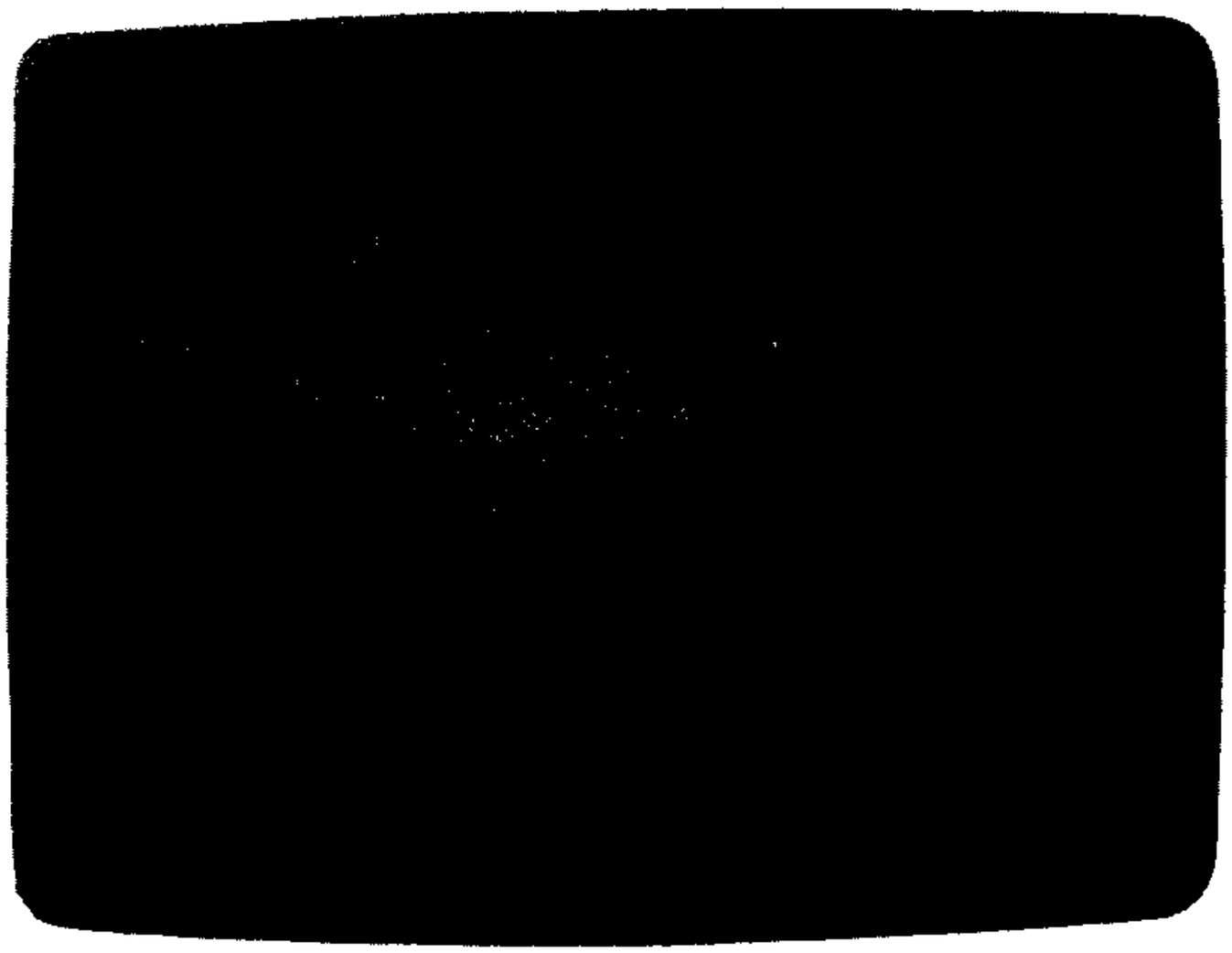


Fig. 7-3. Screen display for the Railroad Tracks exercise.

UNDERSTANDING EACH KEY

This chapter introduces you to each key, one at a time. You should follow along in this section by sitting in front of your computer and typing in the exercises. If you make a mistake and can't figure out how to correct it, you can press the key marked CLR/HOME to erase your screen. If even that doesn't clear

away your problem, press the RESET button on the side of the computer.

This book introduces computing concepts gradually as you are shown how to use the keys. If you make a mistake or feel confused, skip to the next section, or look in the index to see where you might find help, or turn off the computer and come back later. You'll find problem-solving tips throughout the chapter.

The Cursor Keys

Function: These arrow-shaped keys, pictured in Fig. 7-4, move the cursor around the screen.

When you first turn on your computer, a sign-on message, shown in Fig. 7-5, is displayed at the top of the screen. Under this message is a flashing square. This square is called the CURSOR.

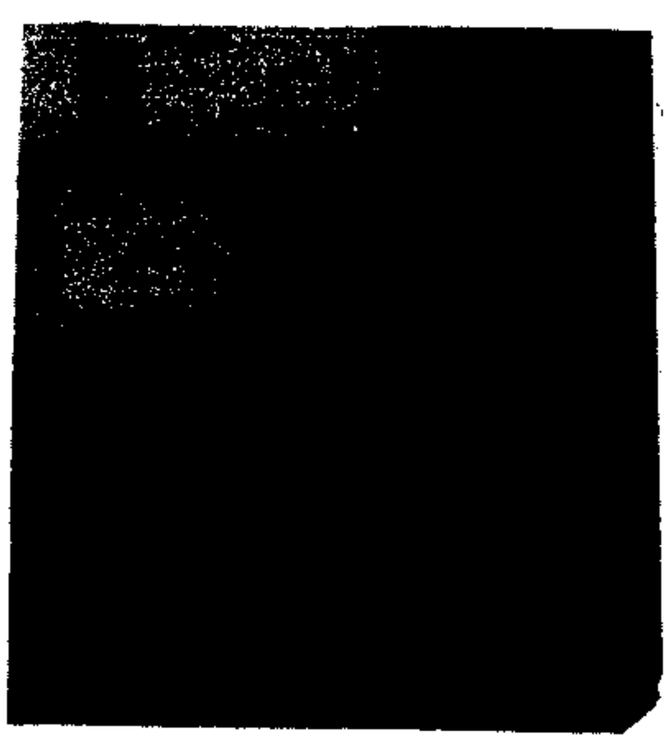


Fig. 7-4. The cursor arrow keys.

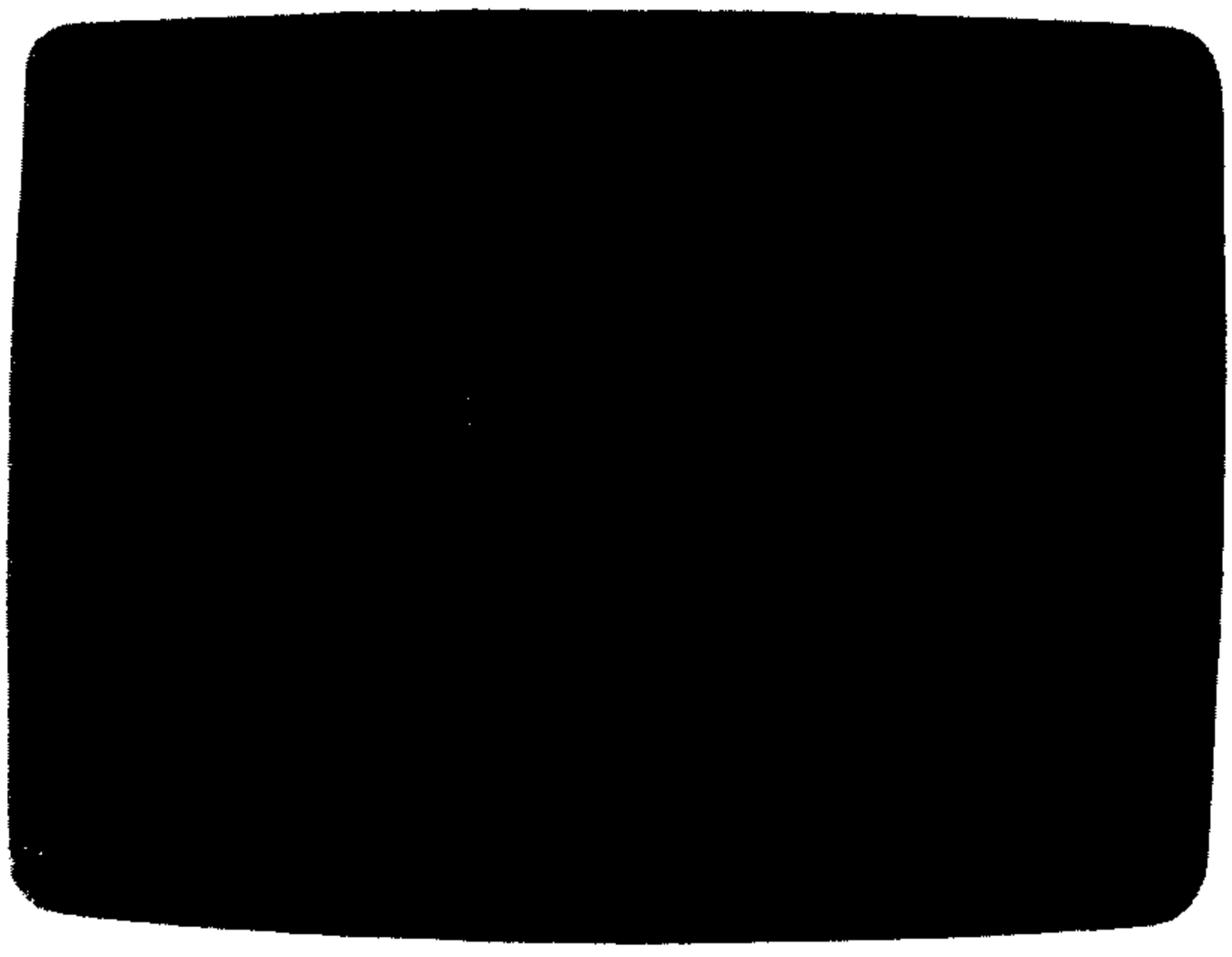


Fig. 7-5. The Plus/4 sign-on message.

The cursor shows you where you are on the screen. As you type on the keyboard, you'll notice that the cursor is always one space ahead of the letters you type — that is, unless you use the cursor keys to move the cursor somewhere else.

You'll also notice that after you press the RETURN key, the cursor always appears at the far left on the first blank line under the word READY. The READY message tells you the computer has followed your last instruction(s) and is waiting for your next command. When you begin typing the next instruction, the characters that you type appear where the cursor is blinking, under READY.

Wherever the cursor is on the screen, the next character you type appears in the cursor's position, and the cursor moves ahead one space. If you move the cursor to a character that you have already typed, you can type over the old character and the old character disappears.

As you'll read later in this chapter, a few other keys can also move the cursor. Try the following on your Plus/4 computer.

Cursor Exercise: Learning To Edit on the Computer Screen

1. Type in the following line and then press the RETURN key:

```
PRINT "PORTLAND IS IN OREGON"
```

   The statement "PORTLAND IS IN OREGON" should now be displayed beneath the line you typed. If you make a typing mistake, just press the RETURN key and retype the line.

2. Press the cursor-up arrow four times so the cursor is on the P in PRINT.

3. Hold down the cursor-right arrow until the cursor is on the first O in OREGON in the top line. The cursor continues to move as long as you hold down the cursor arrow key. As Fig. 7-6 shows, you can still see the O with the cursor blinking on it.

4. Next, type MAINE! on top of the word OREGON. OREGON disappears as you type in MAINE!. Press the RETURN key again. As Fig. 7-7 shows, MAINE! now appears on the screen in the second line where the word OREGON was.

You've just had your first lesson in editing on the computer. Two things happened:

1. You changed a word without erasing the old word.
2. The computer understood the change and printed the new message.

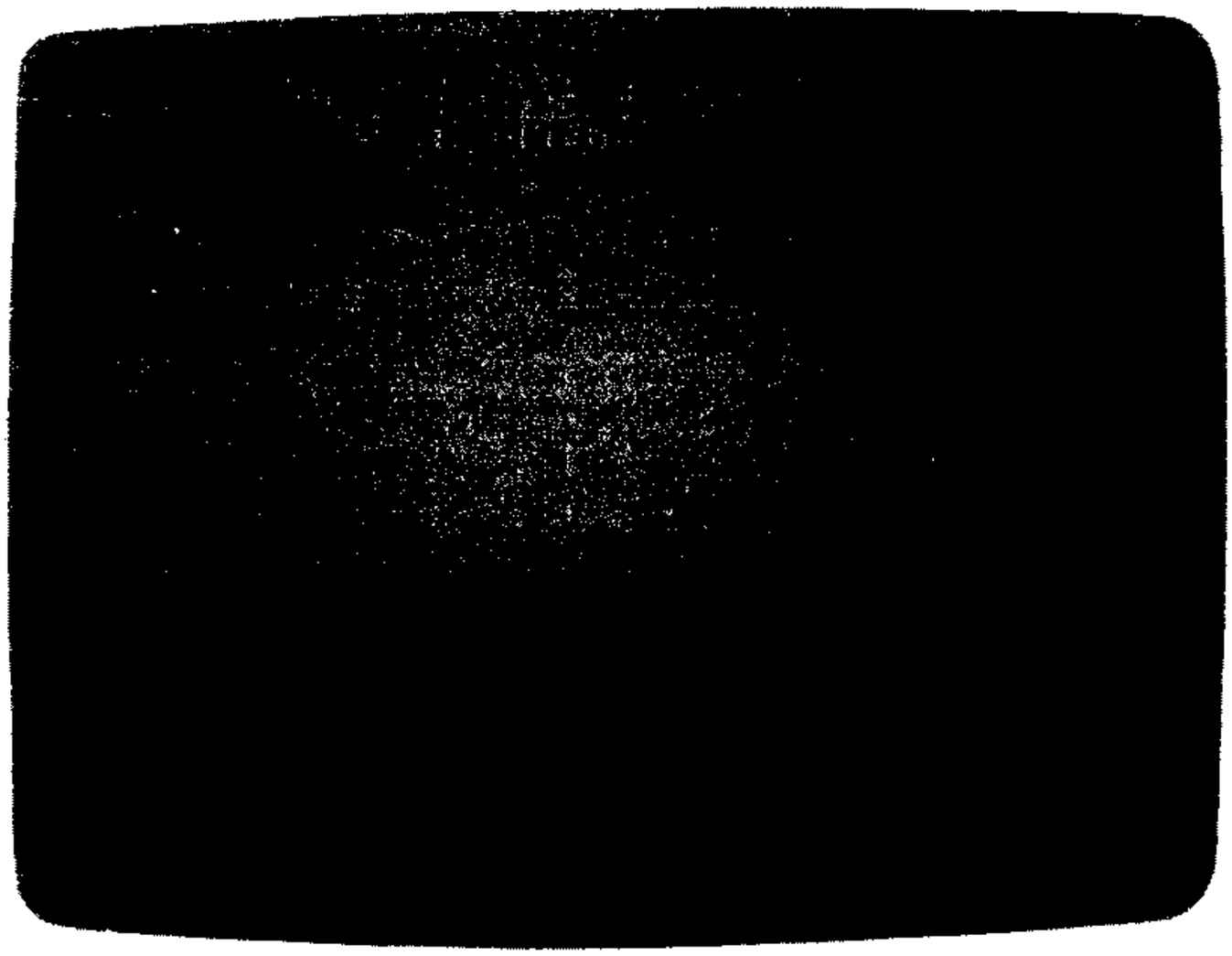


Fig. 7-6. Correcting with the cursor.

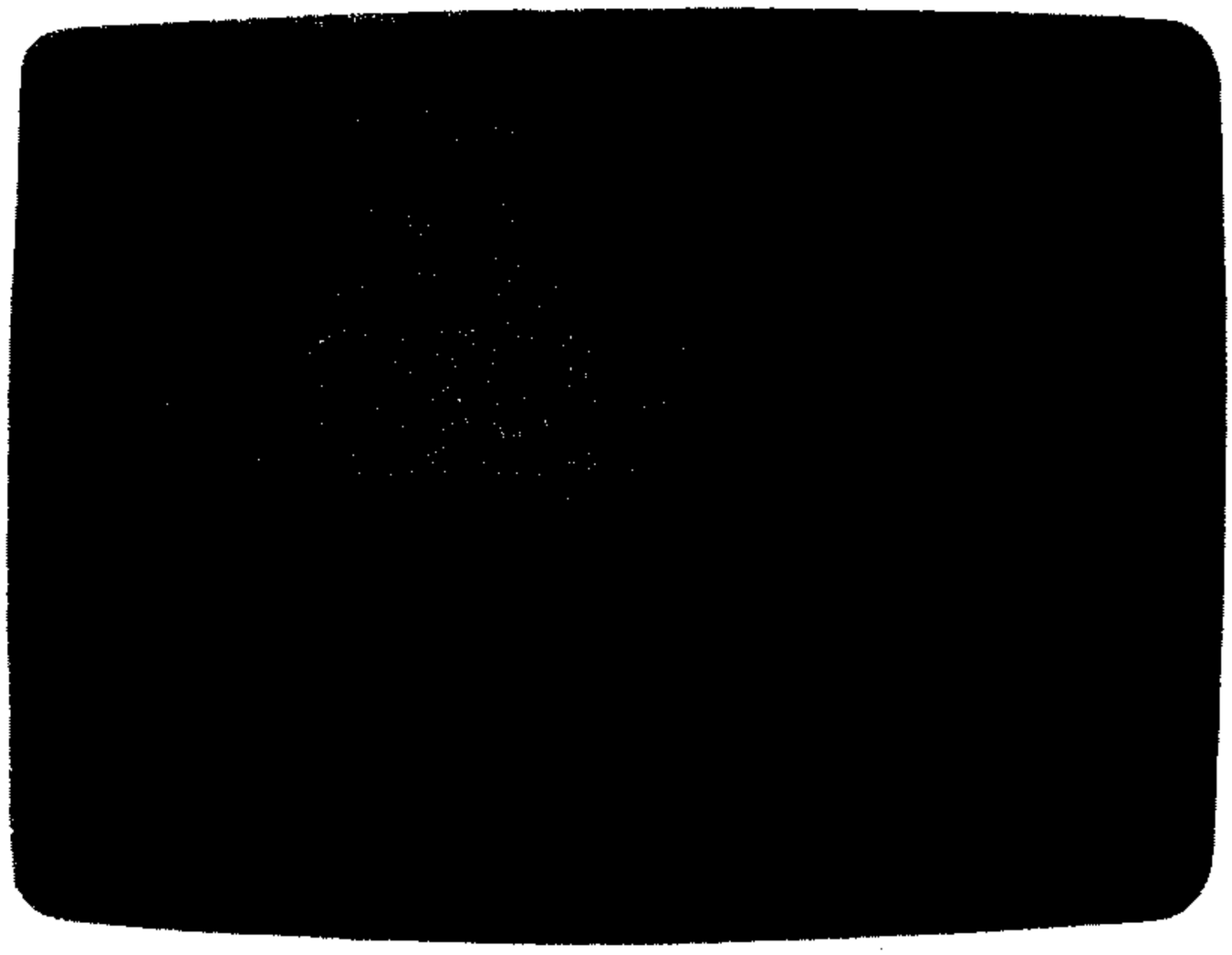


Fig. 7-7. Display for cursor exercise.

Wraparound

To discover another feature of the cursor, called *Wraparound*, hold down the cursor-left arrow key. As you hold down the cursor key, watch the cursor as it travels backwards, jumping from the line under the message you printed and appearing at the far right of the screen — one line up.

When the cursor reaches the end of a line, it doesn't stop there. Instead the cursor automatically "wraps around" to the next line. If the cursor is heading left, it wraps up to the previous line. If the cursor is moving right, it wraps down to the next line. Practice holding down the cursor-left arrow and cursor-right arrow keys and watch the cursor as it wraps from one line to the next.

Scrolling

Once you understand wraparound, you're ready to try *scrolling*. Hold down the cursor-down arrow key for a few seconds. As the cursor gets to the bottom of the screen, watch what happens to the lines at the top of the screen.

As you continue holding down the cursor-down arrow key, the lines disappear, rolling up into the top of the screen. The Plus/4 computer lets you cursor down to use more than the length of the screen. In a sense, there's more screen down there that you can't see all at once. As Fig. 7-8 illustrates, the computer screen is like a

Fig. 7-8. Screen scrolling.

window that shows part of a "scroll," much like the scrolls that the Romans wrote on before notepads and computers.

Scrolling with the cursor keys lets you see what, if anything, is written farther down in the program area, outside of the current view through the screen. You can also, of course, scroll down to a clean screen area.

The important uses for wraparound and scrolling will become more evident as you use your Plus/4 computer. These features are especially useful when you are writing or viewing programs, and when you are using a word processor.

The RETURN Key

Function: Enters into memory information you typed onto the screen. Pressing the RETURN key also moves the cursor to the beginning of the next line.

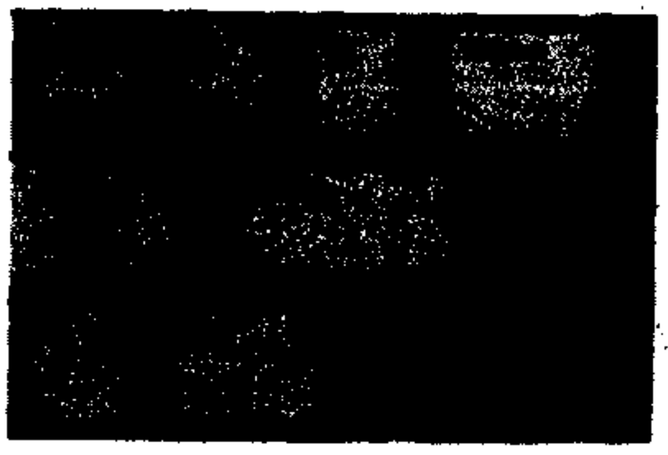


Fig. 7-9. The RETURN key.

You've already used the RETURN key, shown in Fig. 7-9, in previous examples in this book. The function of the RETURN key is central to computer work: it enters instructions into memory, thereby telling the computer to follow your orders.

After you press the RETURN key, the cursor automatically moves to the beginning of the next line. If you have entered instructions that are to be followed immediately, the computer follows the command after you press RETURN. As soon as the computer finishes executing the command, the word READY and the flashing cursor appear at the beginning of the line just underneath.

You must remember to press the RETURN key at the end of each line of instructions. Otherwise, the computer won't accept your commands. This is important to remember when you go back and change a line. Unless you press the RETURN key after you change the line, the computer doesn't accept the change. You don't, however, have to move the cursor to the end of the line before you press the RETURN key. If you press RETURN anywhere in the line, the computer accepts the entire line.

Exercise: Using the RETURN Key

1. Type the following line exactly as it appears and then press the RETURN key:

   ```
   PRINT "FA STANDS FOR FLORIDA"
   ```

   As soon as you press RETURN, the computer accepts and follows the command.

2. Correct this statement by using the cursor keys to position the cursor over the A in FA. Be sure to do this on the line you typed, not the line the computer printed.

3. Type an L where the A in FA is so that the line looks like this:

   ```
   PRINT "FL STANDS FOR FLORIDA"
   ```

4. Press the RETURN key without moving the cursor from the space between the L in FL and the S in STANDS. As you can see, the computer accepts the entire line with the change and prints the new message.

Blocking the RETURN Key

If you press the RETURN key while the SHIFT key or the SHIFT LOCK key is held down, the RETURN key is not able to perform its regular task of entering information into the computer. Occasionally, you might want to block the RETURN key because you don't want the computer to try to interpret what you have typed as an instruction. You'll use RETURN key blocking later in this chapter when you learn about using the graphic key symbols.

BASIC SYNTAX

A computer can only understand a limited number of instructions and those instructions must be entered exactly, according to what are called *syntax rules*. These syntax rules make up the structure of the BASIC computer language. If you enter a command that doesn't follow the form required by the syntax rules, the computer can't understand the command. Instead, as soon as you press the RETURN key, the computer displays a message like the one shown in Fig. 7-10.

When you type something that doesn't follow the syntax rules, you can hold down the SHIFT key when you press the RETURN key to prevent the entry from being interpreted — and rejected — by the computer. For example, if you are drawing designs with the graphic symbol keys, you can move to the next line without sending anything to the computer. Graphic symbols are not part of BASIC syntax, so they'd be rejected if you pressed the RETURN key (unless the graphic symbols are part of a PRINT statement).

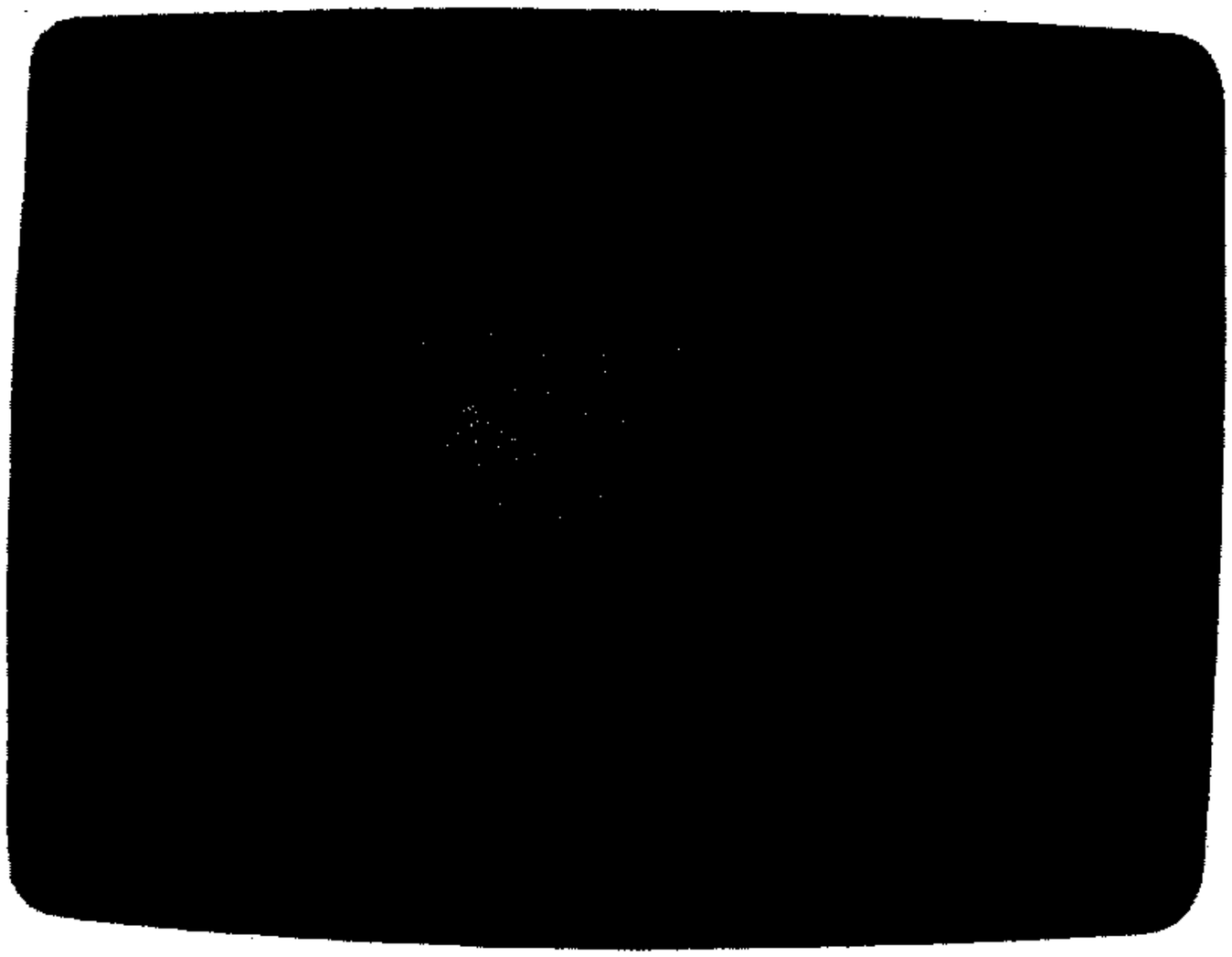


Fig. 7-10. Screen display of a syntax error message.

Exercise: Using a Suppressed RETURN Key

1. Type your name on the screen and press the RETURN key. As you can see, the computer rejects what it considers to be an erroneous command.
2. Type your name again, but this time hold down the SHIFT key when you press the RETURN key. No error message appears this time because you suppressed the RETURN key function by holding down the SHIFT key. Your screen should look like the one in Fig. 7-11.
3. Press the SHIFT LOCK key and then press these keys:

NMNMNMNMNM	press RETURN
VVVVVVVVVV	press RETURN
MNMNMNMNMN	press RETURN

Without releasing the SHIFT LOCK key, press the RETURN key. Because you pressed the RETURN key with the SHIFT key locked, the computer doesn't try to interpret what you just typed, and no SYNTAX ERROR message is displayed.

Your screen should look like the one shown in Fig. 7-12.

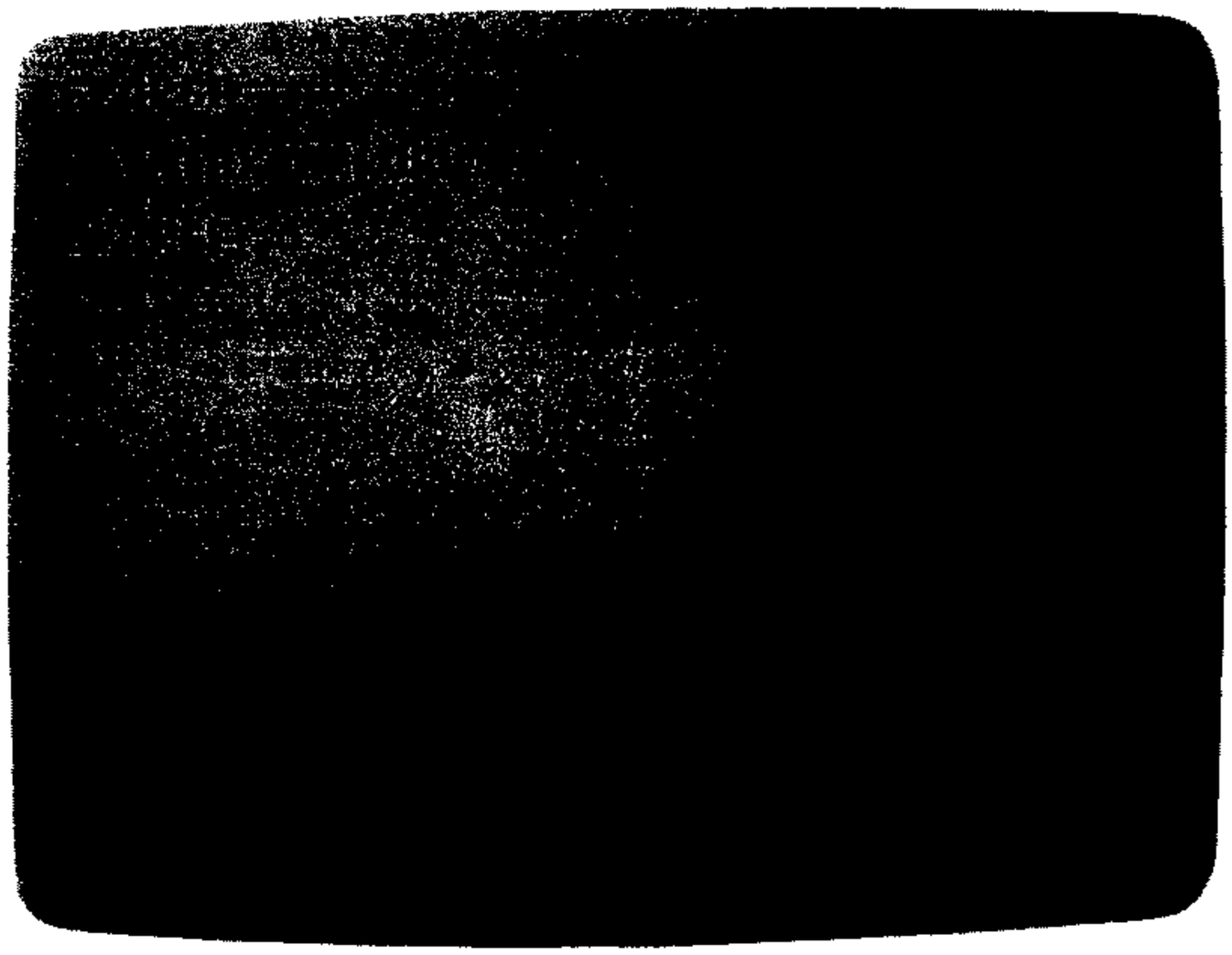


Fig. 7-11. Display illustrating a suppressed RETURN key.

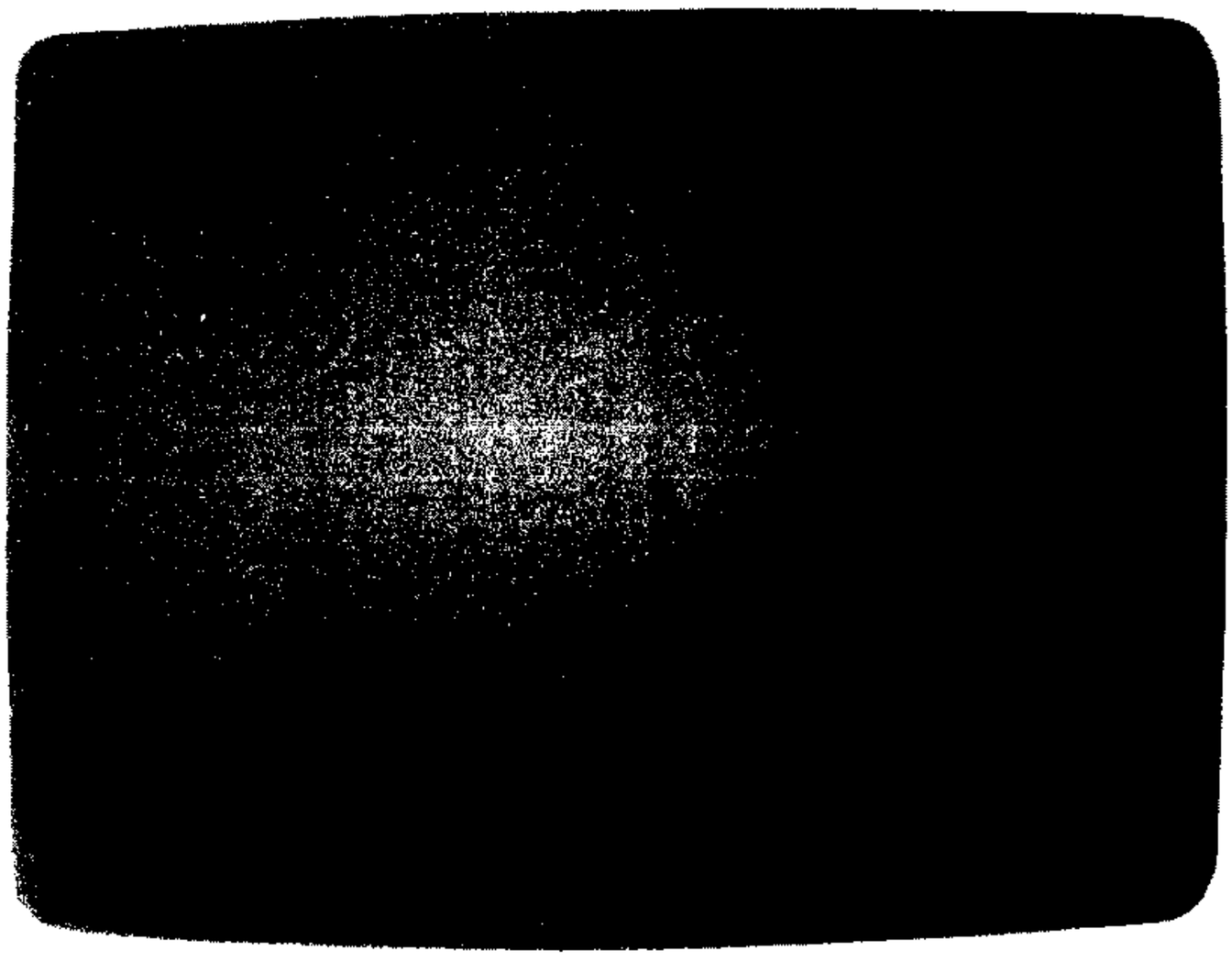


Fig. 7-12. Graphics exercise using the SHIFT key.

The CLEAR/HOME Key

Functions: HOME

1. Moves the cursor to the top left of the screen.

2. Cancels a screen window when you press [HOME] twice. Screen windows are explained in the Escape Key section in this chapter.

CLEAR

Erases the screen and moves the cursor to the top left corner of the screen.

The HOME Position

You've already seen how you can use the cursor keys to move the cursor around the screen. There's an easier and quicker way to get the cursor to the top left corner of the screen: the [CLEAR/HOME] key, which is shown in Fig. 7-13.

Fig. 7-13. The [CLEAR/HOME] key.

Type this line and press the [RETURN] key:

```
PRINT "GO WEST , YOUNG MAN!"
```

Press the [CLEAR/HOME] key and you'll see that the cursor immediately returns to the top left corner of the screen, as shown in Fig. 7-14. Nothing written on the screen is affected when you press [CLEAR/HOME] as long as you don't touch the [SHIFT] key.

The top left corner of the screen is called the HOME POSITION, hence the name of the [HOME] key.

The CLEAR Key

As you'll learn from this exercise, [CLEAR] does more than [HOME].

Exercise: Screen Clearing

1. Use the cursor-down arrow key to move the cursor to the fifth or sixth line on the screen.

2. Type the following line on the screen, and press the RETURN key. (Use your own name.)

```
PRINT "I'M BOB"
```

3. Hold down the SHIFT key and then press the CLR/HOME key. The screen goes blank and the cursor is at the HOME position.

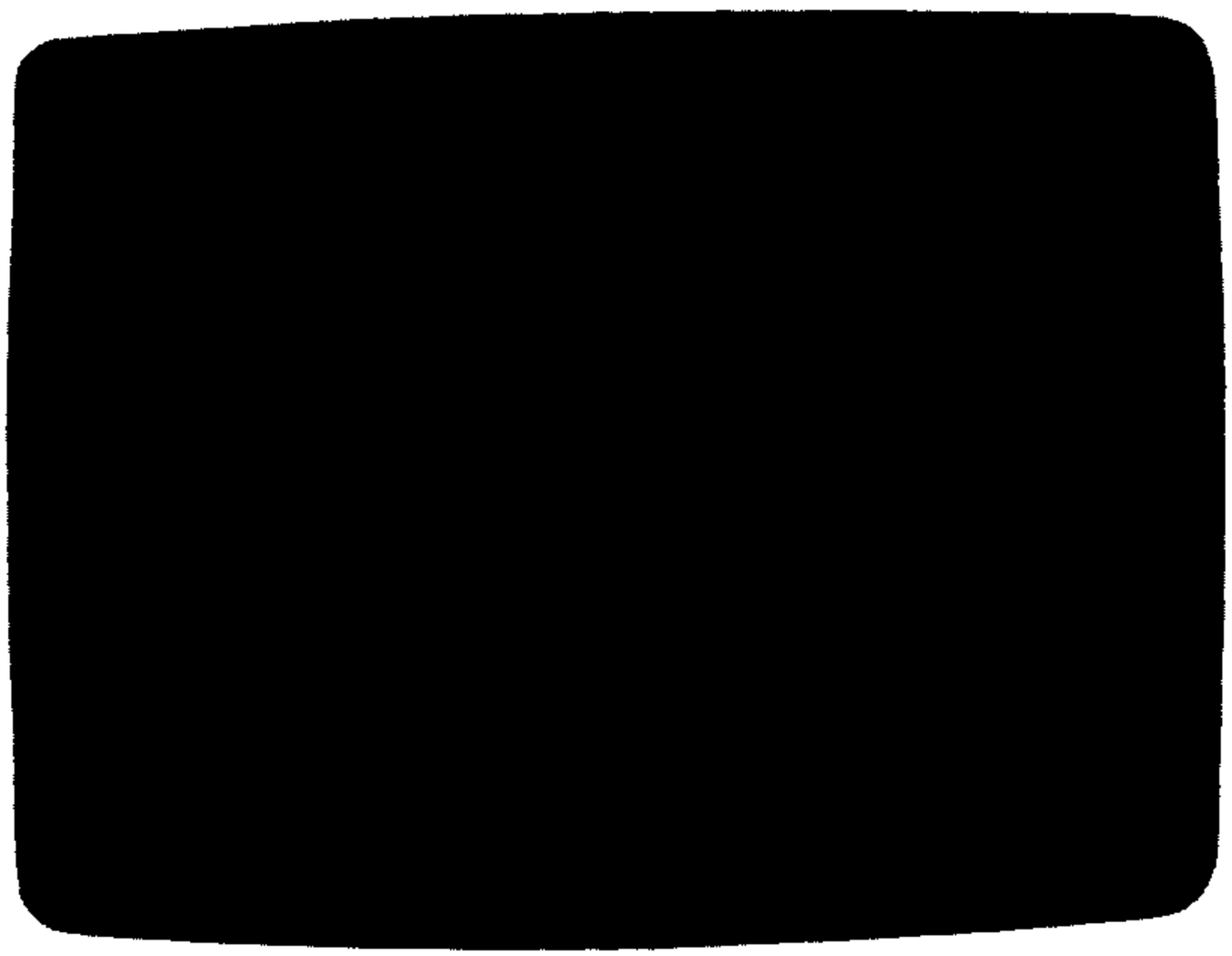


Fig. 7-14. The cursor HOME position.

As this exercise illustrates, when you use the SHIFT KEY WITH THE CLR/HOME key, the cursor goes to the HOME position and the screen CLEARS. Any time you want to erase the screen, just press SHIFT and CLR/HOME. But be careful; CLEARing the screen permanently erases unnumbered instructions that were on the screen.

Like many of the special keys on your Plus/4 computer, the CLR/HOME key may not work this way when you are using commercial software. In commercial software packages, certain keys are turned off to prevent you from doing something that might interfere with your use of the software. Although this might seem inconvenient sometimes, it's usually in your best interest not to be able to be too creative when you're using a software package.

Scrolling Up and Redisplaying Cleared Text

Although you can scroll down the screen as far as you want, you can't always scroll up as far. When you are typing unnumbered instructions onto the screen, you can't scroll past the top of the screen, and you can't redisplay what you typed after you clear the screen. Once the information is off the screen, it's gone forever unless:

1. You typed the information with program line numbers.
2. You saved the information you typed onto a cassette tape or a disk.

When you load and display a stored program from tape or disk, you can scroll back and forth past the top of the screen. By typing the command LIST, you can also redisplay any program after you clear the screen.

The SHIFT and SHIFT LOCK Keys

Functions: SHIFT

1. Types uppercase letters when in Text Mode.
2. Types right-side graphic-key symbols when in Text/Graphic Mode.
3. Lets you switch between Text Mode and Text/Graphic Mode when you press [SHIFT] and [C=] at the same time.
4. Lets you use the top character or operation on non-letter keys, such as [CTRL], number keys, Function keys, etc.

SHIFT LOCK

Holds down the [SHIFT] key for you.

Like the [SHIFT] key on a typewriter, the [SHIFT] key on your Plus/4 computer can let you type uppercase letters. Just hold down the [SHIFT] key while you press any letter.

When you turn your computer on, however, you'll notice that the letters you type in are automatically in uppercase. If you hold down the [SHIFT] and press a letter key, you will get a graphic symbol, not a letter. This is because your computer is in *Text/Graphic Mode* when you turn it on.

Text/Graphic Mode

Text/graphic mode is one of the six modes in which your computer can operate. In Text/Graphic mode, all letters are uppercase only; you can't print lowercase letters. The SHIFT key will let you print the *right-side* graphic symbols that are pictured on the fronts of the letter keys; it lets you print a few of the special symbol keys, also, such as the @ sign and the + sign.

Exercise: Printing Graphic Key Symbols

1. Make sure that you're in Text/Graphic Mode. If you're not sure, type a letter without holding down the SHIFT key. If the letter is uppercase, then you're in Text/Graphic Mode. If it's lowercase, press the SHIFT and C= keys once at the same time. Release the keys quickly. If this doesn't seem to work, press the RESET button on the side of the Plus/4. The computer automatically comes up in Text/Graphic Mode.
2. Type this line but don't press the RETURN key:

```
PRINT "THE ACE OF
```

3. Press the SHIFT LOCK key and type the A key four times. With the SHIFT key locked, the A key prints the spade symbol. Type a closing quote and press RETURN. Your screen should look like what is shown in Fig. 7-15.
4. Press the CLEAR key to erase the screen. Try creating some of your own designs.

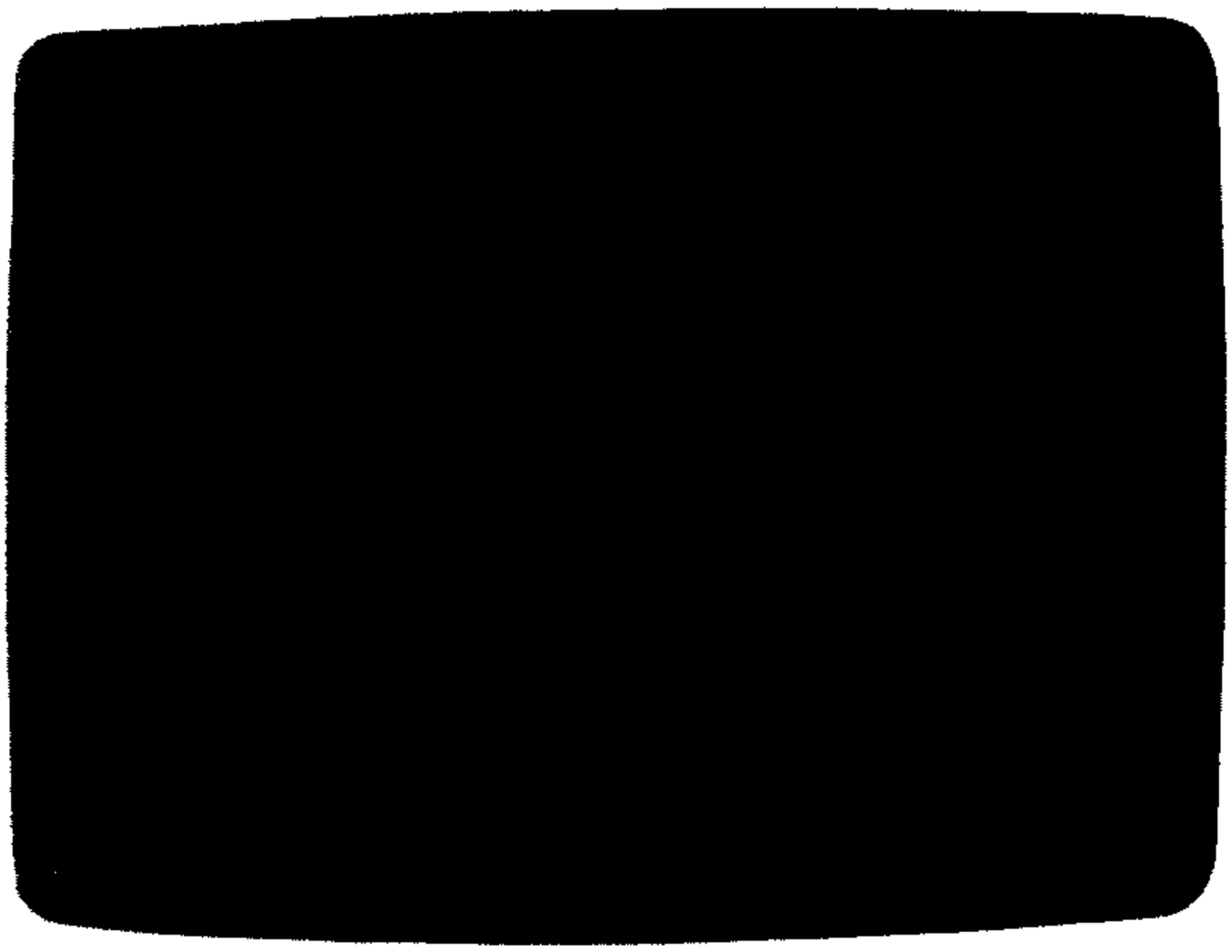


Fig. 7-15. Display showing the symbols for the graphic key exercise.

Text Mode

One of the other six modes is *Text Mode*. In text mode, you can print both lowercase and uppercase letters. You use the SHIFT key to print the uppercase letters.

Switching Between Modes

To switch between Text Mode and Text/Graphic Mode, just press the SHIFT key and the Commodore logo key, C=, at the same time. As soon as you press these two keys, all the characters on your screen switch to the other mode. For example, when you turn on the computer, you're in Text/Graphic Mode, and all the letters on the screen are in uppercase mode. If you press the SHIFT and C= keys, all the letters on the screen will switch to lowercase, and any letters that you type will appear in lowercase (or, in uppercase if you use the SHIFT key).

The number keys and the punctuation keys work the same way in both modes. In both modes, use the SHIFT key to print the characters located on the tops of the number keys (e.g., the characters: ! " # $ %) and on the tops of the punctuation characters (the characters: < > ? [ ]).

The special keys, such as CTRL and RUN/STOP, and the function keys also work the same way in both modes. Hold down the SHIFT key to use the function listed on top of the key.

You don't have to think about whether you're in Text Mode or Text/Graphic Mode when you are using a commercial software package. The mode is almost always programmed into the software.

Exercise: Mode Switching

1. Turn off your computer and then turn it back on again. This is to make sure you're in Text/Graphic Mode.
2. Enter Text Mode by pressing the SHIFT and C= keys simultaneously. Release the keys quickly. All the letters in the power-up message on the screen should now be lowercase letters.
3. Clear the screen by pressing the SHIFT and CLR/HOME keys together.
4. Press the SHIFT LOCK key. Now type the word COMPUTER. Don't press the SHIFT key, but release the SHIFT LOCK key.
5. Press the SHIFT and C= keys together again. The screen should look like the illustration in Fig. 7-16.

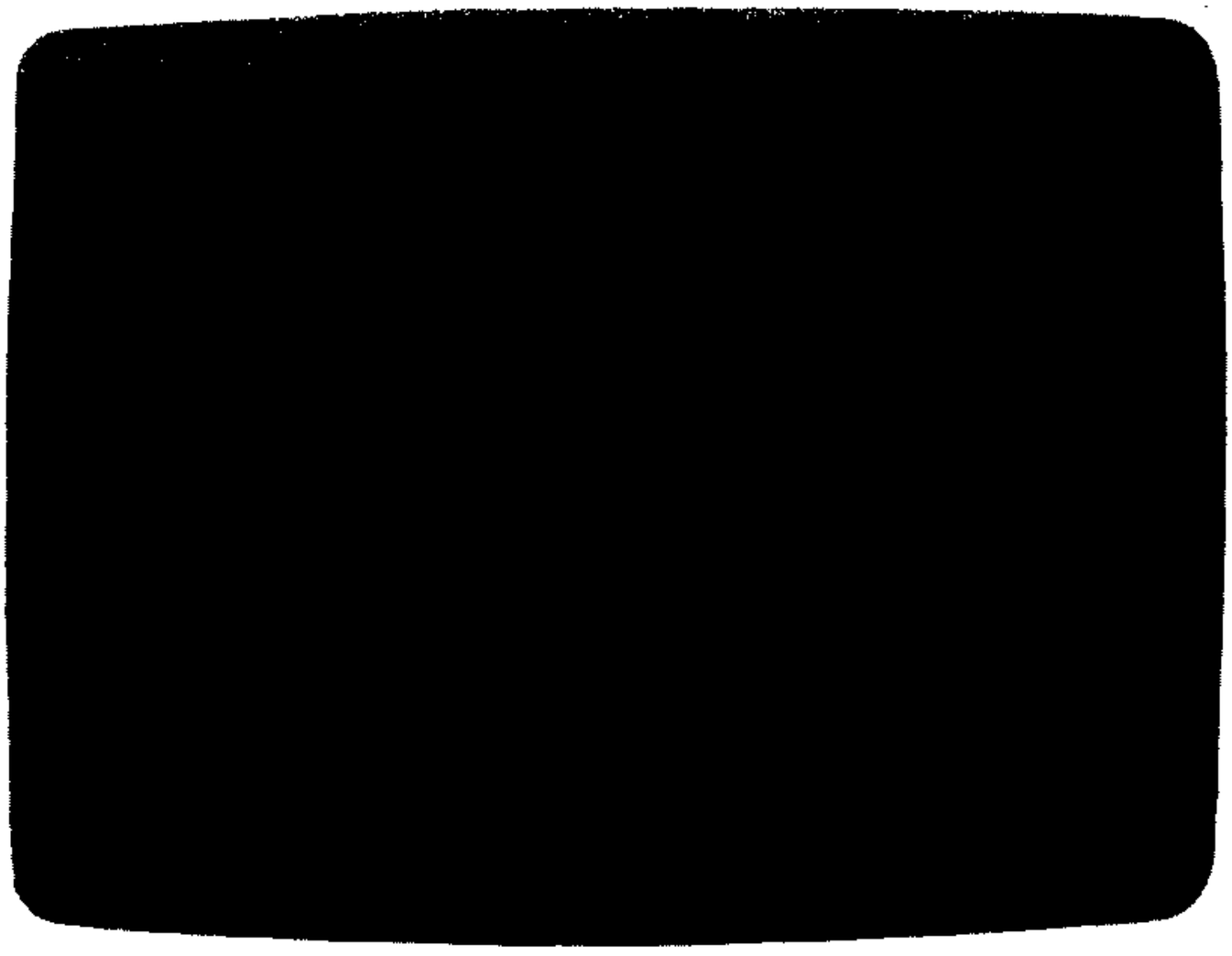


Fig. 7-16. Display for the mode switching exercise.

When you switch between Text Mode and Text/Graphic Mode, your screen displays only the set of characters that makes up the mode. Even though you may have printed a heart in Text/Graphic Mode, this symbol always changes to an uppercase S when you switch to Text Mode.

Using the SHIFT Key With Special Keys

The SHIFT key also lets you use some of the operations of other special keys:

1. The INSERT operation with the INSERT key.
2. The RUN operation with the RUN/STOP key.
3. The CLEAR operation with the CLR/HOME key.
4. The Function keys f4, f6, f8, and f7.

The SHIFT LOCK Key

The SHIFT LOCK key does only one thing: it holds down the SHIFT key. Press SHIFT LOCK once to lock down the SHIFT key. The SHIFT LOCK key stays down when you press it. Press SHIFT LOCK again to release it.

Use the SHIFT LOCK key when you need to use the SHIFT key more than a couple of times in a row.

The Letter Keys and Graphic Symbols

Functions: These keys are used to

1. Print letters.
2. Print the set of graphic symbols that are pictured on the fronts of the letter keys.

As the previous section showed you, your Plus/4 computer has two text modes: The Text/Graphic Mode and the Text Mode.

Text/Graphic Mode

This prints uppercase letters and all the graphic symbols shown on the fronts of the keys. The symbols on the *right side* print using the SHIFT key; the symbols on the *left side* print using the C= key.

Text Mode

This prints uppercase and lowercase letters and the graphic symbols located on the *left front* side of the letter keys. These are the *same* symbols that print when you press the C= key in Text/Graphic Mode.

Exercise: Using Text/Graphic Mode

1. Make sure you're in Text/Graphic Mode. If you're not sure, type a letter without holding down the SHIFT key. If the result is an uppercase letter, then you're in Text/Graphic Mode. If it's a lowercase letter, press the SHIFT and C= keys at the same time.
2. Press the SHIFT LOCK key and type in the following letters:

UUUUIIII	press the RETURN key
BBBWWBBB	press the RETURN key
KKKJKJJJ	press the RETURN key

   Your screen should look like the display shown in Fig. 7-17.

3. Press the CLR HOME key to erase the screen. Press the SHIFT LOCK key to release it.
4. Hold down the C= key and type in the following letters. Press the RETURN key at the end of each line while holding down the C= key.

```
QWQWQWQWQWQW      press the RETURN key
WQWQWQWQWQWQ      press the RETURN key
QWQWQWQWQWQW      press the RETURN key
WQWQWQWQWQWQ      press the RETURN key
QWQWQWQWQWQW      press the RETURN key
```

Your screen display should show the brickwork design shown in Fig. 7-18.

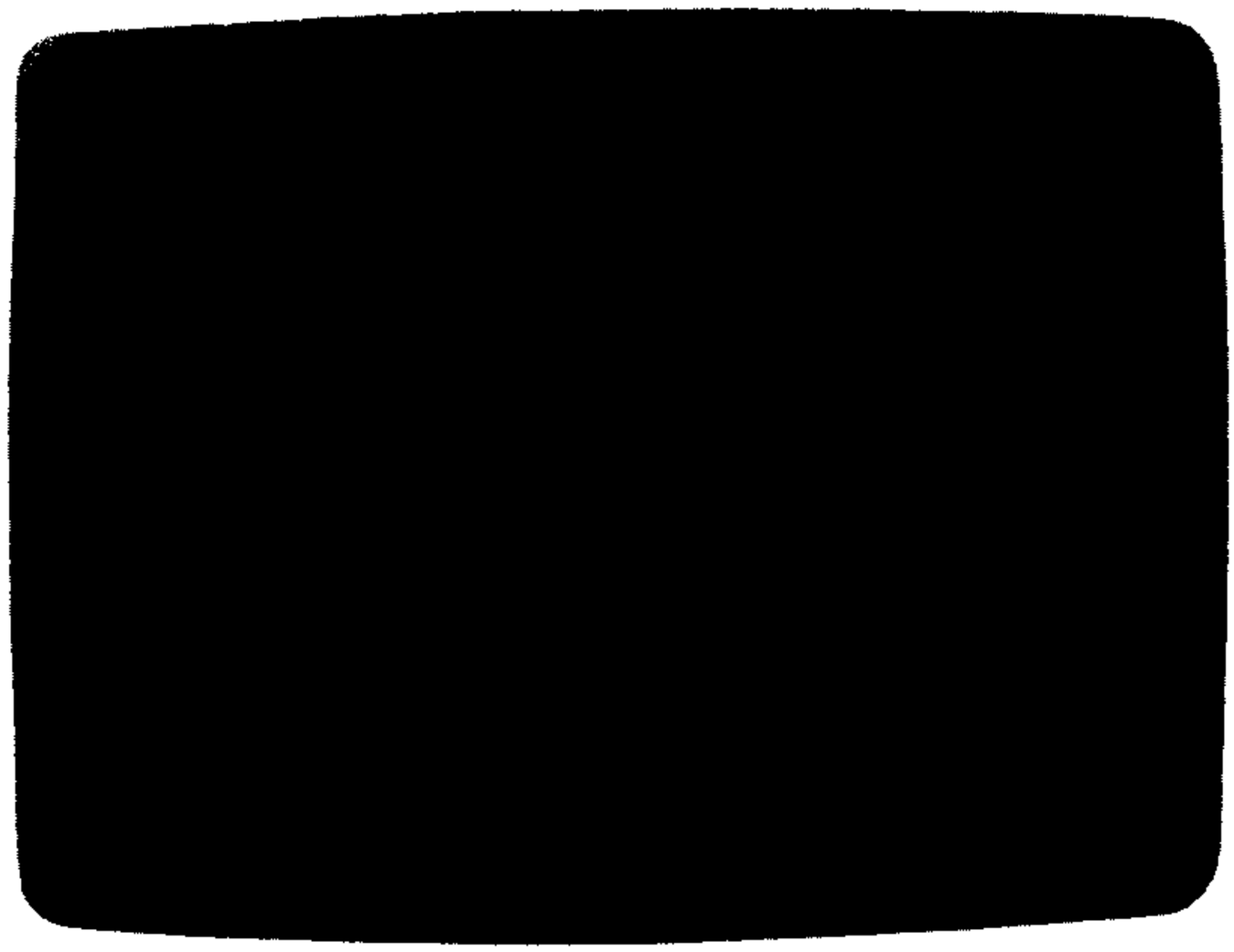


Fig. 7-17. Display for the Text/ Graphic Mode exercise.

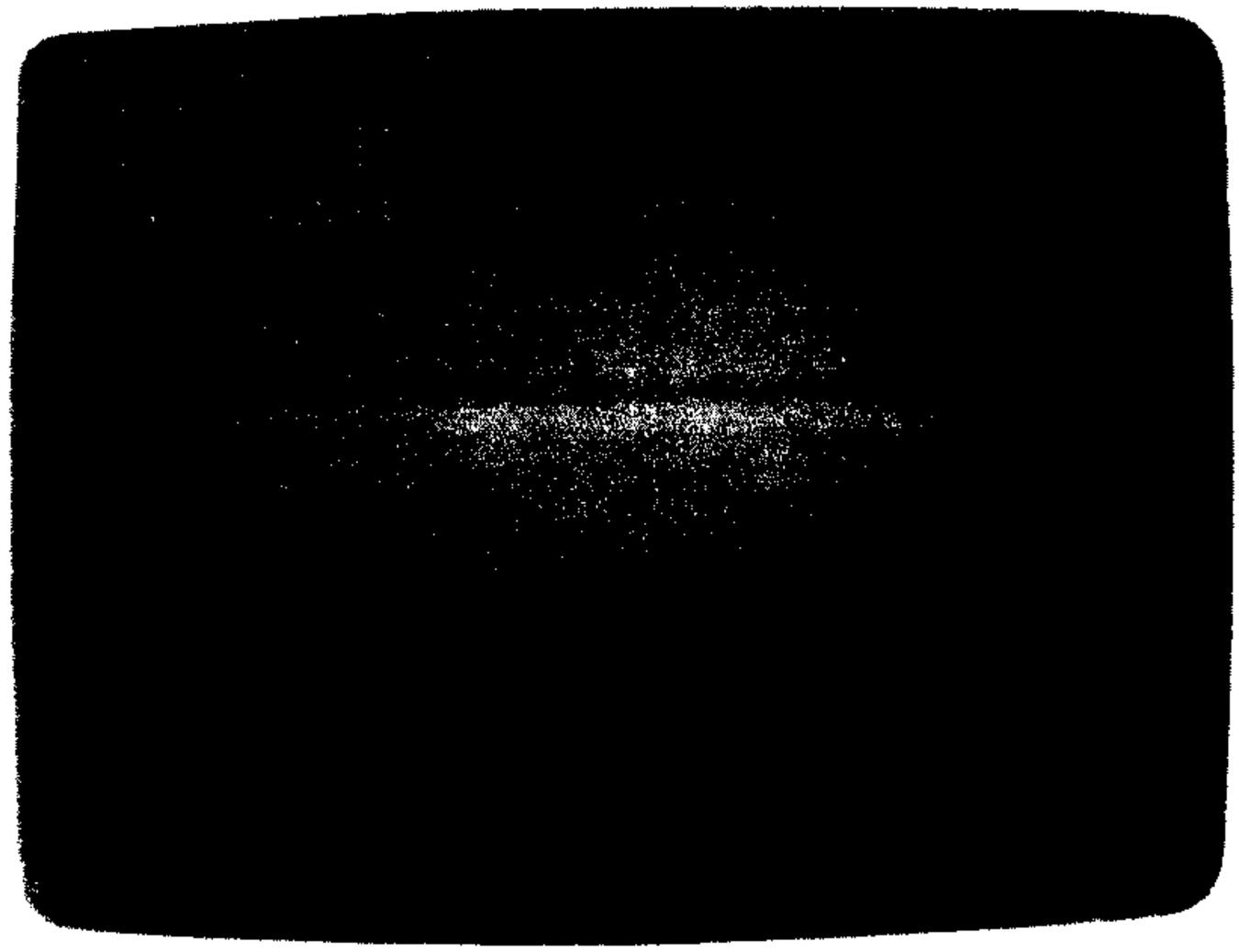


Fig. 7-18. Another display of the Text/Graphic Mode.

5. Press the [redacted] key to erase the screen.

As this exercise shows, you can create a variety of designs using the graphic symbols illustrated on the front of each of the letter keys.

Exercise: Using Text Mode

1. Make sure you're in Text Mode. If you're not sure, type any letter without holding down the [redacted] key. If the letter that appears is a lowercase letter, then you're in Text Mode. If it's an uppercase letter, press the [redacted] and C= keys at the same time.
2. Press the [redacted] key to erase the screen.
3. Hold down the C= key and type in the following letters. Press the [redacted] key at the end of each line while holding down the C= key.

QWQWQWQWQWQW	press the [redacted] key
WQWQWQWQWQWQ	press the [redacted] key
QWQWQWQWQWQW	press the [redacted] key
WQWQWQWQWQWQ	press the [redacted] key
QWQWQWQWQWQW	press the [redacted] key

   Your screen should look the same as it did in the previous exercise (see Fig. 7-18). As you can see, the C= key prints using the left-side graphic symbols in both the Text/Graphic and Text modes.
4. Press the [redacted] key to erase the screen. Try creating some of your own designs.

These exercises show the difference between the set of graphic symbols on the right-front side of the letter keys and the set on the left-front side of the letter keys. The left-side set, which can be printed in either Text Mode or Text/Graphic Mode, is made up of lines and blocks that you can use to make bar graphs and other designs that you might want to have printed in a report. The right-side graphic set includes circles, balls, and the symbols for card suits. You can use these symbols to design your own simple games.

The C= Key

Functions: The C= key

1. Lets you switch between Text Mode and Text/Graphic Mode when you also press the [redacted] key.

2. Prints the set of graphic symbols pictured on the left-hand side of the front of the letter keys.
3. Lets you change the color of the characters on the screen. When you press C= and one of the number/color keys, you can select one of the colors listed in the bottom row of the colors given on the front of the keys.
4. Lets you slow down a program listing or display as it scrolls down the screen.

As the previous section on the letter keys showed, you can print the set of graphic symbols on the left side of the letter-key fronts in both Text Mode and Text/Graphic Mode. The right-side set of symbols can only be printed in Text/Graphic Mode.

The left-side set of graphic symbols is printed with the aid of the Commodore logo key, C= . This key is shown in Fig. 7-19. Printing these graphics is only one of the tasks that this key performs.

Fig. 7-19. The C= key.

CHANGING THE COLOR OF THE SCREEN CHARACTERS

The sixteen basic colors built into the Plus/4 computer are listed in two rows on the fronts of the number keys. There are several ways to change the colors of the screen background and the characters on the screen.

One way to change the character color is to hold down the C= key and press one of the color keys. Of the sixteen colors available through color selection, the C= key lets you choose eight: orange, brown, yellow-green, pink, blue-green, light blue, dark blue, and light green. These colors are the eight listed on the bottom row on the color keys. The colors listed on the top row are selected with the CONTROL key.

When you use the C= key and a color key to change the character color, any characters already on the screen do not change. Only the characters you type after you change the character color are displayed in the new color.

Exercise: Changing Character Color With the C= Key

1. Type the following line and press the RETURN key:

```
PRINT "THE LETTERS ARE BLACK"
```

2. Hold down the C= key and press the 8 key. The characters you type from now on will be blue-green, but characters already on the screen won't be affected.

3. Type the following line and press the RETURN key:

```
PRINT "THE LETTERS ARE BLUE-GREEN"
```

4. Hold down the C= key and press the 9 key. The characters you type from now on will be brown.

5. Type this next line and press the RETURN key:

```
PRINT "THE LETTERS ARE BROWN"
```

Using the C= Key To Slow Down Program Display

When you load and display a program from cassette tape or disk, or when you LIST a program you've just written, the display of the program flies by pretty rapidly on your screen. If you want to slow down the display considerably so you can have time to read the program lines or the program execution, just hold down the C= key. When you want the normal scrolling rate to resume, just release the C= key.

Exercise: Using the C= Key To Slow Down Program Display

1. Type the next program lines exactly as they appear. Press the RETURN key after each line. If you make a mistake, use the cursor keys to move back to the error, and retype the rest of the line. Remember that you must press the RETURN key to enter changes, so if you go back to retype something, press the RETURN key when you finish. Remember, too, that you don't have to be at the end of the line to press the RETURN key.

```
5 FOR X = 1 TO 10
10 PRINT "TWINKLE, TWINKLE, ";
20 PRINT "LITTLE STAR,"
30 PRINT "HOW I WONDER ";
40 PRINT "WHERE YOU ARE"
50 NEXT X
```

2. Now type RUN and press the RETURN key. While the program is running, hold down the C= key to see how the display slows down. Release the key to resume normal speed.

3. Type the word LIST when the program finishes executing. Now press the RETURN key. The Plus/4 computer quickly displays a copy of the program you just typed. Type LIST again, and be ready to press the C= key as soon as you press RETURN. Notice how the C= key slows down the program listing.
4. Type the word NEW and press RETURN.
5. Type LIST again and press RETURN. Notice that the program doesn't list at all this time. That's because the NEW command erases the last program from memory.

WHAT MAKES UP A PROGRAM?

In the previous exercise, you wrote a program and learned to use the RUN command to tell the computer to follow the instructions you typed in. The difference between the lines you've typed in, up until now, and the lines you just typed in, is that you added line numbers to the beginning of the typed line. And, instead of following your command instantly, the computer waited until you entered the RUN command.

The presence of a line number makes a command a program. Even one line can have a line number and be a program. When you write a program instead of just issuing a single command without a line number, the computer doesn't follow the instruction immediately. Instead, the computer waits for you to type RUN.

Immediate Mode

When you issue single commands without line numbers, you are in *immediate mode*, which means that the computer reacts to your command immediately.

Program Mode

When you precede your commands with line numbers, you are in *program mode*. In program mode, you can, of course, give multiple commands before you tell the computer to do anything. This means that you can tell the computer to perform complex tasks.

If you are interested in learning to write programs for your computer, you'll be glad to know that the Plus/4 computer contains the most sophisticated and easiest-to-use version of BASIC language ever built into a Commodore computer.

The CONTROL Keys

Functions: The CONTROL keys will

1. Let you change the color of the characters on the screen. When you press a CONTROL key, shown in Fig. 7-20, and one of the number/color keys, you can select any one of the colors listed on the TOP row of colors on the front on the number keys.

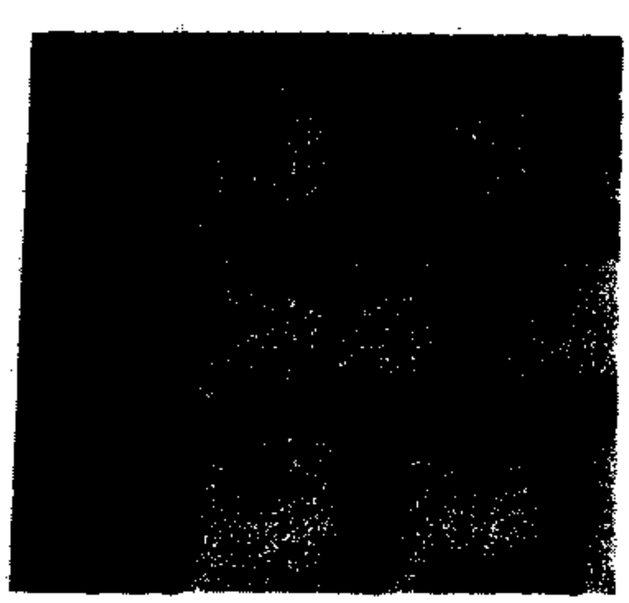


Fig. 7-20. The CONTROL key.

2. Let you turn the reversed characters feature on and off. CONTROL and the 9 key turn on the reverse mode; CONTROL and the 0 key turn off the reverse mode.
3. Let you turn the flashing characters feature on and off. CONTROL and the , (less than/comma) key turn on the flashing mode; CONTROL and the . (greater than/period) key turn off the flashing mode.
4. Let you suspend the program output on the screen.

Changing the Color of the Screen Characters

The sixteen basic colors built into the Plus/4 computer are listed on the fronts of the number keys. As you learned earlier, in the section on the C= key, there are several ways to change the colors of the characters on the screen.

Changing the character color using the CONTROL key is similar to changing the character color with the C= key: hold down the CONTROL key and press one of the color keys. Of the sixteen colors available through color key selection, the CONTROL keys let you choose eight: black, white, red, cyan,

purple, green, blue, and yellow. These colors are the eight listed on the top row of the color keys listing. The colors listed on the bottom row are selected with the C= key.

When you use the CONTROL key and a color key to change the character color, any characters already on the screen do not change. Only characters you type after you change the character color are displayed in the new color.

Exercise: Changing Character Color With the Control Keys

1. Type in the following line and press the RETURN key:

```
PRINT "THE LETTERS ARE BLACK"
```

2. Hold down the CONTROL key and press the 2 key. The characters you type from now on will be colored red, but characters already on the screen won't be affected.
3. Type in the next line and press the RETURN key:

```
PRINT "THE LETTERS ARE RED"
```

4. Hold down the CONTROL key and press the 1 key. The characters you type from now on will be colored black.
5. Type in the next line and press the RETURN key:

```
PRINT "THE LETTERS ARE BLACK"
```

Using the CONTROL Keys To Suspend Program Output

When you LOAD and RUN a program from cassette tape or disk, or when you RUN a program you've just written, the output of the program flies by pretty rapidly on your screen. If you want to suspend the scrolling of the output, just press a CONTROL key and the 3 key. When you want the normal scrolling rate to resume, just press any key.

Exercise: Using the CONTROL Keys To Suspend Program Output

1. Type the following program lines exactly as they appear. Press the RETURN key after each line. If you make a mistake, use the cursor keys to move back to the error, and retype the rest of the line. Don't worry that the words don't all fit on one line. Just keep typing and let the words wrap onto the next line.

```
10 DATA POETRY , HISTORY , ALCHEMY , COOKERY ,
   PARODY
20 FOR C = 1 TO 5
30 READ X$
40 PRINT "HOW I WISH THAT I COULD FIND"
50 PRINT "A COMPUTER THAT HAD ITS OWN MIND,"
60 PRINT "THEN IT COULD DO MY WORK FOR ME"
70 PRINT "WHILE I READ BOOKS OF ";X$
80 NEXT C
```

2. Type the word RUN and press the RETURN key. The Plus/4 computer quickly follows the instructions of the program you just typed, which is to print a copy of the lines of what we hesitate to call poetry. Each time the lines print, the READ command in line 30 assigns a new value from the DATA list to the variable X$.

3. Type the word RUN again when the first execution is over. Press RETURN . After the first seven or eight lines have been printed on the screen, hold down the CONTROL key and press the 1 key. The program stops executing immediately. Press any key to resume. Repeat the RUN command and stop the output with the CONTROL and 1 keys if you want another demonstraton.

DISPLAYING CHARACTERS IN REVERSED IMAGE

The Plus/4 computer lets you display characters in reverse mode, as shown in Fig. 7-21. In other words, if you are typing blue letters on a white background, reversed characters would be white characters on a blue background.

To turn on the reversed-image feature, called *reverse mode*, just hold down the CONTROL key and press the 9 key. Notice that RVS ON is printed on front of the 9 key to show you which key to press.

To turn off the reverse mode, hold down the CONTROL key and press the 0 key. RVS OFF appears on the front of this key.

Exercise: Using Reverse Mode

1. Type the word PRINT and a quotation mark. Don't press the RETURN key.

2. Hold down the CONTROL key and press the 9 key. Don't press the RETURN key. The screen should look like Fig. 7-22.

3. Type the rest of the line and press the RETURN key:

```
THE LETTERS ARE REVERSED"
```

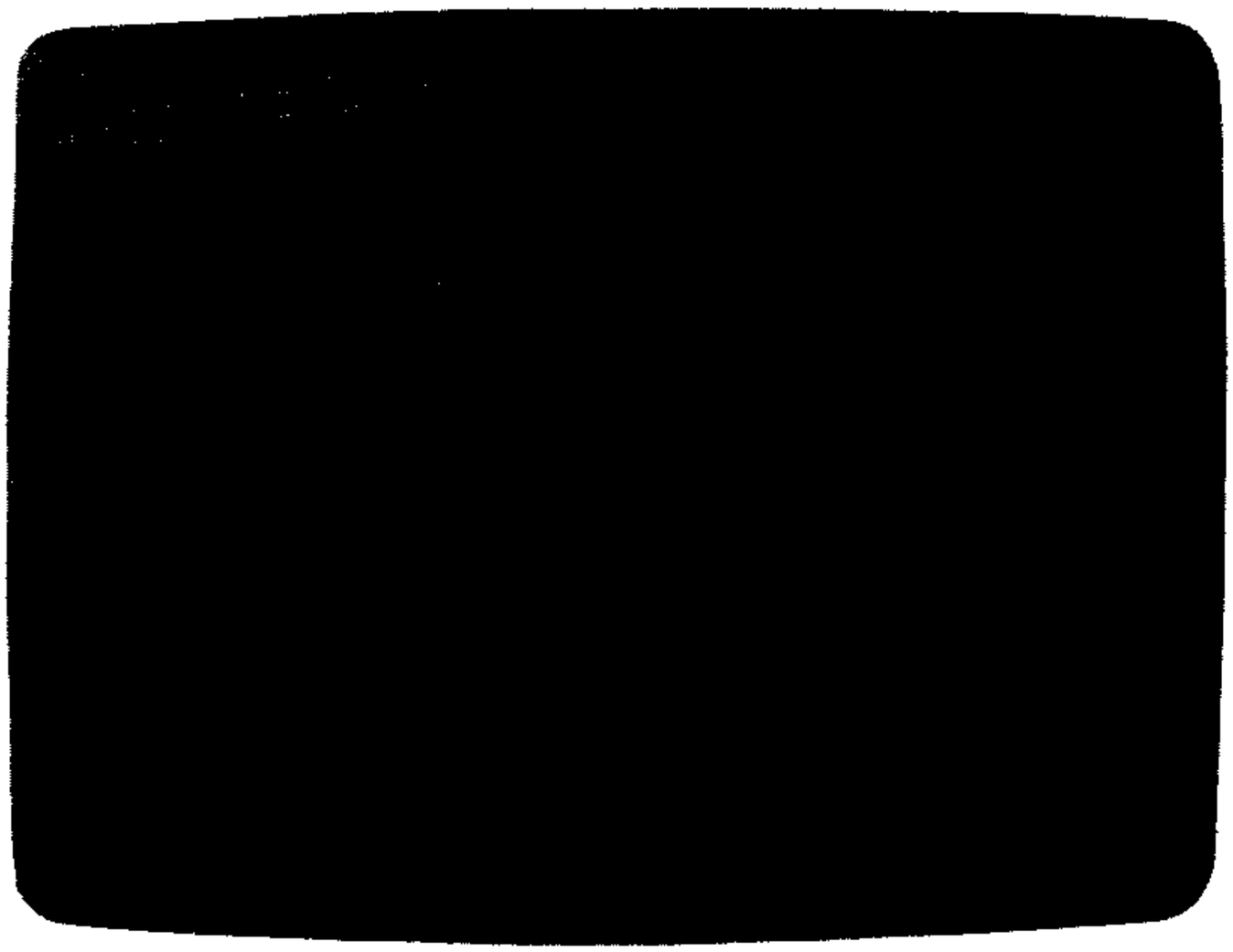


Fig. 7-21. Using the reverse mode.

Fig. 7-22. Showing the Reverse Mode symbol.

4. Type PRINT and a quotation mark again. Don't press the RETURN key.
5. Hold down the CONTROL key and press the 3 key. Don't press RETURN .
6. Type PLEASE DON'T SMOKE, but don't press the RETURN key.

7. Hold down the CONTROL key and press the J key. Press the SPACE BAR once. Don't press RETURN.
8. Type IN PUBLIC BUILDINGS" and press the RETURN key. The screen should look like what is shown in Fig. 7-23.

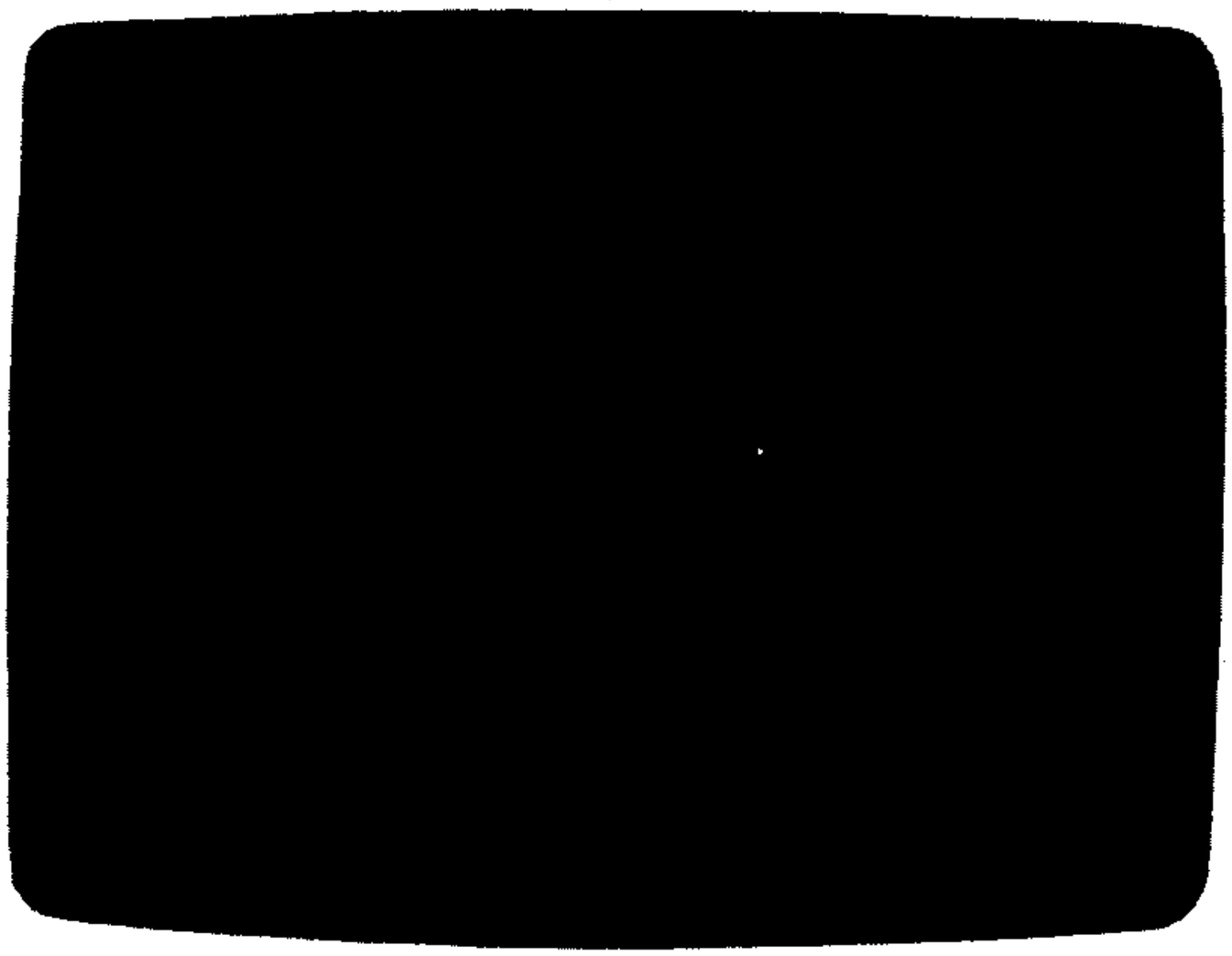


Fig. 7-23. Showing the Reverse Mode exercise.

Note on Problems: If you can't find out why a command or program isn't working the way it should, try typing it over again. Type NEW and press RETURN first, to clear any old program lines. If all else fails and you can't even seem to control the cursor, press the RESET switch on the side of the computer.

DISPLAYING FLASHING CHARACTERS

The Plus/4 computer lets you display flashing characters. In other words, the characters on your screen can flash on and off, just as the cursor flashes.

To turn on the flashing feature, called *flashing mode*, just hold down the CONTROL key and press the , (less-than/comma) key. Notice that FLASH ON is printed on the front of this key to show you which key to press.

To turn off flashing mode, hold down the CONTROL key and press the . (greater-than/period) key. FLASH OFF appears on the front of this key.

Exercise: Using Flashing Mode

1. Press the SHIFT and CLEAR/HOME keys to erase your screen.
2. Type the word PRINT and a quotation mark. Don't press the RETURN key.
3. Hold down the CONTROL key and press the LESS-THAN (<) key. Don't press the RETURN key. The screen should look like what is shown in Fig. 7-24.

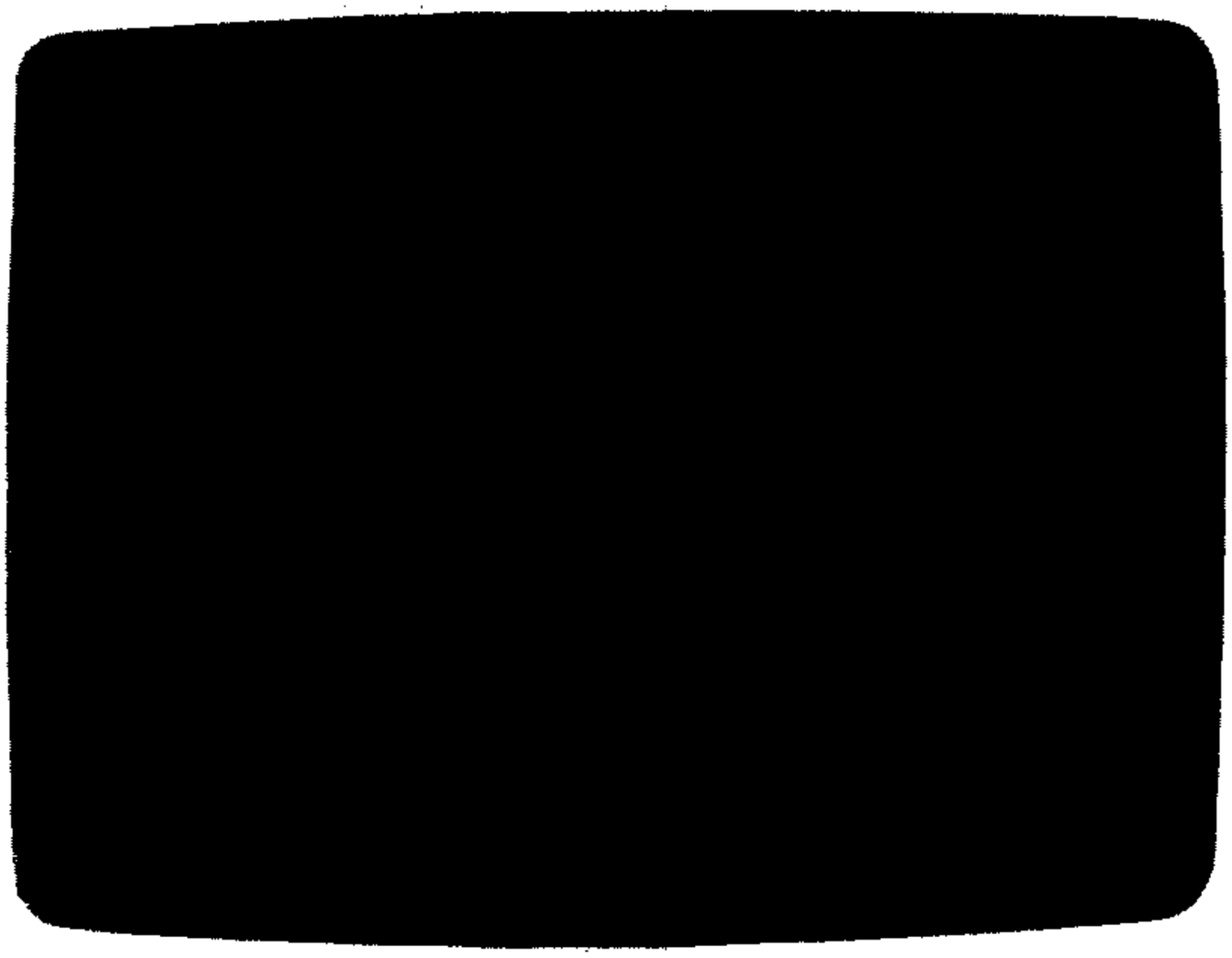


Fig. 7-24. Showing the Flashing Mode symbol.

4. Type the rest of the line and press the RETURN key:

   THE LETTERS ARE FLASHING"

5. Type PRINT and a quotation mark again. Don't press the RETURN key.
6. Hold down the CONTROL key and press the LESS-THAN key. Don't press RETURN.
7. Type PLEASE DON'T SMOKE; don't press the RETURN key.
8. Hold down the CONTROL key and press the GREATER-THAN key. Don't press RETURN. Press the SPACE bar once.
9. Type in IN PUBLIC BUILDINGS" and press the RETURN key. The screen should look like the display shown in Fig. 7-25 with the words PLEASE DON'T SMOKE flashing (this

part of the message doesn't appear in the photograph because it isn't possible to photograph a *Flashing* mode).

You can also combine reverse and flashing modes to print an eye-catching message that flashes in reverse mode.

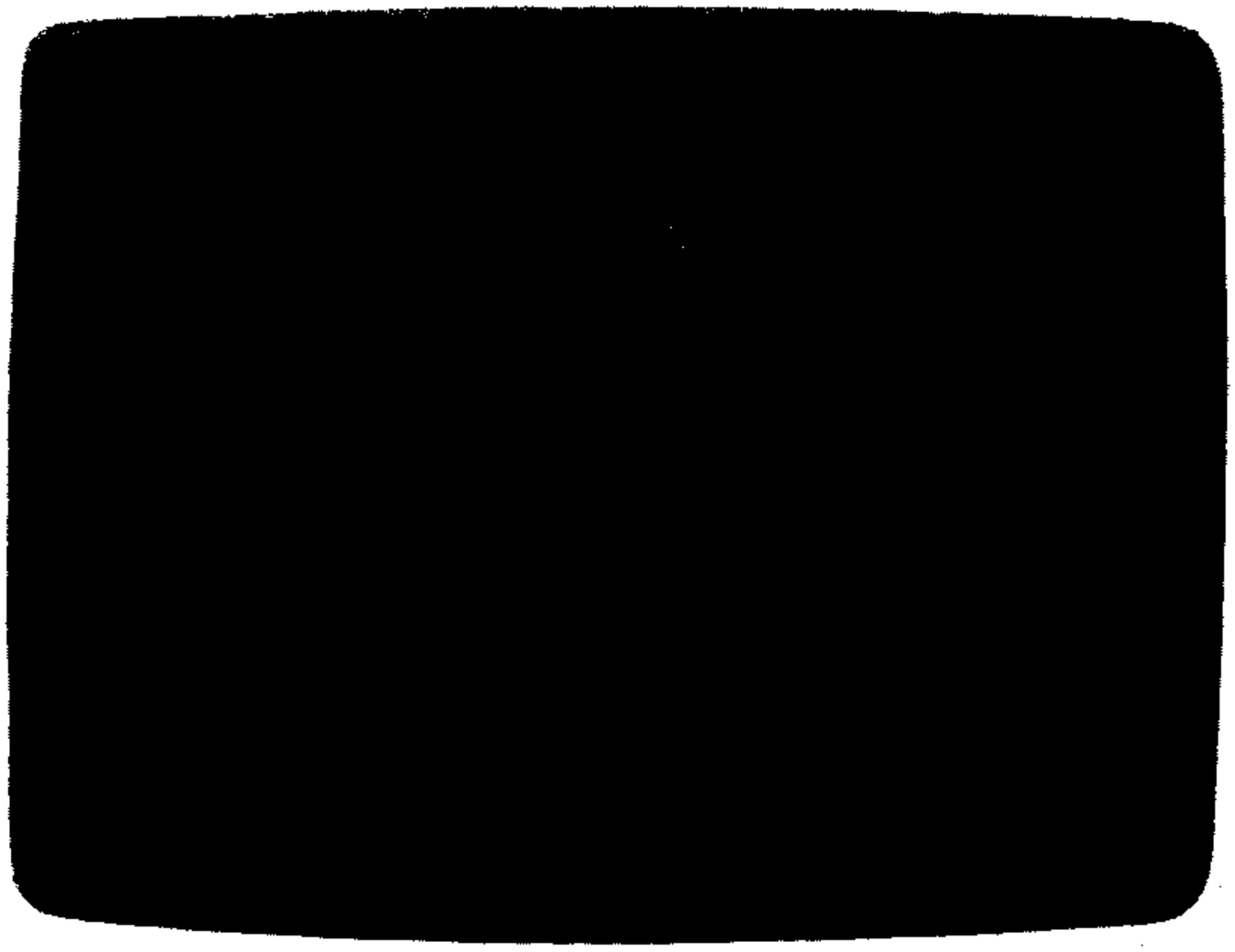


Fig. 7-25. Showing the Flashing Mode exercise.

Exercise: Using the Reverse and Flashing Modes Together

1. Press the [SHIFT] and [CLEAR/HOME] keys to erase your screen.
2. Type the word PRINT and a quotation mark. Don't press the [RETURN] key.
3. Hold down the [CONTROL] key and press the LESS-THAN key. Don't press the [RETURN] key.
4. Hold down the [CONTROL] key and press the [9] key. Don't press the [RETURN] key. The screen should look like that of Fig. 7-26.
5. Type DON'T FEED THE ANIMALS!" and press the [RETURN] key. The screen should look like that of Fig. 7-27, with the words DON'T FEED THE ANIMALS flashing and in reverse (this part of the message isn't photographable).

Fig. 7-26. The Reverse and Flashing Mode symbols.

Fig. 7-27. Illustrating the Reverse and Flashing Mode exercise.

More About Using Reverse and Flashing Modes in Quotes

You might have wondered why we didn't always turn off the reverse and flashing modes in these examples. Typing a closing quote automatically turns off the reverse and flashing modes. You don't have to turn them off with the CONTROL key and the

[redacted] or [redacted] keys unless you want to turn off the mode before the end of the message you are PRINTing. If you do want to turn off one of the modes before the end of the message, as we did in the message about not smoking, you must include the turn-off sequence in the PRINT statement.

You might also wonder why your computer prints the odd characters when you turn reverse and flashing modes on and off inside the PRINT statement. The section about quotation marks later in this chapter will explain what these characters are. If you turn the reverse and flashing modes on or off outside of a PRINT statement, the reversed characters do not appear.

The INSERT/DELETE Key

Functions: INSERT

Opens up space between characters so you can insert additional characters.

DELETE

Erases the character to the left of the cursor. The [redacted] key closes up space as it deletes characters.

The DELETE Key

So far, this book has told you to use both the cursor key and retyping to correct errors. But the Plus/4 computer has other editing features that are more useful. Perhaps the most important editing feature is the [redacted] key. When you press this key without pressing the [redacted] key, the Delete function erases characters.

The [redacted] key erases the character immediately to the left of the cursor. If you use the cursor keys to move into the middle of a line, the [redacted] key not only erases the character to the left of the cursor, the key also automatically moves all the characters to the right of the cursor back to the left one space so that there is no gap where the deleted character was. Of course, you can also delete a blank space.

Like other keys, the [redacted] key continues to work as long as you hold it down. In other words, DELETE will erase more than one character at a time if you continue to hold down the key.

Exercise: Using the Delete Key To Edit

1. Type PRINN. Don't press the [redacted] key. The cursor should remain to the right of the word you just typed.

2. Press the DELETE key once so that the second N is erased. Now type in T so the word PRINT appears on the screen. Don't press RETURN.

3. Type the rest of the line and press the RETURN key:

```
PRINT "TV VIOLENCE CAN'T BE HARMFUL"
```

4. Use the cursor-up arrow and cursor-right arrow keys to move the cursor to the space between the T in CAN'T and the B in BE in the line you typed.

5. Hold down the DELETE key until the T and the apostrophe key are erased. Press RETURN. The screen should now look like what is shown in Fig. 7-28.

Fig. 7-28. Illustration of the DELETE key exercise.

When you press the RETURN key to execute the corrected line, the computer replaces CAN'T with CAN. But notice what happens to HARMFUL. When you execute the corrected line, the screen displays HARMFULUL. This happens because the computer executes the corrected line on the line that's immediately beneath the command. It so happens that the first executed line is already on the screen on that line. The computer doesn't erase the first line before executing the second; instead, the computer just prints the line on top of what's already there.

To print the corrected line, move the cursor to the closing quotation mark in the line you typed. Then press the SPACE bar or the INSERT key twice so that two blanks appear between the L in HARMFUL and the closing quote: HARMFUL ".

If you use the [SPACE] bar, be sure to type the closing quote after the two blank spaces. Now press the [RETURN] key. The line now reads TV VIOLENCE CAN BE HARMFUL. You replaced the unneeded UL with the two blanks that you added before the closing quotes.

The INSERT Key

You can close up space with the [DEL] key and open up space with the [INS] key. You must hold down the [SHIFT] key when you use the [INS] key.

When you use the cursor keys to move the cursor to the middle of a line, the [INS] key can open up space to the right of the cursor. All characters to the right of the cursor will move to the right until you release the [INS] key. Once space is opened between characters, you can add additional characters to the line. The [INS] key can open up one space or many spaces, depending on how long you hold down the key. The [INS] key has a repeat feature just like the [DEL] key has.

Exercise: Using the INSERT Key To Edit

1. Press the [SHIFT] and [CLR/HOME] keys to erase your screen.
2. Type in the word PINT. Don't press the [RETURN] key.
3. Use the cursor keys to move the cursor to the I in PINT.
4. Press the [INS] key so that one space opens up between the P and the I. The cursor should remain where it was. The screen should look like that in Fig. 7-29.
5. Use the cursor-right arrow key to move the cursor to the space you opened. Type in [R] so that the word reads PRINT. Don't press the [RETURN] key.

Exercise: Using the DELETE and INSERT Keys Together

1. Leave the word PRINT on the screen. Don't press the [RETURN] key.
2. Type in "HE ALWAYS EATS TOAST" and press [RETURN].
3. Move the cursor to the closing quotation mark in the line you just typed.
4. Hold the [SHIFT] and [INS] keys down until you open up enough room to type -ON-A-STICK. The following are hints on adding and deleting extra spaces:

Fig. 7-29. Display of the INSERT key exercise.

   A. If you didn't open up enough spaces, just hold down the SPACE key and press the INSERT key again until you have enough space to type the letters.

   B. If you opened up too many spaces, you can delete the extra spaces after you type in -ON-A-STICK. To delete extra spaces, move the cursor to the closing quotes and press the DELETE key until the spaces are erased.

5. Type -ON-A-STICK in the space you just opened, but don't press the RETURN key.

6. Use the cursor keys to move the cursor to the E in EATS in the line you typed.

7. Hold down the DELETE key until you have erased ALWAYS. Now press the RETURN key. The screen should look like that shown in Fig. 7-30.

NOTE: If you have problems with this exercise, it's probably because you pressed the RETURN key before you should have. Try typing the exercise again and be careful to follow the instructions as they appear.

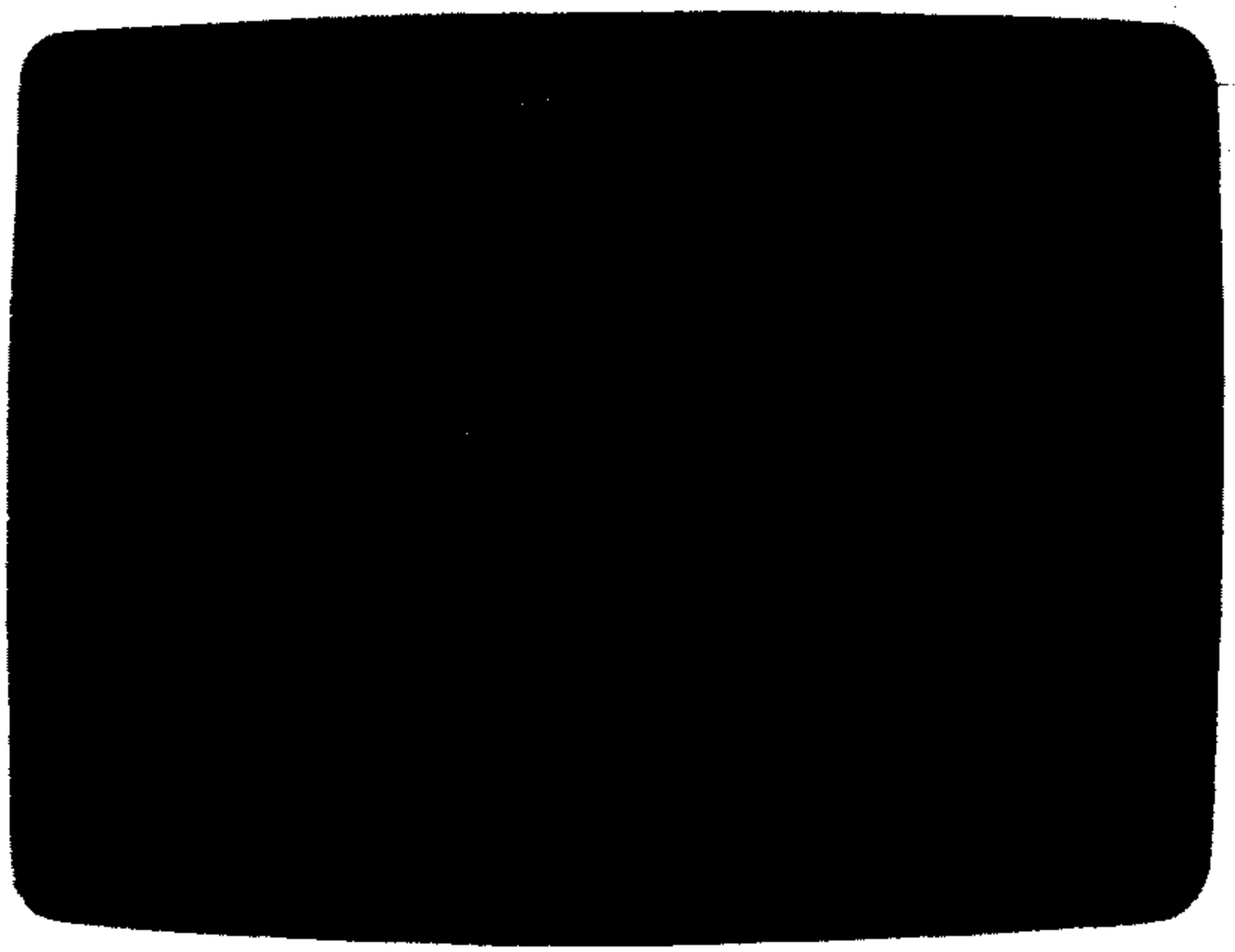


Fig. 7-30. Display for the DELETE and INSERT key exercise.

The SPACE Bar

Functions: This key

1. Moves the cursor ahead, leaving a blank space.
2. Erases any character it passes.

The SPACE bar works like the SPACE bar on a typewriter: it moves everything one space ahead. If you hold down the SPACE bar on the computer, the cursor continues to move. In this sense, the SPACE bar works like the cursor-right arrow key.

The SPACE Bar, the Cursor Keys, and the DELETE Key

The SPACE bar does not, however, always work like a cursor key. A cursor key doesn't affect characters it passes over, but the SPACE bar erases any character it passes. In this sense, the SPACE bar works like the DEL key. But, while the DEL key erases the character immediately to the left of the cursor, the SPACE bar erases the character immediately under the cursor. In addition, the DEL key closes up space when it erases, but the SPACE bar does not close up space.

Like other keys, the SPACE bar can move the cursor just one space if you press it once, and will move the cursor many spaces if you hold it down.

Exercise: Using the SPACE Bar To Edit

1. Press the [SHIFT] and [CLR/HOME] keys to erase your screen.
2. Type in the following line and press the [RETURN] key:

```
PRINT "MARY HADDA LITTLE LAMB"
```

3. Move the cursor back to the second D in HADDA.
4. Press the [SPACE] bar once and then press the [RETURN] key. The screen should now display this message:

```
PRINT "MARY HAD A LITTLE LAMB"
MARY HAD A LITTLE LAMB
```

Notice that as soon as you press the [RETURN] key, the error is automatically corrected on the copy of the line that the computer displayed.

The ESCAPE Key

Function: Works together with other keys for screen editing tasks. There are a total of eighteen ESCAPE functions.

So far this book has introduced several keys that make it easy to edit what you type on the screen. The Plus/4 computer has other editing features, called *escape functions*, that you can use by pressing the ESCAPE key and one other key. The ESCAPE key is marked Esc on the keyboard and is shown in Fig. 7-31. The most interesting ESCAPE function is setting a screen window. Other ESCAPE functions include an automatic insert mode, scrolling controls, and reducing screen display.

To use any of the ESCAPE functions listed in Table 7-1, press the ESCAPE key, release it, and then press the key listed to the left of the function you want to use. Note that you can terminate any ESCAPE function, except the screen window, by pressing the [ESC] key and then pressing the [X] key. You cancel a screen window by pressing the [ESC] key twice.

Fig. 7-31. The ESCAPE key.

Table 7-1. ESCAPE Key Functions

Press Esc and This Key	ESCAPE Function
A	Turns on automatic insert mode.
B	Sets bottom of the screen window.
C	Cancels automatic insert mode.
D	Deletes current line.
I	Inserts a line.
J	Returns to the beginning of the current line.
K	Goes to the end of the current line.
L	Turns on normal scrolling.
M	Turns off scrolling.
N	Returns to normal screen display size (cancels ESCAPE ☰).
O	Cancels insert, quote, reverse, and flashing modes.
P	Erases all characters from the current cursor position to the beginning of the current line.
Q	Erases all characters from the current cursor position to the end of the current line.
R	Reduces normal screen display size.
T	Sets top of the screen window.
V	Scrolls up.
W	Scrolls down.
X	Cancels the current ESCAPE function (except a screen window).

REDUCING SCREEN DISPLAY

As we mentioned in Chapter 4, you may find that your tv set does not completely display the edges of the Plus/4 screen. If you can't clearly and completely read the leftmost and rightmost letters when you turn on your computer, you can slightly reduce the screen display and solve this problem. To reduce the screen display size, just press the ESCAPE key, release it, and then press the ☰ key.

THE SCREEN WINDOW

Sometimes when you are writing or debugging a program, you may wish to have two screens instead of one so you can keep track of two activities. For example, when you are using one of the text modes, you may wish to display one of the graphics modes on

one part of the screen and display program lines on the rest. The split-screen graphic modes display up to five lines of text, but sometimes this may not be enough, or you may wish to display the text in a different part of the screen.

Setting a Screen Window

You can create a work area of any size and in any part of a text mode screen by SETTING A SCREEN WINDOW. When you set a screen window, everything you type appears in the window, and the rest of the screen contents remain unaffected, so you can type while you also view other material. Of course, if you set the window over any other characters, the old characters may be typed over. Fig. 7-32 illustrates a screen window.

Fig. 7-32. A screen window.

Setting a screen window is a simple procedure. Just follow these steps:

1. Choose the screen area where you want to locate the screen window.
2. Move the cursor to where you want the top left corner of the screen window to be.
3. Press the [redacted] key.
4. Press the [redacted] key, which stands for *top*.

5. Move the cursor to the bottom right-hand corner of the window you want to set.
6. Press the ESC key.
7. Press the B key, which stands for *bottom.*

Now the screen window is set and everything you type will appear inside the window. The computer ignores the rest of the screen.

Releasing a Screen Window

When you want to use the full screen again, just press the HOME key twice. The screen returns to normal and the cursor appears in the HOME position (top left corner of the screen).

Using a Screen Window To Display Two Things at Once

A screen window lets you display two or more different things at the same time. You can put a screen window anywhere on the screen, and it can be as wide and long as the screen, or as narrow and short as you like. You can have, for example, a screen window that's forty columns across by two rows down, or five columns across and 14 lines down. The dimensions of the window are up to you.

Using a Screen Window To Edit a Program

One of the most practical uses for screen windows is program editing. With a screen window, you can simultaneously display the program on the whole screen and display the execution of the program in the screen window. You can cancel the window and make changes to the program on the whole screen, and can then create another window and run the program again. By running the program in a screen window, you don't have to keep listing the program, which can cover up the program execution.

We'll write a short program and run it in a screen window. When we get a SYNTAX ERROR message telling us something's wrong with the program, we can just look at the program listing, which is outside the window, and see where the problem is. For practice, type in the following brief program exactly as it appears, but don't RUN it yet.

```
10 FOR X= 2 TO 8: COLOR 0,X,
20 PRINT "I HAVE A PROBLEM"
30 INPUT "WHAT SHOULD I DO?"; A$
40 IF A$ ="STOP" THEN END
```

```
50 NEXT X
60 GOTO 10
```

Line 10 changes the color of the screen each time the program executes. Line 20 prints a message. Line 30 asks you to type an answer to the question, WHAT SHOULD I DO?. The program waits until you type an answer and press [redacted]. Line 40 checks what you typed. If you typed STOP, the program ends right away. Line 50 works with line 10 to change the screen color. Line 60 tells the computer to go back and repeat the program, starting at line 10. If the program ends at line 40 because you typed STOP, lines 50 and 60 don't execute.

We're still working on this program, and we're not sure that it will execute the way we want it to. We'll run the program in a screen window so we can see the program lines while the program runs. Follow these steps:

STEP 1 Move the cursor down column 1 to the middle of the screen.

STEP 2 Press [redacted], let it go, and press [redacted] to set the top of the window.

STEP 3 Move the cursor down about ten rows, and then move it across the screen until the cursor is in about the middle column.

STEP 4 Press [redacted], let it go, and press [redacted] to set the bottom of the window.

STEP 5 Press [redacted] to move the cursor to the top of the window. [redacted] always moves the cursor to the top of the screen. Since we created a window, the computer treats the top of the window as if it were the top of the screen. The part of the screen outside the window is ignored.

STEP 6 Type RUN and press [redacted]. You can press the [redacted] key instead to run the program. Either method tells the computer to execute the program. As soon as the program starts to run, the computer displays the message ?SYNTAX ERROR IN 1Ø, which tells us there's an error in line 10.

STEP 7 Look up at the program, which is still displayed outside the window at the top of the screen. There shouldn't be a comma at the end of the COLOR command in line 10, and it has caused the syntax error.

STEP 8 Cancel the screen window by pressing the [redacted] key twice. Then move the cursor to the

space after the final comma on line 10. Press the [redacted] key once to erase the comma. Then press the [redacted] key. Be sure to press [redacted]; if you forget, the correction won't be entered into the computer's memory.

STEP 9. Create another screen window to run the program again. This time use the right side of the screen. Move the cursor to the center column and row of the screen. Press [redacted], release it, and press [redacted] to set the window top. Move the cursor to the bottom right-hand corner of the screen and set the window bottom ([redacted] and [redacted]).

STEP 10. Press [redacted] to move the cursor to the top left-hand corner of the window. RUN the program again. This time, the program should work correctly. When the question, WHAT SHOULD I DO?, is displayed, type in WORRY and press [redacted]. When the question is displayed again, type in SCREAM and press [redacted]. When the question is displayed again, type whatever you want. When you want to stop running the program, just type in STOP in response to the question. The program stops and the prompt, READY, is displayed to tell you that the computer is ready to accept your next command. If you want to cancel the screen window now, press [redacted] twice.

The RUN/STOP Key

Functions: STOP

1. Stops the execution of a program that's currently running.
2. Stops the completion of a command, such as LOAD, in a text mode.
3. Works with the [redacted] button to clear the screen and reset the computer while retaining the BASIC program in memory.

RUN

Tells the computer to load and run a program stored on a disk.

The STOP Key

When you want to interrupt the execution of a BASIC program, just press the STOP key (shown in Fig. 7-33). This feature is particularly useful when you find that the program contains an infinite loop (which means that the program just repeats endlessly) or some other error that makes continued execution pointless. You may need to hold down the STOP key for a second. Press the STOP key again if the program doesn't stop right away.

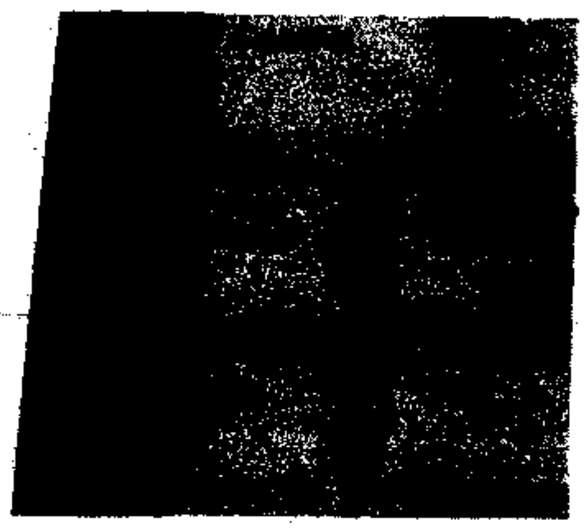


Fig. 7-33. The STOP key.

Resuming Execution of a Program Stopped With the STOP Key

When you stop a program with the STOP key, you can still resume execution. Just type in CONT and press the RETURN key. You can also make limited changes after you stop a program with the STOP key and before you continue execution with the CONT command. You can also issue other commands, such as LIST, between pressing the STOP key and typing in CONT.

The STOP key also works in conjunction with the RUN/STOP button to clear the computer while retaining the current BASIC program in an "unused" condition.

Exercise: Using the STOP Key To Stop Program Execution

1. Type in the following program exactly as it appears. Don't forget the numbers at the beginning of each line. Press the RETURN key at the end of each line.

```
1 PRINT "CAN WE STOP NOW?"

2 GOTO 1
```

2. Type RUN and press the RETURN key. The line, CAN WE STOP NOW?, should be printing repeatedly on your screen.
3. Press the STOP key to halt the program display. Your screen should look like the one in Fig. 7-34.

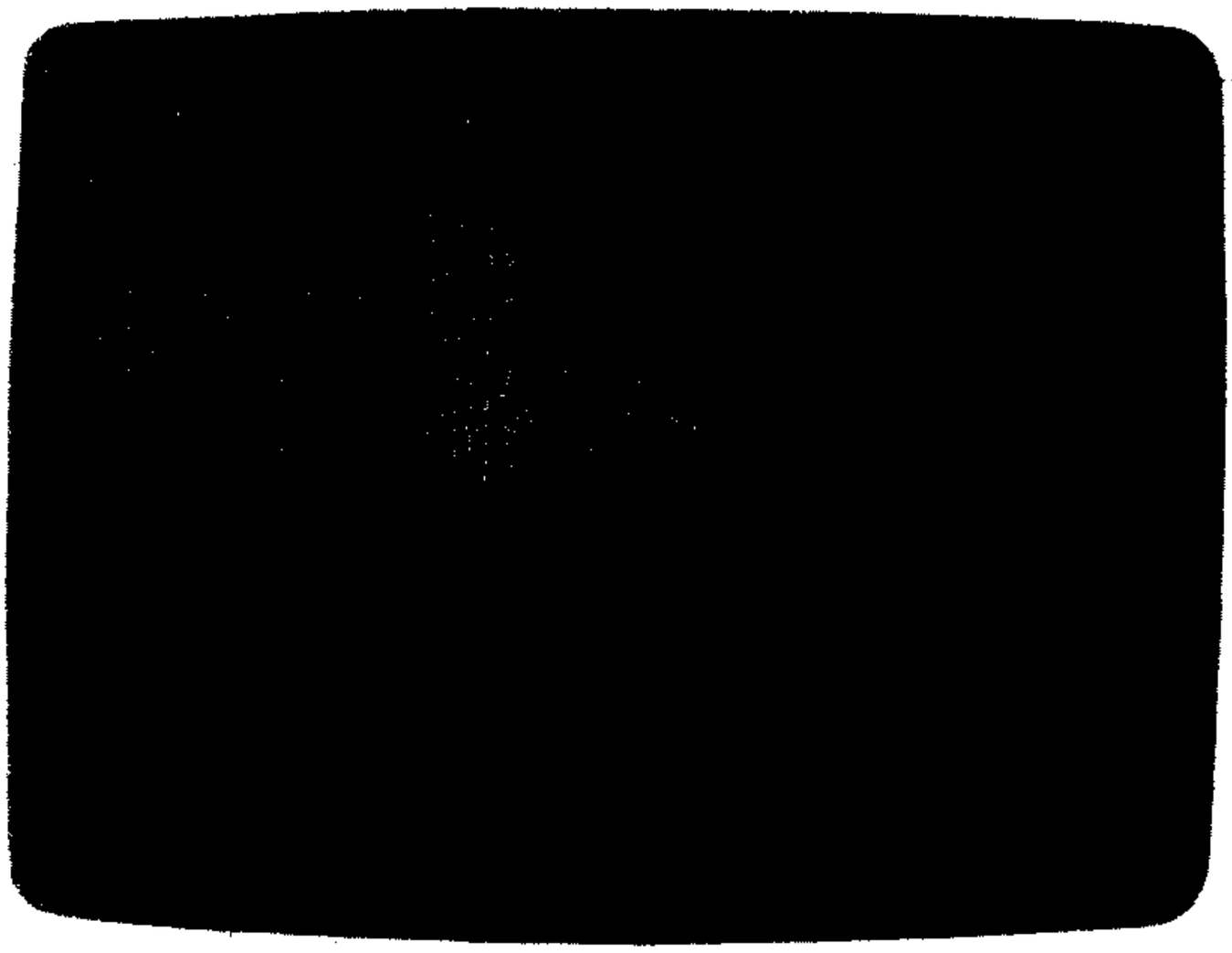


Fig. 7-34. Display of a [redacted] key exercise.

4. Resume program execution, if you want to, by typing CONT and pressing the [redacted] key. You might also want to press the [redacted] key, type LIST, and press [redacted] to display the program again, and then type CONT and press [redacted] to resume execution. Press [redacted] again when you want to stop.

Using the RUN/STOP Key With the RESET Button

In Chapter 4, you learned that the [redacted] button lets you clear the screen and the current memory residents. As you read in that chapter, there are two ways to use the [redacted] button.

Using the RESET Button To Completely Clear the Computer Memory

When you want to completely clear the screen and the current memory contents, including the BASIC program currently in memory, just press the [redacted] button. It is located on the right side of the Plus/4 computer.

Using the RESET Button To Clear the Computer and Retain the Current Program

When you want to clear the screen and the current memory contents, but NOT including the BASIC program currently in

memory, hold down the [redacted] key while you press the [redacted] button. The lines of the current program are unaffected when you use the [redacted] key with the [redacted] button. This procedure clears many values that have been assigned to variables in the program, which means that the program is in the same condition it was when you first ran it.

As soon as you complete this reset procedure, the computer switches automatically to the built-in machine-language monitor. Just type the [redacted] key and press the [redacted] key to get back to BASIC language. Type in LIST and press [redacted] to display a copy of your program on the screen.

The RUN Key

The RUN key lets you automatically load and run the first program that is on a disk without using the LOAD (or DLOAD) and RUN commands. This procedure only works with the first program on disk. You don't have to supply the program name, or type any other commands. Just press the RUN key.

Exercise: Using the RUN Key

1. Press the [redacted] and [redacted] keys to erase your screen.
2. Turn on your disk drive and insert a program disk.
3. Press the [redacted] and [redacted] keys. The screen displays a message telling you that the computer is searching for and loading the program.

   As soon as the program is loaded, the first screen of the program you loaded appears. Use the software according to the directions that came with the software package.

The Exclamation Point

Function: Works just like the exclamation point on a typewriter.

The exclamation point has no special function on the Plus/4 computer. Just use it as you would use the exclamation point key on a typewriter.

The Quotation Mark and Quote Mode

Function: Works with the PRINT command to tell the computer to display the enclosed message on the screen.

You've already used the quotation mark key many times in exercises in this book. As you've seen for yourself, the computer always displays exactly what's inside the quotation marks. Although the computer rejects misspellings and other syntax errors in BASIC commands, the computer displays anything inside quotes, no matter how many errors that message contains.

The Quote Mode

The reason that the Plus/4 computer is so tolerant of errors inside quotation marks is that the quotation marks do more than just open and close a message. When you type the opening quotation mark after PRINT, or another command that includes information in quotes, you enter the *quote mode.* You must type a closing quotation mark or press the [redacted] key to exit the quote mode.

Three major features distinguish the quote mode from the normal mode:

1. The computer doesn't try to interpret anything you type in the quote mode, so you can type anything you want in quotes.
2. Some features, such as moving the cursor with the cursor arrow keys, do not execute in quote mode; you can only tell the computer to execute these features as soon as you reenter normal mode.
3. Some keys that you type, such as the cursor arrow keys, display symbols in the quote mode that are not displayed in normal mode. These symbols represent the functions that can't execute in the quote mode. The execution of these functions is deferred until you execute the PRINT command in normal mode. Quote mode recognizes that you've included one of these functions by displaying a 1-character code inside the quotes. The 1-character code is not displayed when the PRINT command executes. Instead, the function represented by the code performs its job.

   For example, when you press the [redacted] and [redacted] keys in a PRINT command in quote mode, the screen does not clear and the cursor remains inside the quotes. In addition, a reversed heart appears inside the quotes. When you execute this PRINT command, the screen-clear function does clear the screen, and the reversed heart is not displayed as part of the PRINT command.

The exercises on reverse mode and flashing mode showed you some of the 1-character codes that appear in quote mode. *Note:* Until you are used to the way that the quote mode works, you may sometimes feel frustrated. If you can't seem to control what you're typing in in the quote mode, press the [redacted] key and start

over. One of the common problems occurs when you go back to correct a line that was typed in quote mode. If you retype a quote, even the closing quote, the computer thinks you've reentered the quote mode and the quote mode rules apply. You can tell this has happened when you can't control the cursor but, instead, a 1-character code appears each time you press a cursor arrow key. When this happens, just press [redacted] and retype the line.

Using Flashing Mode in Immediate Mode

Try turning on the flashing mode now, when you aren't in the quote mode. Type a few letters to show yourself that you have turned on the flashing mode. Now, turn off the flashing mode. When you turned flashing mode on and off, no 1-character code appeared when you turned on the flashing mode. The character code only appears in the quote mode.

Now type [redacted] and a quotation mark, press [redacted] and [redacted]. The 1-character code is displayed. Type FLASH and another quotation mark. Press [redacted] to display the flashing message.

Execution Delays in Quote Mode

Another feature that distinguishes turning on the flashing mode while in the quote mode and in normal mode is the difference in starting time when the flashing mode begins. In quote mode, the flashing mode doesn't begin as soon as you press the [redacted] key and the [redacted] key. For example, note that in the previous PRINT statement, you turned on flashing mode right after the opening quote, but the following characters were not flashing. Instead, the flashing starts when you press the [redacted] key to execute the statement. However, when you turned on flashing mode while you were in normal mode, the flashing started right away.

In quote mode, the execution of certain features is deferred until you are back in normal mode. You can't execute flashing mode while you are in quote mode — you can only tell the computer to turn on flashing mode as soon as the quote mode is over and, then, the command is executed in normal mode.

The reversed 1-character codes that appear in the quote mode stand for a deferred feature, such as flashing mode and reverse mode. When you execute a quote mode statement in normal mode, the computer recognizes the 1-character code as the signal to turn on the flashing mode, or clear the screen, or do whatever the character code represents.

Exercise: Using Quote Mode

1. Press the SHIFT and CLEAR/HOME keys to clear the screen.
2. Type in PRINT " and press the SHIFT and CLEAR/HOME key again. Don't press the RETURN key.
3. Press the cursor-down arrow key four times and the cursor-right arrow key four times. Don't press the RETURN key. The screen should look like that shown in Fig. 7-35.

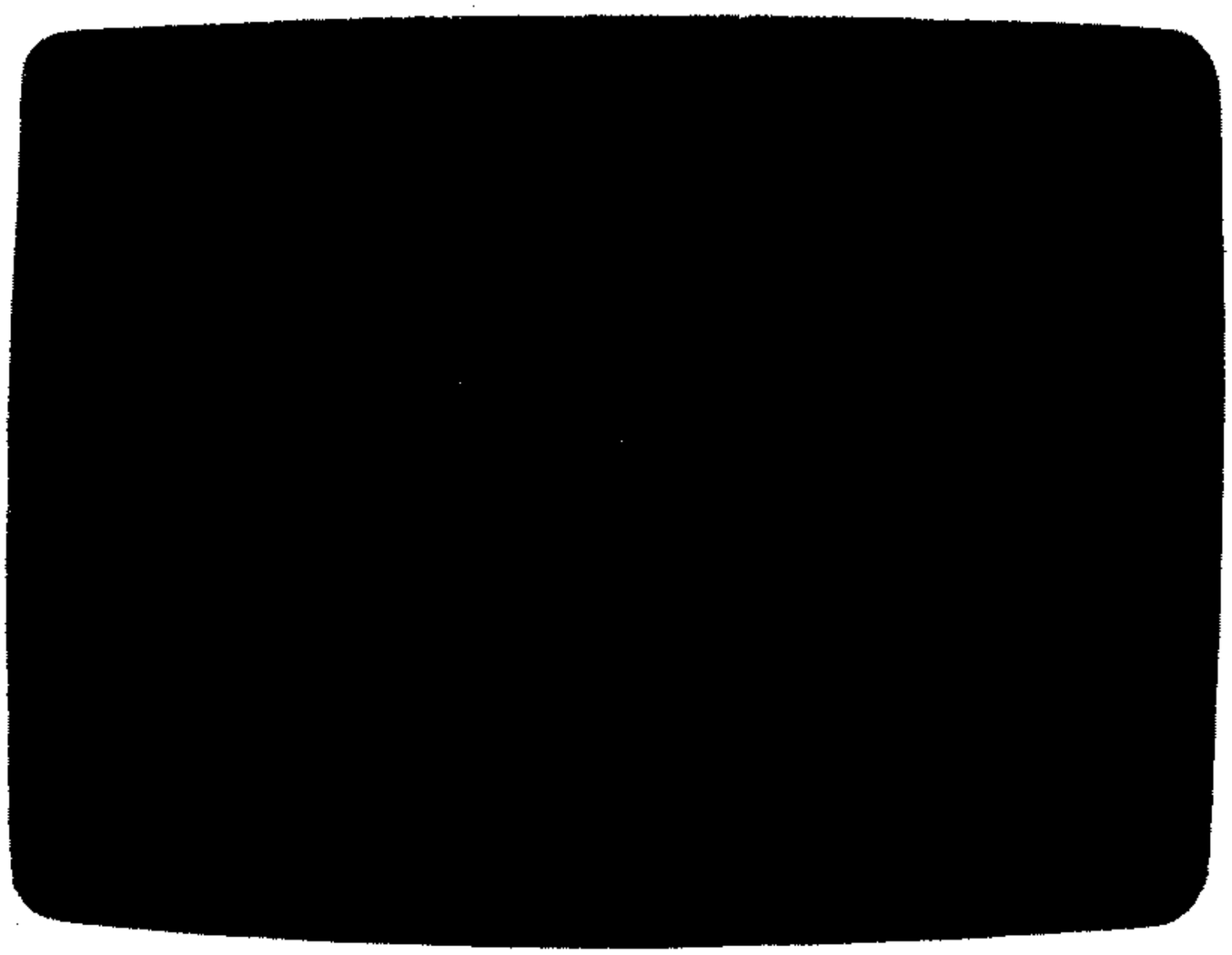


Fig. 7-35. Display showing Quote Mode symbols.

4. Type in PLEASE and press the CONTROL and RVS ON keys. Don't press RETURN.
5. Press CONTROL and the 3 key. Press the SPACE BAR once; don't press RETURN.
6. Now type DON'T LITTER and press the CONTROL and RVS OFF keys. Press the SPACE BAR once. Don't press RETURN.
7. Press the C= key and the Z key. Don't press RETURN.
8. Now type in ROADWAYS" and press the RETURN key. The screen should look like that of Fig. 7-36.

In this exercise, you told the computer to clear the screen and move the cursor as soon as the quote mode ended and the command was executed in normal mode. These two screen

control operations were identified in quote mode by the symbols that stand for the operations. You also changed the character color twice (in step 5 and step 7). These changes were also deferred until the command was executed in normal mode. And, you turned reverse mode ON and OFF, though these actions, too, did not execute until you left the quote mode.

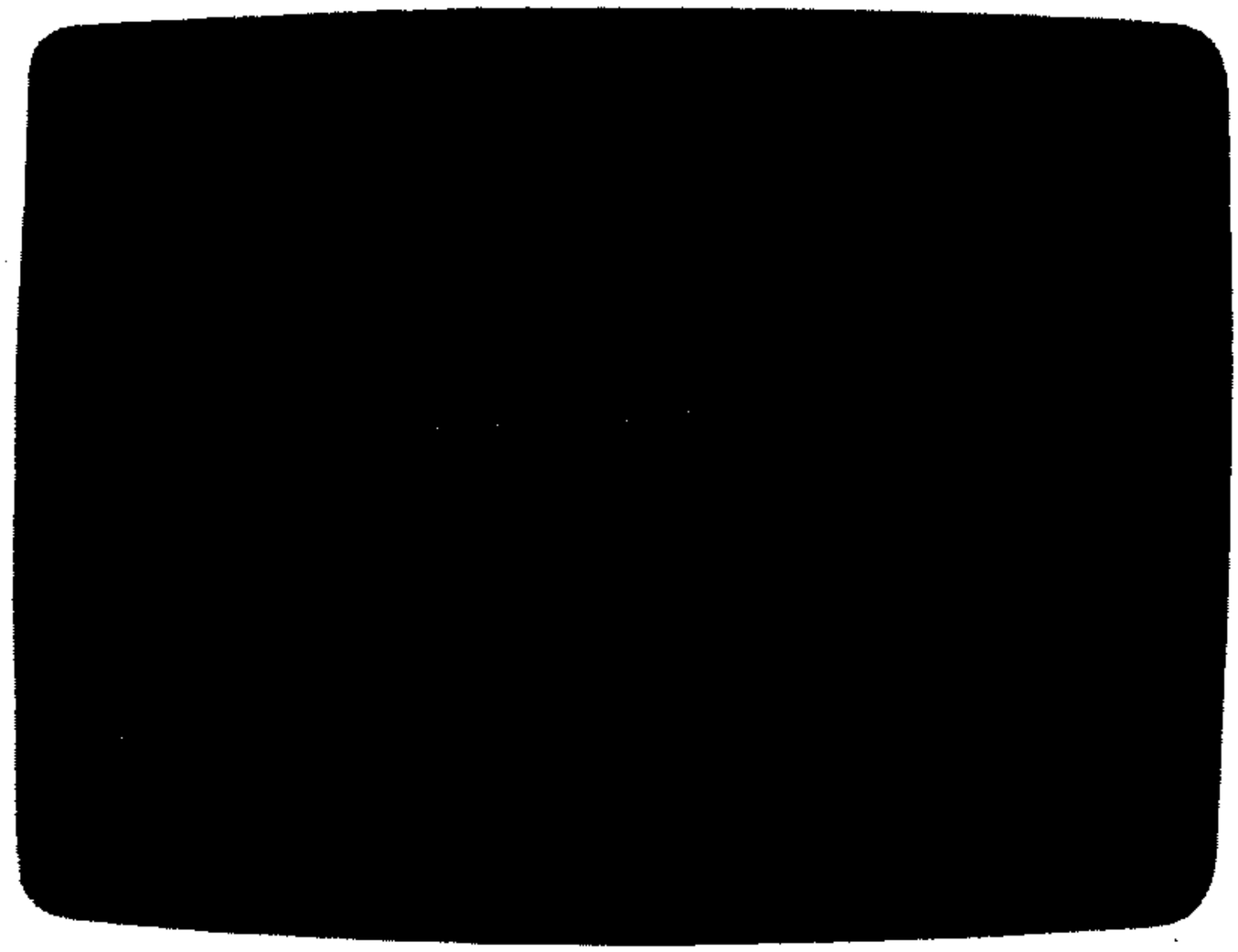


Fig. 7-36. Display of the Quote Mode exercise.

The #-Sign Key

Functions: This key

1. Prints the standard symbol for number.
2. Serves as a required parameter for some commands, such as GET, that control file access.
3. Stands for a single character space in an output field in a PRINT USING command.

The # sign is a required element of the file commands GET#, INPUT#, PRINT#, and PRINT# USING. These commands put data into or get data from data files. For example, INPUT# gets data from an opened file. INPUT, without the # sign, gets data from the keyboard by telling you to type it in during program execution.

The PRINT USING command lets you design special formats for output. For example, you can use the PRINT USING command to make sure that all of a series of numbers are printed with a $ sign and two decimal digits. The # sign is used to indicate the digit places. Here's how this command looks:

```
PRINT USING "$##.##"
```

PRINT USING outputs the numbers in this format regardless of how the numbers are input. For example, Fig. 7-37 shows how this PRINT USING command would display the numbers 32, .4, and 22.456.

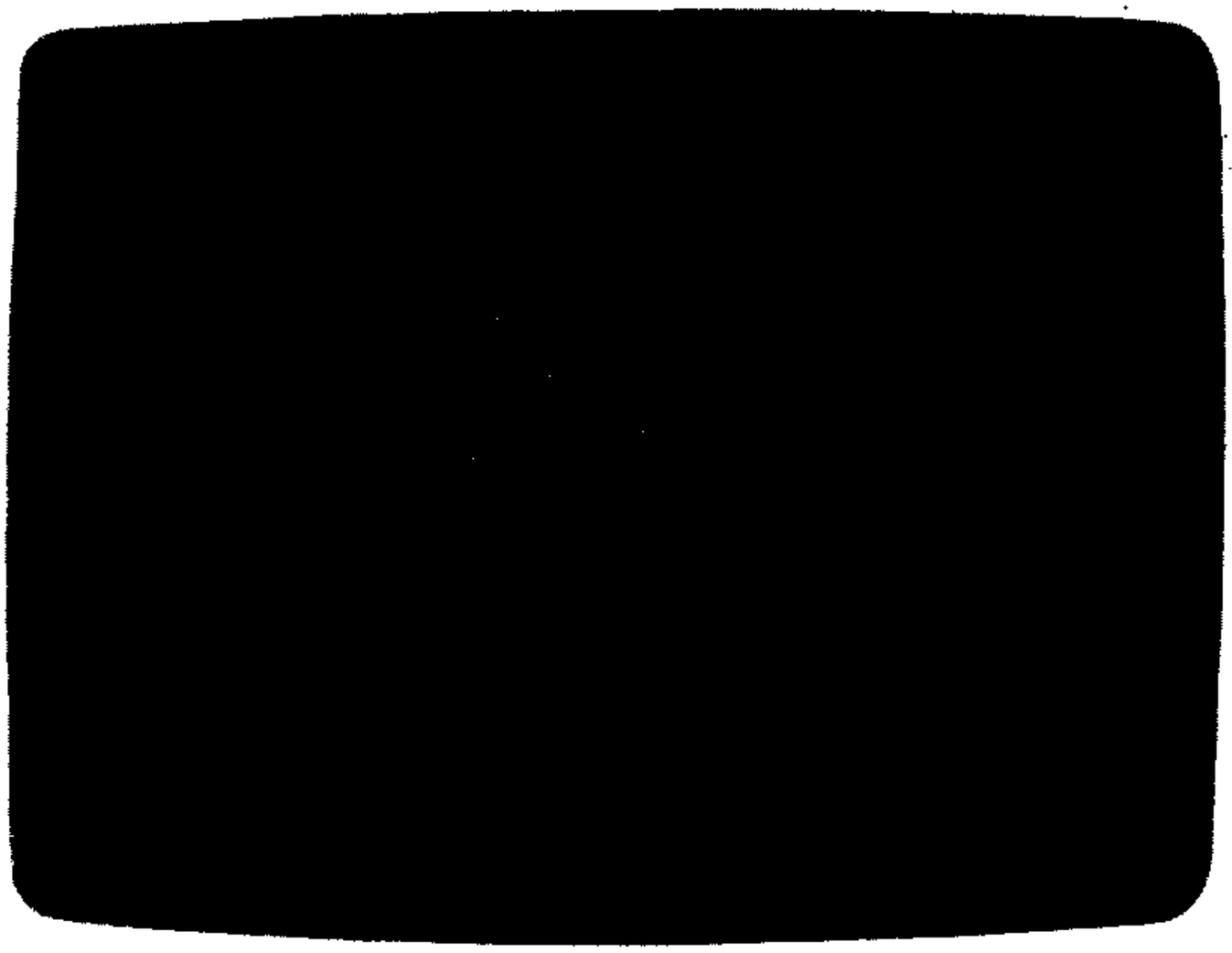


Fig. 7-37. Using the PRINT USING command.

The $-Sign Key

Functions: This key

1. Prints the standard symbol for dollars.
2. Indicates a string variable.

The only special use for the $ sign is an important one: identifying a text, or *string* variable.

Using Variables

A variable is a symbol for another value. For example, when a television commercial compares its product to Brand X, the name Brand X is a variable that stands for an unnamed value, such as Acme Soap Suds.

A variable can stand for one value or many values. The value of a variable can change during the execution of a program. A variable adds versatility and reusability to programs.

Variable Types

There are three variable types. These are given in the following list. Their symbols and some typical examples are shown in Table 7-2.

1. *Integer Variables* stand for whole numbers only. Numbers with decimal parts aren't allowed.
2. *String Variables* stand for any characters in quotes. This includes numbers, letters, blank spaces, and any special symbols. If a number is in quotes, the computer considers it to be text and, therefore, without any mathematical value. In other words, you can't add "2" + 2.
3. *Floating Point Variables* stand for any number, whether whole or decimal. Decimal numbers are also called *real numbers.*

Table 7-2. Variable Types

	TYPE OF VARIABLE		
	Integer	**Text String**	**Floating Point**
Symbol	%	$	None
Contents	Whole numbers	Characters in quotes	Decimal or whole number
Examples	A%, B2%, AB%	A$, B2$, AB$	A, B2, AB
Possible values	1, 100, 4567890	"NAME", "# 1", "I.O.U.", "35"	1.2468, 100, 4567890, 0.5

Exercise: Using Variables

1. Press the [redacted] and [redacted] keys to clear the screen. Type NEW and press the [redacted] key to erase the computer memory.
2. Type in the following lines exactly as they appear. Press [redacted] after each line.

```
1  X = X + 1
2  PRINT X
3  GOTO 1
```

3. Type RUN and press [redacted]. Watch the program execute. Press the [redacted] key when you are ready to stop the program.

If you stop the program after it executes five times, your screen should look like Fig. 7-38.

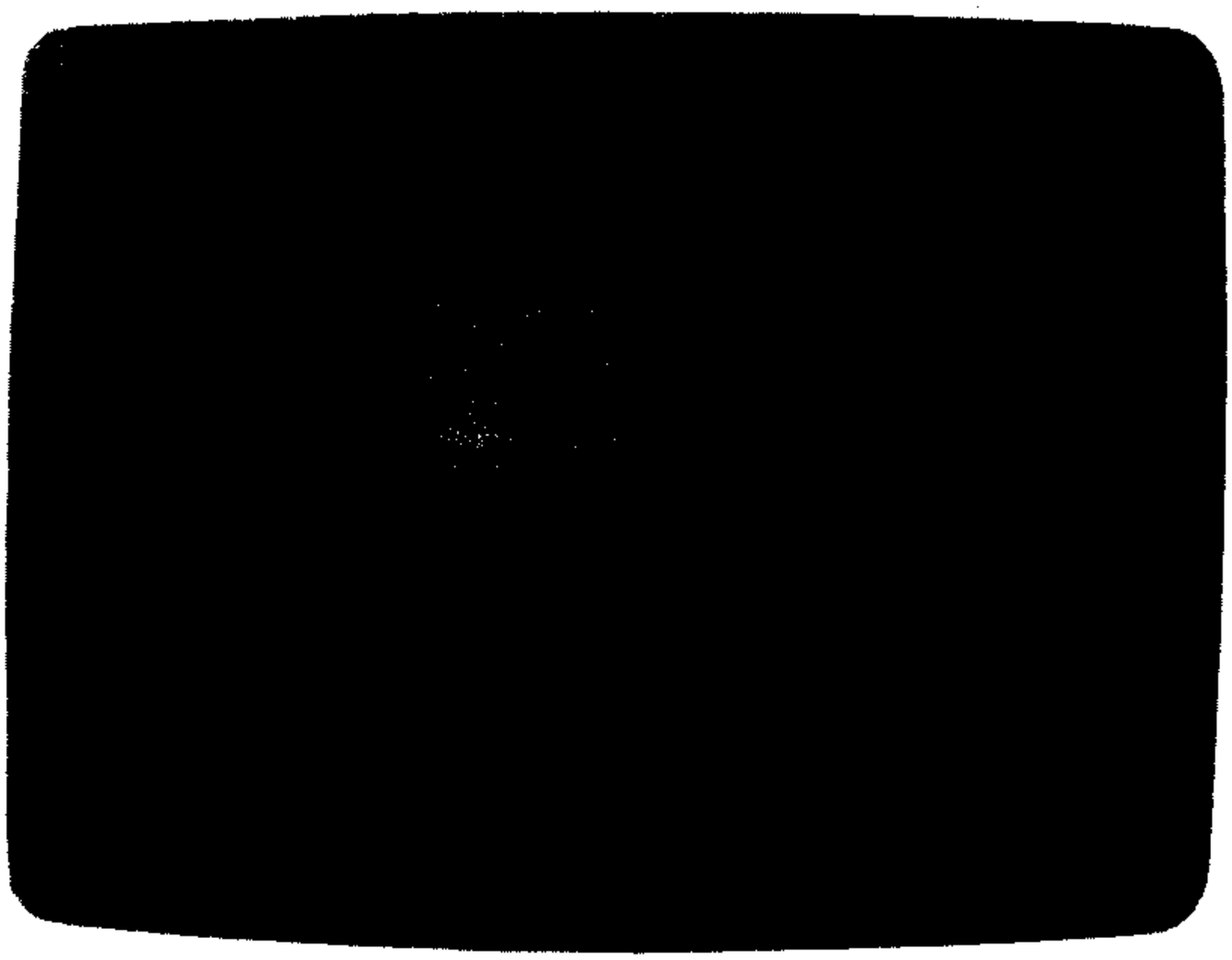


Fig. 7-38. Display of exercise using variables.

How This Program Works

As you can see, the value of the variable X changes every time the program executes. Here's an explanation of what happens in this program.

Line 1 adds 1 to the current value of X. The computer automatically gives variables a value of 0 until you give it some other value. So the first time that line 1 executes, X = 0 + 1. The second time the line executes, X = 1 + 1. Then X = 2 + 1, and so on. This line illustrates the reusability of a variable. A variable can be equal to as many different values as you want to assign during the course of a program execution.

Line 2 teaches something new about the PRINT command. For the first time, you told the computer to print something that isn't enclosed in quotes. Instead of printing an exact copy of what you ordered, the computer printed the VALUE of what you told it to print. The computer didn't literally print X; it printed what X stands for. Each time X is printed, the computer displays the current value for X. Since the value of X changes during the program, the computer will print more than one value for X during program execution. You'll learn more about the versatility of the PRINT statement later in this chapter.

Line 3 tells the computer to go back and execute the program again, starting at line 1. Each time the program executes, there is a new value for the variable X.

Exercise: Using String Variables

1. Press the SHIFT and CLEAR/HOME keys to clear the screen. Type NEW and press RETURN to erase the computer memory.
2. Type the following lines exactly as they appear. Press RETURN after each line.

```
1 DATA "HELLO," ," MOM"
2 READ A$ , B$
3 PRINT A$;B$
```

3. Type in RUN and press RETURN. The screen will look like what is shown in Fig. 7-39.

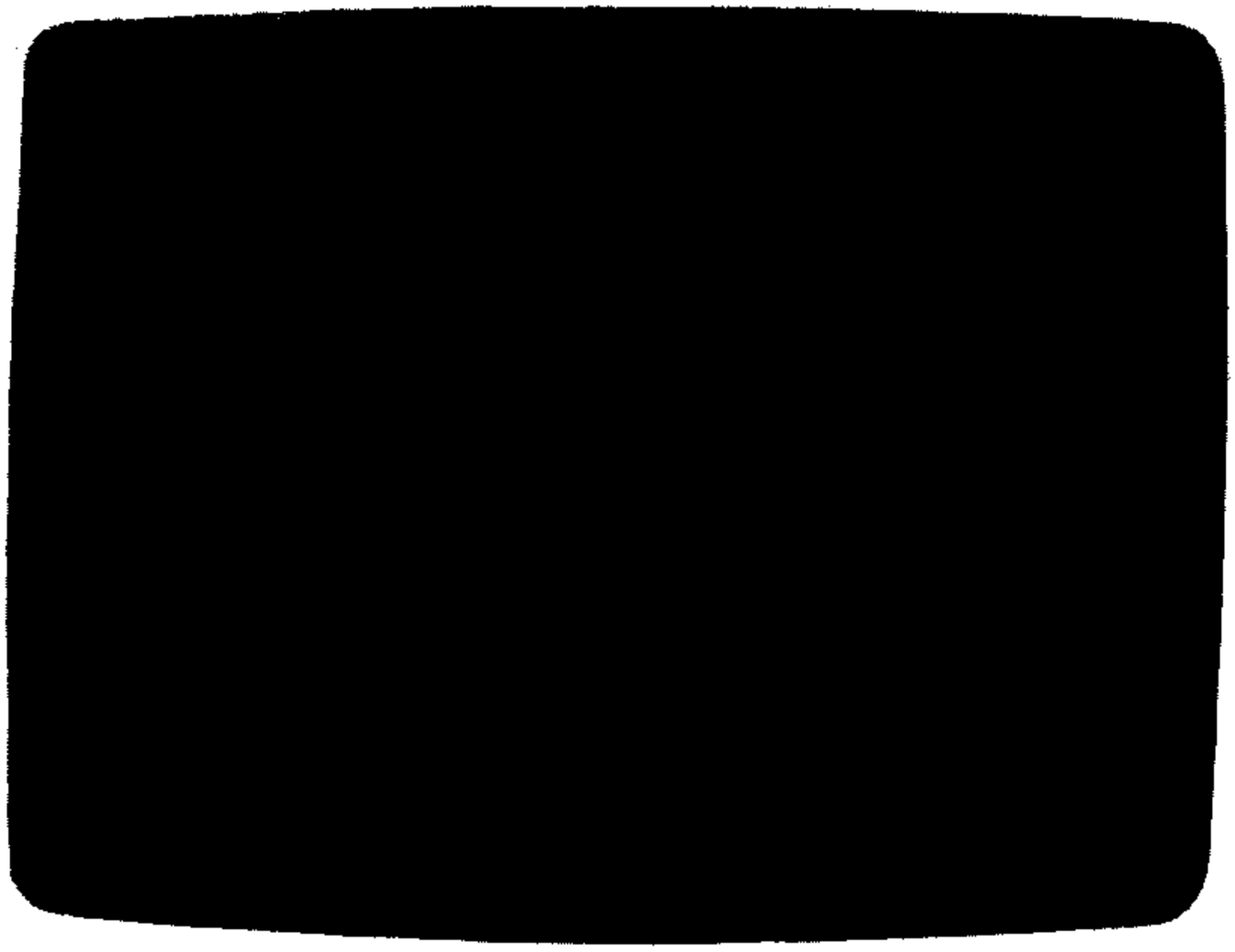


Fig. 7-39. Display for exercise using text string variables.

How This Program Works

The following is an explanation of what happens in this program.

Line 1 lists two pieces of data, both of which are words in quotes. Data in quotes is called STRING DATA.

Line 2 reads the data from the DATA statement. READ and DATA statements always work together. DATA statements contain lists of data, and READ statements contain lists of variables. READ statements assign values from the DATA list to the variables in the READ statement list. The READ statement in line 2 assigns the first data items to the string variable A$ and the second data item to string variable B$.

Line 3 prints the values that the variables A$ and B$ stand for.

The % Sign Key

Functions: This key will

1. Print the standard symbol for percent.
2. Indicate an integer variable.

The only special use for the % sign is an important one; it identifies an *integer variable.* Integer variables can represent any whole number. Numbers with decimal parts can't be assigned to an integer variable.

As we mentioned in the previous section, a variable is a symbol for another value. A variable can stand for one thing or for many things. Also, the value of a variable can change during the execution of a program. We also told you that there are three variable types:

1. *Integer variables,* which stand for whole numbers only.
2. *String variables,* which stand for characters contained inside quotes.
3. *Floating-point variables,* which stand for any number, whether whole or decimal. Decimal numbers are also called *real numbers.*

Exercise: Using Integer Variables

1. Press the [redacted] and [redacted] keys to clear the screen. Type NEW and press [redacted] to erase the computer memory.
2. Type the following lines exactly as they appear. Press [redacted] after each line.

```
1 DATA 3,4,5,6,5
2 READ A%,B%
3 PRINT A%;B%
4 READ F%,G%
5 PRINT F%;G%
```

3. Type RUN. The screen should look like that shown in Fig. 7-40. NOTE: If your screen doesn't look like the illustration check the lines you typed. Did you remember to type the % sign each time it appeared in the exercise? Did you type commas and semicolons exactly as they appear in the program? If not, move the cursor back and edit the incorrect lines. Remember to press the [redacted] key after you correct each line. When you finish, type LIST and press [redacted] to make sure that all your corrections were entered into memory. Then RUN the program again.

Fig. 7-40. Display for exercise using integer variables.

How This Program Works

Here's what happens in this program.

Line 1 lists four pieces of data, the first three of which are whole numbers. The fourth is a decimal number.

Line 2 reads the data from the DATA statement. As we mentioned earlier, READ and DATA statements always work together. DATA statements contain lists of data and READ statements contain lists of variables. READ statements also assign data items to the variables in the READ statement list. The READ statement in line 2 assigns the first data item to the integer variable A% and the second data item to integer variable B%.

Line 3 prints the values that the variables A% and B% stand for.

Line 4 reads the next two data items from the DATA statement in line 1. The third value, 5, is assigned to the integer variable F%. But there's a problem with the fourth data item. The variable to be assigned this value is an integer variable, which means it can only accept whole numbers for values. Since 6.5 is a decimal value, and integer variables will only accept whole numbers, the program prints 6, not 6.5, for the variable G%.

The &-Sign Key

Function: Prints the standard symbol for "and."

There is no special use for the & sign. Note that you can't substitute this symbol for the BASIC word AND, which is used in some conditional statements. You must use the word AND.

The Apostrophe Key

Functions: The apostrophe key

1. Prints the standard symbol for apostrophe.
2. Appears in some commands used in the machine-language monitor, which is built into the Plus/4 computer. The machine-language monitor commands are briefly described in Appendix B.

Note that you can't substitute an apostrophe for quotation marks. If you want to print quotation marks within the quotation marks of a PRINT statement, you can use apostrophes as the inner quotes. Or you can use the CHR$ value (34) for the quotation marks you want to actually appear in the computer display of the command execution. Fig. 7-41 illustrates the use of the string function CHR$(34).

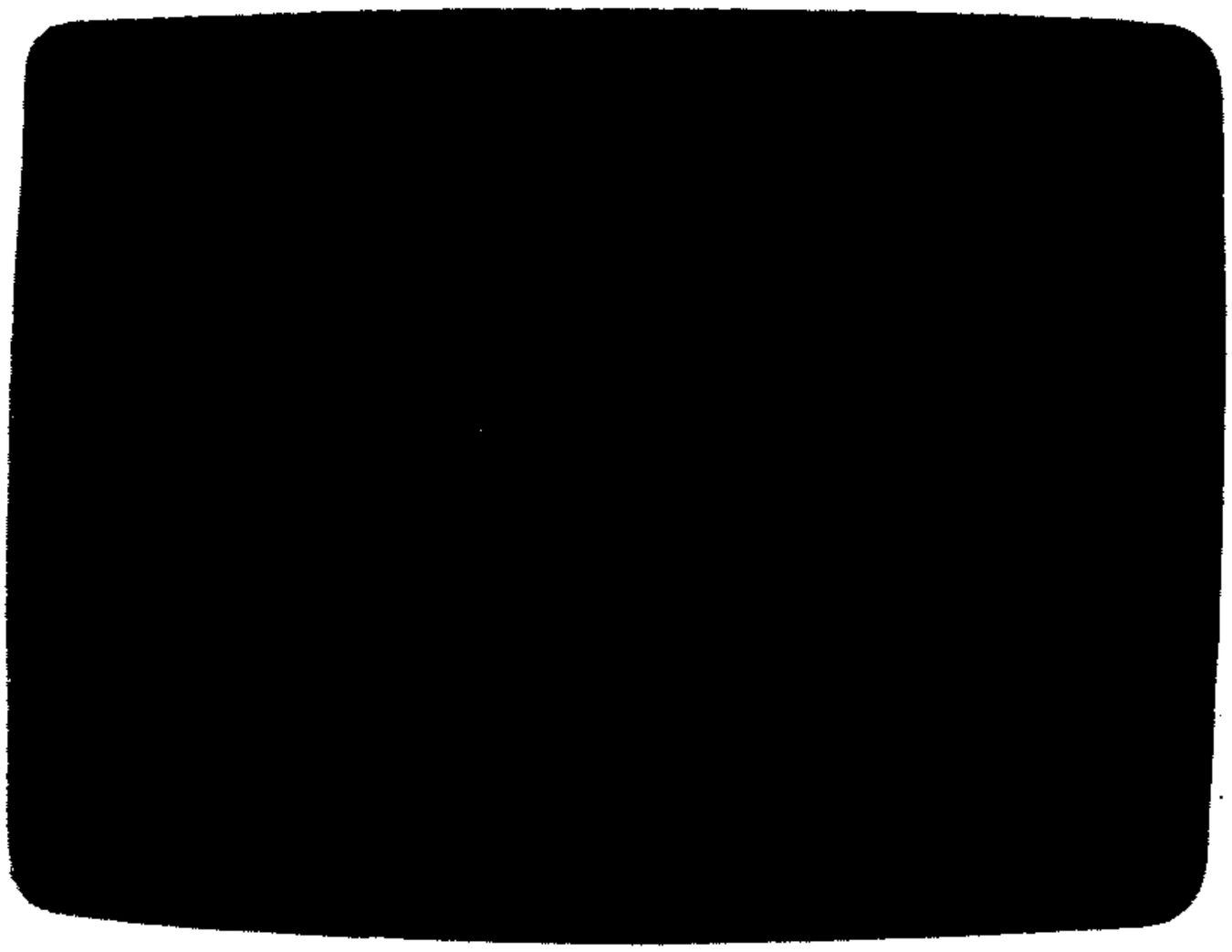


Fig. 7-41. Using a CHR$ code in quote mode.

The Equal Sign

Functions: The equal sign

1. Indicates the assignment of a value to a variable or to a constant value in a variety of commands.
2. Prints the standard equal sign in calculations and in relational operations.

Using the Equal Sign To Assign Values to Variables

So far you've used the equal sign in equations that assign a value to a variable. For example, when we introduced variables in the section explaining the dollar-sign key, we used the command X = X + 1. The equal sign can also assign constant values to variables, such as X% = 3 and X = 6.5.

You can also use the equal sign to assign text values to string variables, such as X$ = "HELLO" and A$ = "$64,000".

Using the Equal Sign in Relational Operations

You can use the equal sign to check for the relationship of a variable to a value. In other words, you can tell the computer to do something if and when the relationship between a variable and a value is equal. For example:

```
IF X = 3 THEN N$ = "THREE"
```

This command assigns the value "THREE" to the string variable N$ *only* if the relationship between the current value of the variable X and 3 is equal. If X doesn't equal 3, the relationship is one of inequality, so the computer doesn't make N$ equal to THREE.

The equal sign is only one of six relational operations. The other relational operators and their functions are described in Chapter 8.

The @ Sign Key

Function: Prints the standard @ sign.

The English Pound-Sign Key

Function: Prints the standard English Pound symbol.

The Bracket Keys

Function: Prints standard brackets. (Note that you can't substitute brackets for parentheses in BASIC commands.)

The Colon Key

Functions: The colon key

1. Prints the standard colon.
2. Separates commands when you have more than one command per line.

The Plus/4 computer lets you type more than one command on a line. For example:

```
X = X + 1: Y = X - 0.5: PRINT X,Y
```

Without the colons, you couldn't use the immediate mode (i.e., no line numbers and immediate execution when you press the RETURN key). Instead, the program would look like the following in program mode:

```
1 X = X + 1
2 Y = X - 0.5
3 PRINT X,Y
```

The advantage of using multiple commands in one line (whether in immediate mode or in program mode) is that your program executes faster. As you learn to write longer and more complex programs, you'll discover additional advantages to putting several commands on one line.

The Semicolon Key

Functions: This key

1. Prints the standard semicolon.
2. Causes items in PRINTed output to be displayed next to each other instead of in separate print zones of ten spaces each.
3. Separates a prompt string and an input variable in an INPUT command.
4. Stops the cursor from moving to the next line after a command is executed.

Using Semicolons in PRINT Commands

When you use semicolons to separate multiple items in a PRINT command, the items are displayed next to each other when you execute the PRINT command. Text items are displayed with no

spaces at all between them, and numeric items are displayed with a blank space on each side of each number. This space is left for numeric signs (i.e., negative or positive signs) so if a number to be displayed is negative, the minus sign will appear in what would be the leading blank space.

Using Commas in PRINT Commands

In the program in the last section, where you were shown how to use colons to put multiple commands on one line, we used a comma to separate the X and Y in the PRINT command. When you run this program, the output looks like that displayed in Fig. 7-42.

Fig. 7-42. Using commas in a PRINT command.

When you use commas to separate PRINT command items, each item is printed in a separate print zone of 10 spaces. The output would look like that shown in Fig. 7-43 if you were to use a semicolon instead of a comma in the PRINT command.

As we mentioned previously, no space is displayed between text items when you use semicolons in PRINT commands. You must provide a blank space at the beginning or end of a text item if you want a blank space to appear in the screen display. For example, type in the following program and note the difference in the PRINT commands when a blank space is included at the end of the first item and then when no space is included:

```
1 PRINT "DATA ";"BASE"
2 PRINT "DATA";"BASE"
RUN
```

Fig. 7-43. Using semicolons in a PRINT command.

Exercise: Using Semicolons in Print Commands

1. Type in NEW, press RETURN, and then type in the following program. Press RETURN after each line.

```
1 INPUT "WHAT'S YOUR NAME";A$
2 PRINT "HELLO,";A$;", HOW ARE YOU?"
```

2. Type RUN and press the RETURN key.
3. Type your name in response to the question WHAT'S YOUR NAME?. Press the RETURN key. The screen should look like that displayed in Fig. 7-44, but with your name on the screen.

Using a Semicolon in INPUT and PRINT USING Commands

In the previous example, we used a semicolon in the INPUT command in line 1. The INPUT command lets you type data from the keyboard during program execution. This makes the program easy to reuse.

The semicolon joins the two parts of the INPUT command: the prompt string (which is the statement in quotes) and the INPUT variable (which must be a string variable when you are inputting a text string). The INPUT variable is a required part of the INPUT command. The data that you type into the keyboard when you are prompted for input is assigned to the input variable. The prompt

Fig. 7-44. Formatting the PRINT command output.

string is optional. The prompt string makes the input request easier to understand. If you don't include a prompt string, you don't include the semicolon.

The semicolon serves a similar purpose in a PRINT USING command; it separates a text string from variables.

Using Semicolons To Keep the Cursor From Moving to the Next Line

You've already seen how colons can link commands and how semicolons can link parts of a command. Semicolons can also link PRINT commands to force their output to be displayed all on one line rather than on a separate line for each PRINT command. Semicolons block output from moving to the next line after the first command is executed. For example:

```
1 PRINT "WASHINGTON ";
2 PRINT "IS THE NATION'S CAPITOL"
```

Type RUN. The display in Fig. 7-45 shows that the semicolon prevented the text string IS THE NATION'S CAPITOL from being printed on the next line.

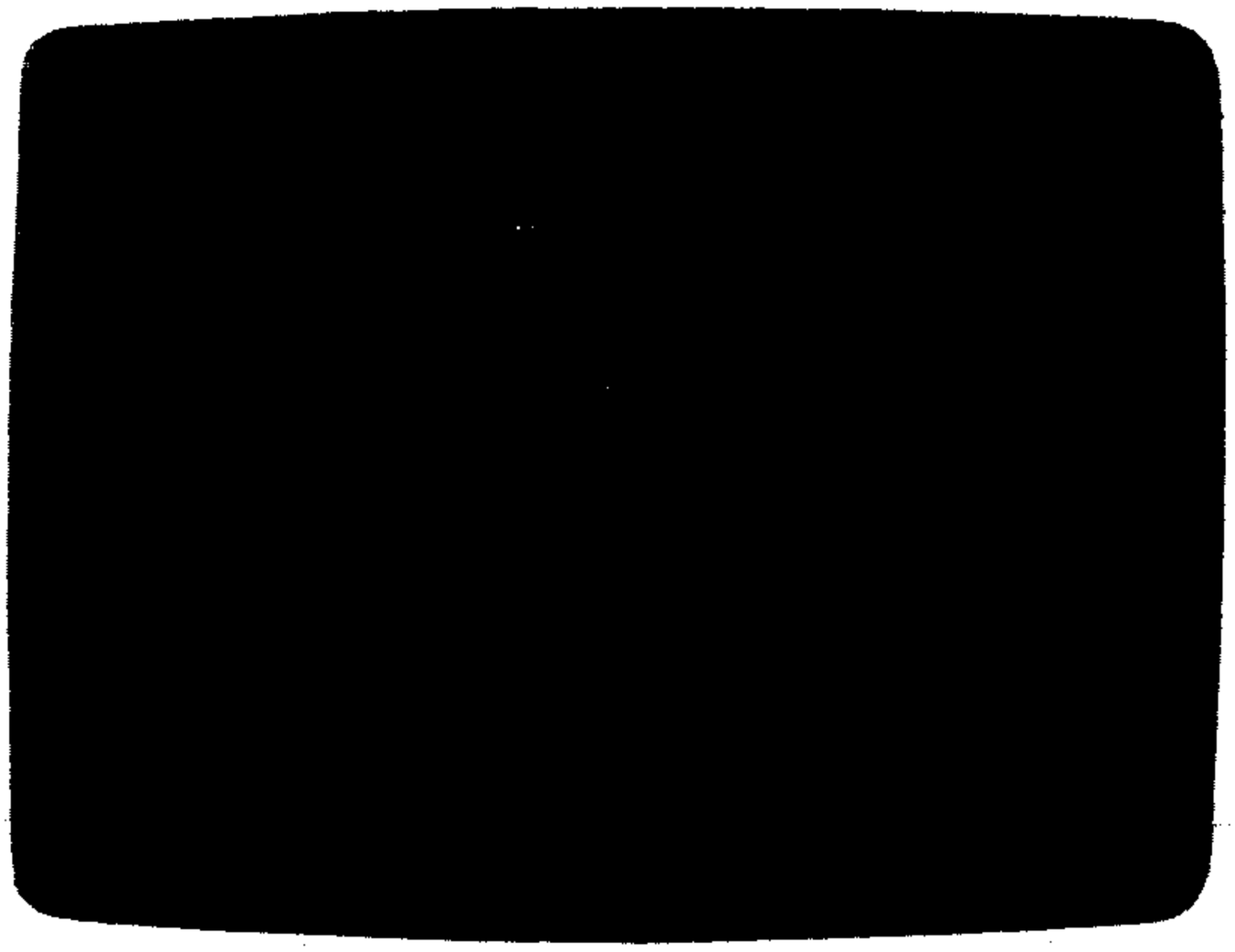


Fig. 7-45. Using a semicolon to format output.

The Comma Key

Functions: The comma key

1. Prints the standard comma.
2. Causes items in PRINTed output to be displayed in separate print zones of ten spaces each.
3. Stops the cursor from moving to the next line after a PRINT command is executed.
4. Can be printed in PRINT USING and PUDEF formats.
5. Separates items in DATA, READ, INPUT, DIM, and many other commands.
6. Acts as a place holder for the default values of parameters in some commands, such as COLOR, BOX, etc.

Using Commas in PRINT Commands

In the last section, you learned how to use semicolons to put separate multiple items in a PRINT command so that the items would be displayed next to each other when you execute the PRINT command.

When you use commas to separate multiple PRINT command items, each item is printed in a separate *print zone* that is 10

spaces wide. The Plus/4 screen is 40 columns across, so there are four print zones per line.

If one item in a PRINT list is over 10 spaces long, the next time after the long item is displayed in the first empty print zone. In other words, if the first item you print takes up 1½ print zones, the next item appears in the third print zone.

If there are more items in one PRINT command than there are print zones in one line, the output continues on the next line. The example given in Fig. 7-46 illustrates how items are printed in print zones.

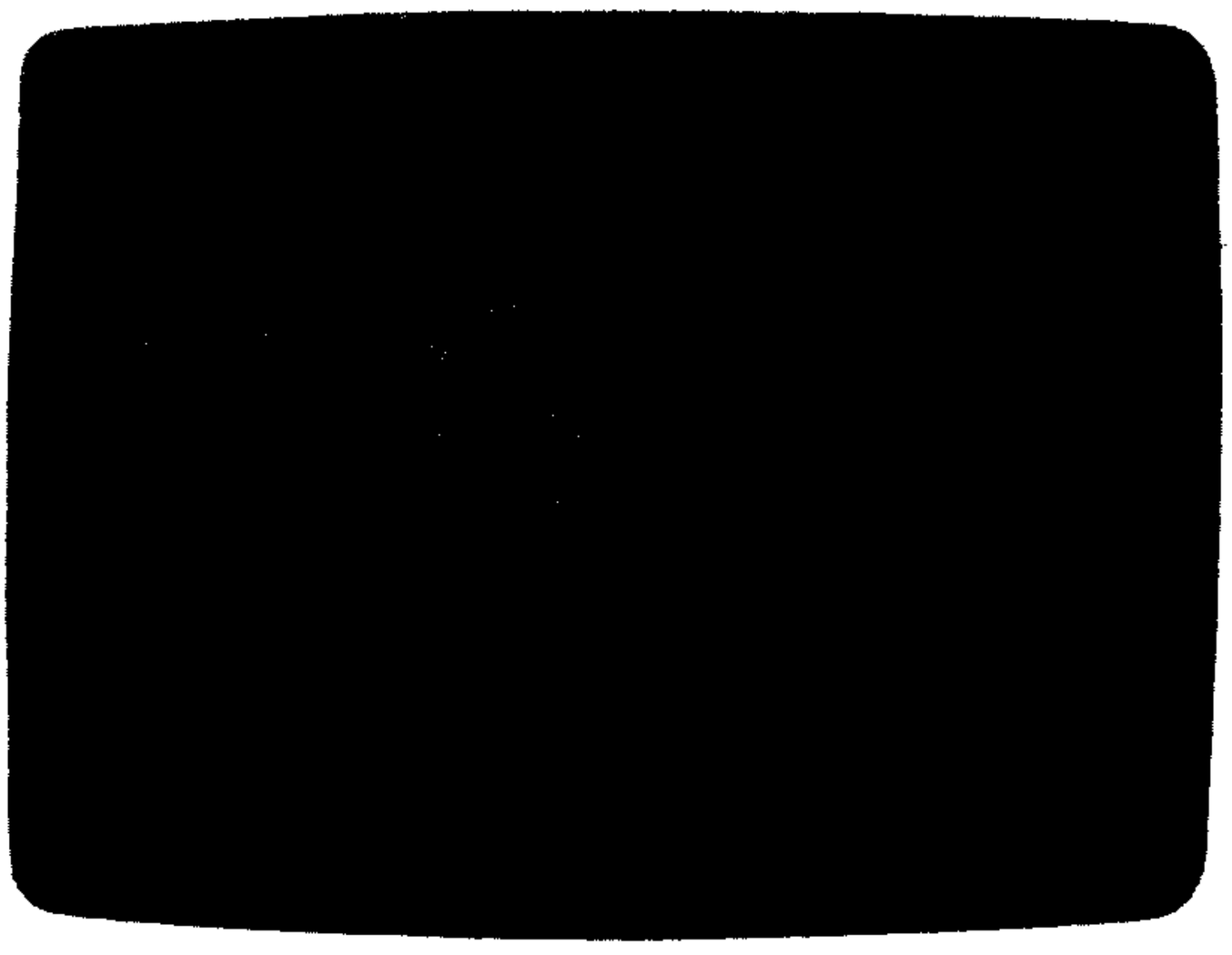


Fig. 7-46. Output being placed into print zones.

How the Program Works

Note that the following program is the same as the one displayed in Fig. 7-46.

```
1 X=10
2 FOR C=1 TO 4
3 PRINT " 123456789";: NEXT C
4 PRINT "EACH PRINT ZONE","IS", X, "SPACES"
```

Line 1 assigns the value of 10 to the variable X.

Line 2 begins a FOR . . . NEXT LOOP. This loop tells the computer to follow the commands between the FOR command and the NEXT command. The numbers in the FOR statement tell the computer how many times to repeat the commands in the loop.

Line 3 finishes the FOR . . . NEXT loop. In this case, the command PRINT " 123456789" is repeated 4 times. The semicolon in this line prevents the cursor from moving to the next line, so #123456789 is printed four times on the same line. This line is included to help you see where the print zones begin and end. The colon separates the PRINT command and the NEXT command.

Line 4 prints four times, demonstrating the way print zones are filled. Note that the second item, IS, is printed in the third print zone because the first time, EACH PRINT ZONE, takes up all of the first print zone and part of the second. Remember that each item separated by a comma must start in a new print zone. SPACES is printed on the next line because all the print zones on the first line are filled.

Review

In line 3, the space before the 1 in the PRINT command stands for the first place in the 10-space print zone, so the 10 spaces are counted 0–9, not 1–10. The semicolon in line 3 forces the output from line 4 to be printed on the same line as the output from line 3. The colon in line 3 links two separate commands: PRINT and NEXT.

In the output display shown in Fig. 7-46, you can see that the E in EACH and the I in IS both appear under the leading blank space that is printed by line 3. This indicates that text starts printing in the first space in a print zone. In contrast, the 10 that is output starts under the 1 of the fourth zone, which is the second space in the print zone. Remember that the computer always leaves a space before each number to allow for a negative sign.

Exercise: Using Commas and Semicolons in PRINT Commands

1. Type NEW, press RETURN, and type in the following program. Press RETURN after each line.

```
1 FOR C=1 TO 2
2 X = X+5: Y = X-10: Z =X+Y
3 PRINT X;Y,Z;: NEXT C
```

2. Type RUN and press the RETURN key. The screen should look like that of Fig. 7-47.

Don't Use Commas in Numbers

When we write large numbers, we normally use commas to separate the number into readable groups of three digits (e.g., 1,345,789). But you can't do this with large numbers on a computer. The computer thinks that commas are used to separate

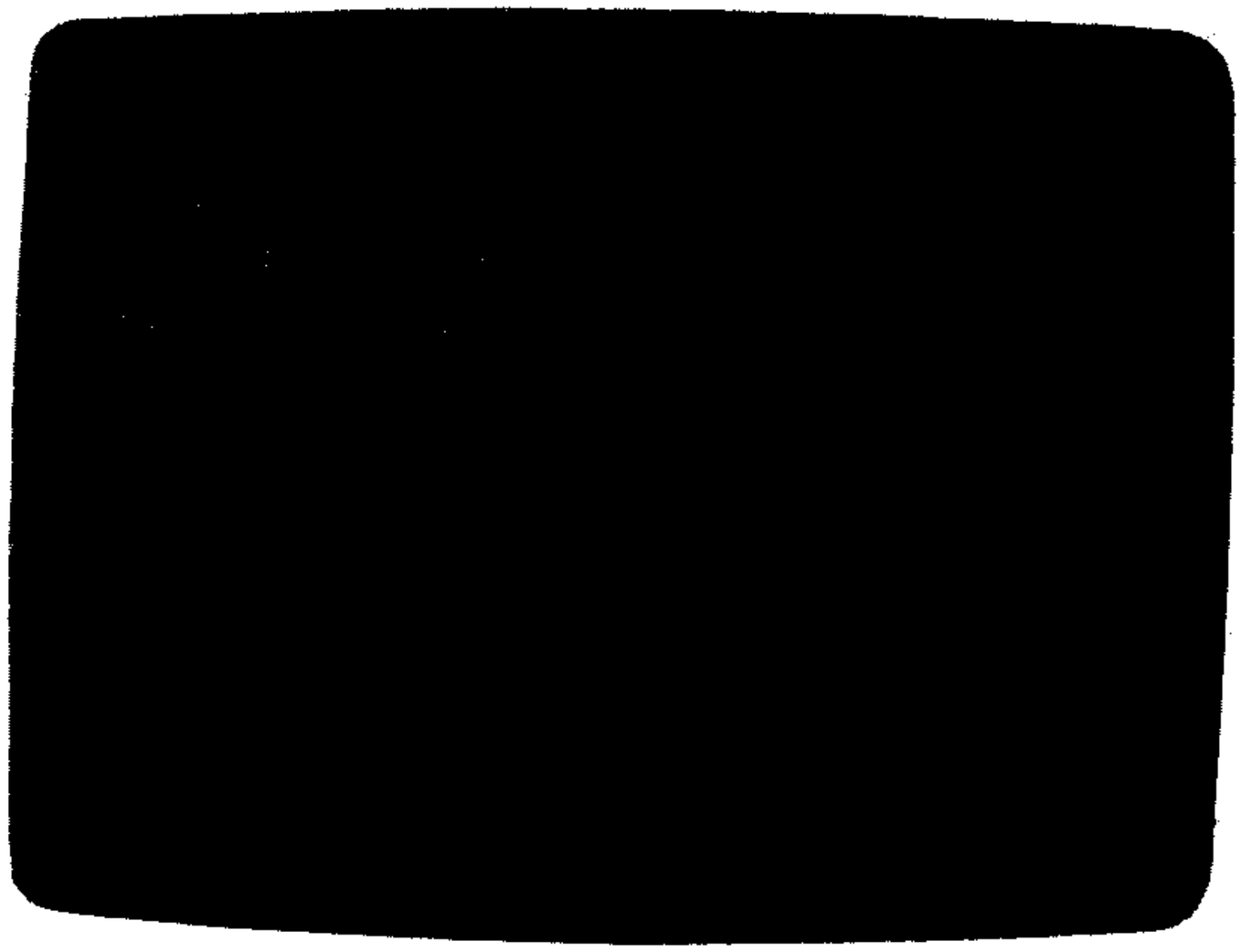


Fig. 7-47. Using commas and semicolons in the PRINT commands.

different numbers, so if you put commas into a number, the computer will think you've entered more than one number. For example, the computer thinks 1,345,789 is three numbers: 1 and 345 and 789. You'll learn more about displaying large numbers in the next chapter.

Using Commas To Continue Output on the Next Line

You've already seen how colons can link commands and how semicolons can link output. You can also use commas to link output. For example, type in the following program and type RUN to execute it. Be careful to type the punctuation exactly as it appears in the exercise.

```
1 PRINT "E.T.,  ";
2 PRINT "CALL",
3 PRINT "HOME"
```

Now, type RUN. Your screen should look just like the display shown in Fig. 7-48.

Note that using a semicolon to link the output from lines 1 and 2 prints E.T. and CALL right next to each other. Using a comma to link the output from lines 2 and 3 prints HOME in the next print zone after CALL. As you recall, using commas within a PRINT command (such as PRINT X,Y) causes the items to be printed in separate print zones (each print zone equals 10 spaces), while using a semicolon in a PRINT command (such as PRINT X;Y)

causes the items to be printed right next to each other. The same logic guides the printing of output from separate PRINT commands that are linked by commas or semicolons.

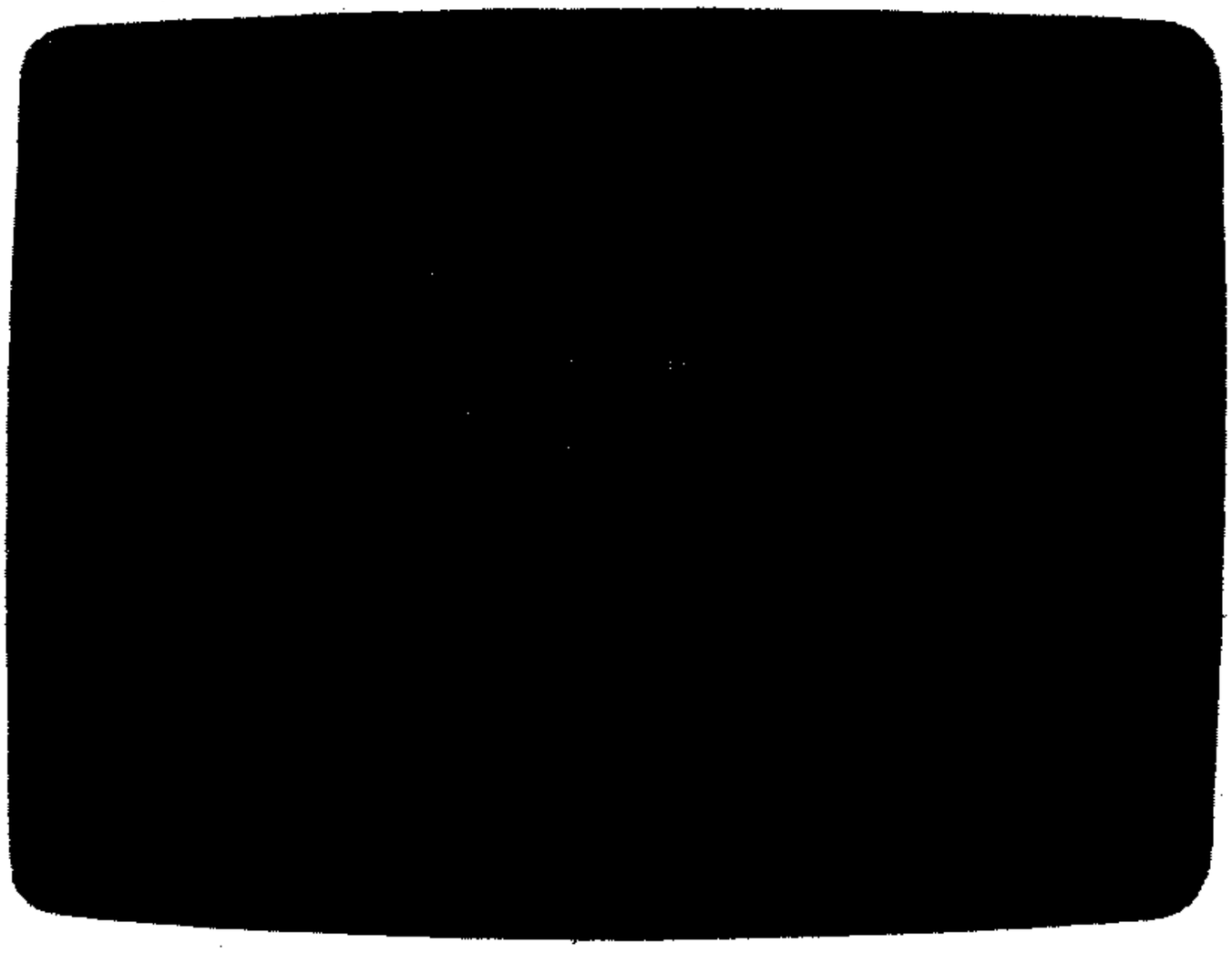


Fig. 7-48. Formatting the output.

Using a Comma To Separate Items in Commands Other Than PRINT

In several previous examples, we've used commas to separate a list of items. For example:

```
PRINT X,Y,Z
```

With the exception of the PRINT command, you cannot substitute semicolons for commas. Commands such as DATA, READ, and INPUT require commas for separating data items. The semicolon we used in an INPUT command separated a prompt string from the input variable. In other words, we separated two parts of a command, not two similar items in a list.

Using a Comma as a Place Holder for Default Values

In some commands, such as BOX, a default value is automatically assigned to certain command elements. You can assign a value different from the default but, if you don't, the default is automatically used. For example, the BOX command has five elements, or *parameters,* as the optional parts of a command are called. These parameters are explained in Table 7-3.

Table 7-3. BOX Command Parameters

Parameter	Purpose
First	The source of the color used to draw the box. This number can be from 0 – 3; the default is 1, the color of the characters.
Second	The X,Y coordinates of one corner of the box.
Third	The X,Y coordinates of the opposite corner.
Fourth	The optional tilted angle at which the box will be drawn. The default is 0 degrees, or no tilting.
Fifth	The option to draw the box solid or in outline. The default is 0, or outline only.

The first, fourth, and fifth parameters have default values, so you don't have to include any value if you want to use the default. However, the computer recognizes which value goes with a parameter by position only. You have to list the parameters in order. So, if you are going to list parameters after the defaults, you must put a comma in the place of the default so the computer knows which coordinate you're referring to. For example,

```
BOX, 10,25, 50,75,,1
```

Here we've accepted the default of 1 for color source. We left a comma in the place between the first parameter and the second, so the computer doesn't think the 10 identifies the color source. 10,25 and 50,75 are the corner coordinates. The comma after 75 stands for the default value for the fourth parameter. If we'd accepted the default for the fifth parameter, too, we could have omitted everything after the 75 because you don't need to use the commas to mark places if they're at the end of the command. In other words, the command would look like this:

```
BOX, 10,25, 50,75
```

If you want to see how these boxes look, type in the following line to enter High-Resolution Split-Screen graphic mode:

```
GRAPHIC 2,1
```

Now press the [redacted] key and type in the BOX commands. Type GRAPHIC 0,1 to return to Text/Graphic Mode.

The Period Key

Function: Prints the standard period and decimal point.

Note that you *must not* put periods after line numbers or at the end of command lines in a program. For example, the following line would be rejected by the computer:

```
1. INPUT " WHAT TIME IS IT"; T$.
```

The Question-Mark Key

Function: This key

1. Prints the standard question mark.
2. Is the abbreviation for the command PRINT and can be used in place of PRINT in any PRINT or PRINT USING command, but not in a PRINT# command.
3. Appears as the prompt for INPUT commands to tell you to type a value during program execution.

BASIC COMMAND ABBREVIATIONS

The version of BASIC language built into the Plus/4 computer permits abbreviations of many of the BASIC commands. The abbreviations can save time and programming space, but you must use the correct abbreviations.

Perhaps the most commonly used abbreviation is the question mark, which stands for the word PRINT in the PRINT command.

Exercise: Using the Question Mark as the PRINT Abbreviation

1. Type in the following command and press the RETURN key:

```
?"PLEASE WAIT"
```

2. Type in the next program. Press RETURN after each line.

```
1 FOR X = 1 TO 5
2 X = X + 1: Y = X - 1
3 ?"TOTALS:",
4 ?X;Y
5 NEXT X
```

3. Type RUN and press the RETURN key. Now type LIST (or L and SHIFTed I, which is the abbreviation for LIST). The computer will automatically spell out abbreviations when you list the program. The screen should look like that of Fig. 7-49.

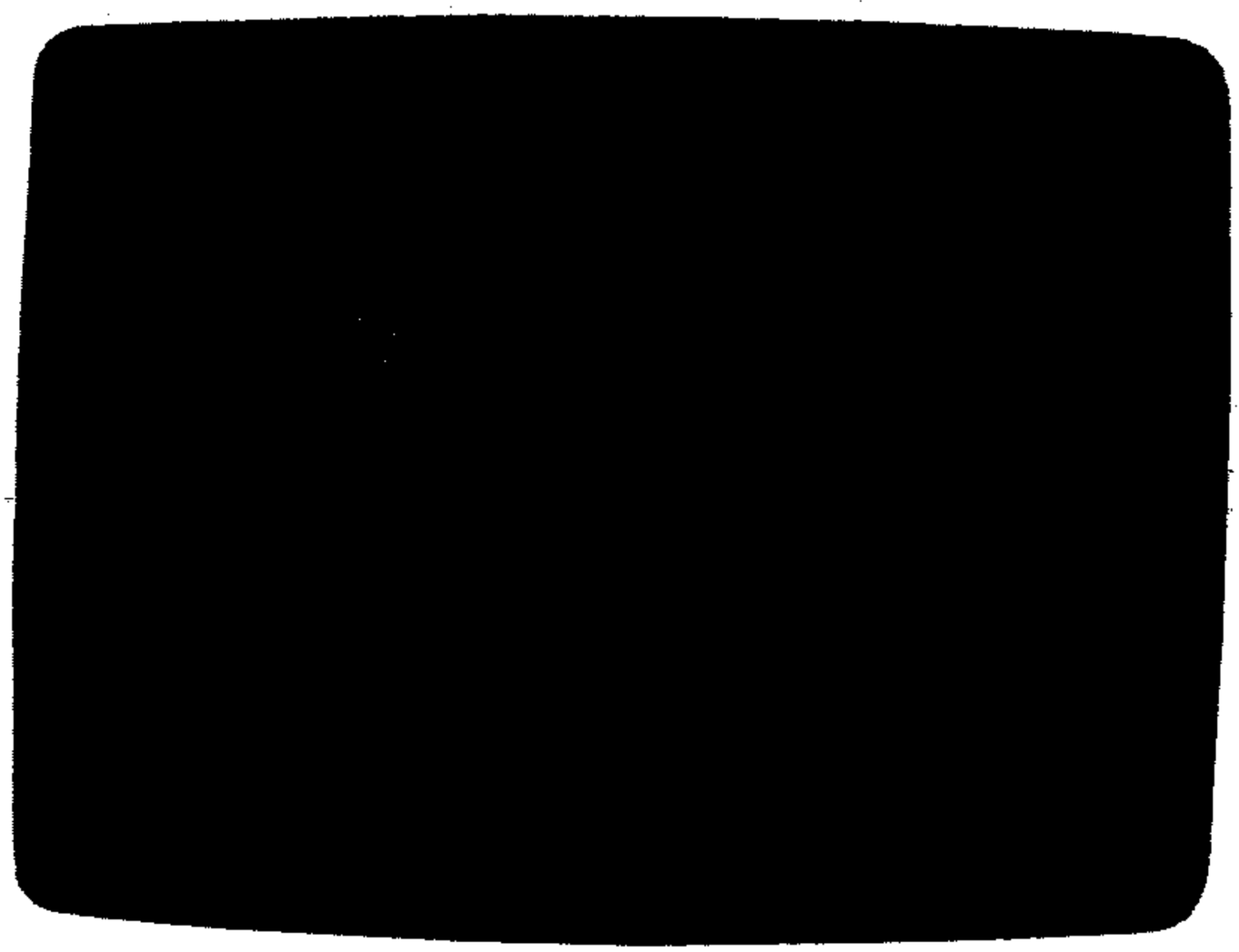


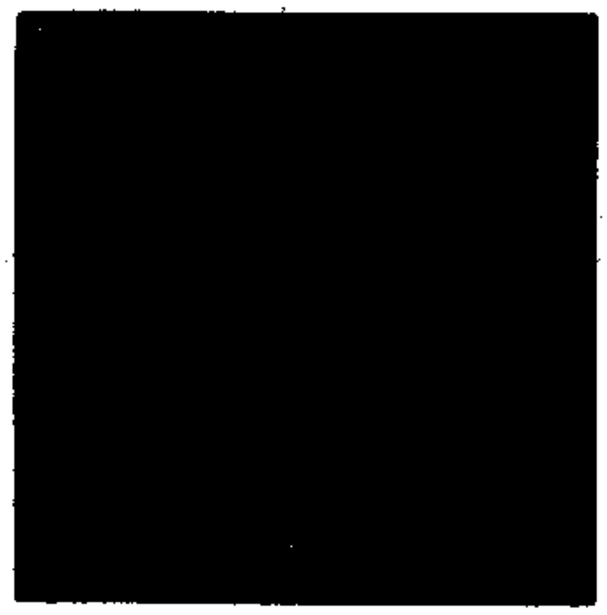
Fig. 7-49. Using the PRINT command abbreviation.

Using the Question Mark in Calculations

The next chapter will explain how the PRINT command, or its abbreviation, the *question mark,* is used for solving calculations on the computer.

CHART 7-1. Major Key Functions

	SCREEN EDITING
Cursor Arrow Key	Moves the cursor around the screen.
HOME Key	Returns the cursor to top left corner of the screen.
CLEAR Key	Clears the screen and returns the cursor to the HOME position.
INST Key	Opens up space between characters so you can insert additional characters.
DEL Key	Erases the character to the left of the cursor.
ESC Key	Sets a screen window. ESC T sets the top left corner; ESC B sets the bottom right corner. NOTE: Other ESCAPE key functions can be used to edit the screen.
	MODE SWITCHING
SHIFT and C= Keys	Switches between Text Mode and Text/Graphic Mode.
CONTROL and 9 Keys	Turns on the reversed-image mode.
CONTROL and 0 Keys	Turns off the reverse mode.
CONTROL and < Keys	Turns on the flashing mode.
CONTROL and > Keys	Turns off the flashing mode.
	GRAPHIC SYMBOL PRINTING
C= and a letter/graphic symbol key	Print the set of graphic symbols pictured on the front left side of the letter keys in both Text/Graphic and Text Modes.
SHIFT and a letter/graphic symbol key	Print the front right-side graphic-key symbols in Text/Graphic Mode only.
	COLOR CHANGING
COLOR and a number/color key	Selects one of the colors listed on the *top* row on the number/color keys.
C= and a number/color key	Selects one of the colors listed on the *bottom* row on the number/color keys.
	OTHER FUNCTIONS
RETURN	Enters into memory any information you type.
STOP	Stops the execution of a program that is currently running.



CALCULATING WITH THE PLUS/4

You've already used some of the features on the number keys. You've learned that adding line numbers turns command lines into program lines. You've changed the character color, using the colors listed on the fronts of the number keys. You've also used some of the punctuation and other characters listed on the tops of the number keys.

What you haven't done much of yet is use the numbers to calculate mathematical problems. The number keys, along with other keys that act as mathematical and relational operators, let you solve complex problems quickly.

In this chapter, you'll gradually learn how to use the Plus/4 to calculate as you are introduced to the keys that are used in mathematical problem solving.

The Plus Sign

Function: Serves both as the addition sign in calculations and as the optional positive sign for numbers.

The Minus Sign

Function: Serves both as the minus sign in calculations and as the negative sign for numbers.

DISPLAYING POSITIVE AND NEGATIVE SIGNS

In the last chapter, while discussing how commas and semicolons affect the format of PRINT command output, you learned that the PRINT command displays a blank space on both sides of a number when it is not printed in quotes. As you read in that section, the blank spaces are left to allow space for negative or positive signs that may be displayed with the number. However, the Plus/4 computer doesn't display positive signs unless you tell it to do so.

The Plus/4 computer assumes that a number is positive unless you indicate otherwise so, therefore, the negative signs aren't optional. If a number is negative, the minus sign must always appear with the number. The minus sign generally appears in the space in front of the number (for example, −29). The Plus/4 computer displays a blank space after each number so you can be sure which number goes with a negative sign.

CALCULATING IN THE IMMEDIATE MODE

You've already used simple calculations in previous examples and exercises. In addition, you've learned that you can use variables in calculations. This chapter will teach you much more about quick calculating, solving complex problems, and using equations to control programs.

So far, you've typed math problems in program lines and printed the answers in another line. But the Plus/4 computer will also let you solve calculations using a PRINT command. You can put a calculation in a PRINT command in the immediate mode and get the answer right away. For example, type PRINT 3 + 2 and press the RETURN key. Note that you don't need to include the equal sign in this type of calculation.

Solving Calculations in a PRINT Command

This example shows you a new way to use the PRINT command. When you tell the computer to PRINT a calculation, the computer actually prints the solution. Of course, if you put the problem in quotes, the computer doesn't solve the equation, but prints exactly what's inside the quotes. The computer can't recognize a calculation when it's inside quotes. You can combine the PRINT command capabilities to display the calculation and its solution as follows:

```
PRINT "15 + 18 =";15 + 18
15 + 18 = 33
```

Type this line:

```
4 + 3
```

and press the RETURN key. Type RUN. Instead of displaying a solution, the computer displays an error message. The computer takes the number 4 to be a line number and thinks you are writing a program. When listing, you get

```
4  + 3
```

Only when running, do you have an error and, thus, get a "?SYNTAX ERROR" message. The Plus/4 computer doesn't know what you want to do with the numbers because you haven't typed in a command.

The PRINT command has two functions:

1. To display anything in quotes exactly as it appears.
2. To solve equations and display the results.

When you tell the Plus/4 to PRINT 4 + 3, you are telling the computer to figure out what 4 + 3 equals and then display the solution. The same is true when you tell the computer to PRINT X. You are telling the computer to find out what X equals and then display the solution.

Exercise: Calculation in Immediate Mode

1. Type in the following line and press RETURN :

```
PRINT 23 - 30
-7
```

2. Type in the next line and press RETURN :

```
PRINT 45 + 20.5; .14 - .55
65.5 -.41
```

The * Key

Functions: The asterisk is the multiplication sign. This key

1. Prints the standard asterisk symbol.
2. Serves as the symbol for multiplication.

The Plus/4 computer uses the * sign for multiplication instead of the standard X. This substitution spares the computer the problem of figuring out whether you mean the letter X or the multiplication sign.

The / Sign Key

Functions: The / (a virgule, or slash) is the division sign key. It

1. Prints the standard slash symbol.
2. Serves as the symbol for division.

Exercise: Calculating in Program Mode

1. Press the [redacted] and [redacted] keys to clear the screen. Type NEW and press the [redacted] key to erase the computer memory.
2. Type lines 1 and 2 exactly as they appear below. Press [redacted] after each line. Then type RUN and press [redacted] .

```
1 X = 6 * 2
2 PRINT X; X/3
RUN
  12   4
```

In this program, line 2 prints the solution of the equation from line 1; it then solves another equation and prints its result.

3. Type in lines 3 and 4 below and press [redacted] . Then type RUN and press [redacted] .

```
3 FOR Y = 1 TO 4
4 PRINT X/Y: NEXT Y
RUN
  12   4
  12
  6
  4
  3
```

This exercise shows you that you can add new program lines even after you RUN the program. All you do is use different line numbers. The reason you can do this is that the program is still active until you erase it with the NEW command, reset or turn off the computer, or reuse the line numbers to write a new program. This reusability is also why we tell you to erase the memory by typing NEW before you start entering another program. This is a good habit because it prevents you from unintentionally mixing old lines into your new program.

The Up-Arrow

Function: Serves as the symbol for exponentiation (raising a number to the power of another number).

The Plus/4 lets you use exponential numbers in calculations. You can raise a number to a negative or positive power. Since the Plus/4 computer can't write superscript (raised numbers), this is how you type an exponent:

1. Type in the number you want to raise to the power of another number.
2. Type in the up-arrow, which is the symbol for exponentiation.
3. Type in the number of the power to which you want the other number raised. For example, this is how you would type 3 to the second power 3 ↑ 2.

If you want to find out the value of an exponent, just type PRINT and the exponent. For example, to solve for 3 to the second power, type:

```
PRINT 3↑2.
```

You can also include exponents in simple and complex calculations.

Exercise: Using Exponents

1. Type in the following lines and press the RETURN key:

```
PRINT 3↑2
```

   The answer that appears on the screen is 9.

2. Move the cursor to the end of the line you just typed and add + 4 so the problem reads: PRINT 3 ↑ 2 + 4. Press the RETURN key. The answer should be 13.
3. Move the cursor to the 2 in the line you typed. Type 5 / 6 over the 2 + 4 so that the line reads: PRINT 3 ↑ 5 / 6. Press the RETURN key. The answer to this calculation is 40.5.

SOLVING COMPLEX CALCULATIONS

So far we've just solved simple problems that involved only one calculation. But the Plus/4 computer can be used to solve very complex problems, too. For example:

```
PRINT 12 * 30/90 + .432 - 6.888
-2.456
```

If you had to solve this problem by hand, where would you start? Would you work from left to right, solving one problem at a time? The Plus/4 computer works according to a set of calculating rules that may not be exactly the same as you'd use if you solved the problem youself. Once you've learned the simple rules, you can be sure to type the problem in the order you want the computer to solve it.

The Solution Order for Complex Calculations

The Plus/4 computer always solves calculations in this order:

First Priority:	Exponentiation
Second Priority:	All multiplications and divisions
Third Priority:	All additions and subtractions

If a problem contains more than one calculation from each priority group, the problems of the same priority are solved left to right. For example:

```
PRINT 2 + 4 * 6 / 8
```

In this problem, 4 is multiplied by 6. Then the result, 24, is divided by 8. Then the result, 3, is added to 2.

You can see how the execution order works by typing in the following program and noticing the answers you get:

```
1 PRINT 2 + 10 / 5
2 PRINT 10 / 5 + 2
3 PRINT 2 + 10 / 5 * 3
4 PRINT 10 / 5 * 3 + 2
5 PRINT 10 / 5 - 4 * 3  + 2
6 PRINT 10 / 5 * 3 + 2 - 4
RUN
  4
  4
  8
  8
 -8
  4
```

How the Program Works

There's no difference in the answers to lines 1 and 2 of the preceding program because division is always performed before addition. It doesn't matter whether the 2 is at the beginning or the end of the calculation because it is always added to the result of 10 divided by 5. The answers to 3 and 4 are the same for the same

reason: 2 can't be added until after the first priority operations are completed. In these cases, 10 is divided by 5 and the result, 2, is multiplied by 3 before the 2 is added.

After the first priority operations are solved, line 5 looks like this: PRINT 2 − 12 + 2 and line 6 looks like this: PRINT 6 + 2 − 4. Since addition and subtraction have the same solution priority, the problems are now solved left to right.

The Parentheses Keys

Functions: These keys

1. Print the standard symbols for a parenthesis.
2. Alter the standard execution order in calculations.
3. Enclose parameters in functions, in the DIM statement (which names the number of elements in an array), and in the DEF FN statement (which lets you define a function).

Using Parentheses To Alter the Solution Priority in Calculating

If you want to solve parts of a complex calculation in an order different from the standard order imposed by the computer, you can use parentheses to change the priority. The Plus/4 computer solves the parts of a problem contained in parentheses before any other parts of a complex equation. You can put more than one operation inside a set of parentheses.

Exercise: Using Parentheses in Calculations

1. Press the [redacted] and [redacted] keys to clear the screen. Type NEW and press the [redacted] key to erase the computer memory.
2. Type the following two program lines exactly as they appear. Press [redacted] after each line. Then type RUN and press [redacted] Your screen should look like this:

```
1 PRINT 3 + 7 * 2
2 PRINT (3 + 7) * 2
RUN
 17
 20
```

In the first line, the computer follows the standard priority for solving complex equations. First, 7 and 2 are multiplied and, then, the result, 14, is added to 3.

In the second line, the parentheses alter the standard priority. Because 3 + 7 is enclosed in parentheses, this part of the problem is solved first. Then the result, 10, is multiplied by 2.

Using Multiple Sets of Parentheses in a Complex Calculation

If more than one part of a complex calculation is enclosed in parentheses, the parenthetical problems are solved left to right (e.g., 6 * (3 + 2) / (4 − 2) + 10). If more than one operation appears in a set of parentheses, these operations are solved according to the standard priority order, but they are all solved before any operation outside the parentheses is solved (e.g., 6 * (3 + 2 / 4 − 2) + 10).

You can put parentheses within parentheses, too. When you do this, the innermost parenthetical operation is solved first. For example, in the calculation 16 / (2 * (3 + 1)), the innermost operation, 3 + 1, is solved first. Then the result, 4, is multiplied by 2. Finally, that result, 8, is divided into 16.

Exercise: Using Multiple Sets of Parentheses in Calculations

1. Press the [redacted] and [redacted] keys to clear the screen. Type NEW and press the [redacted] key to erase the computer memory.

2. Type the following four program lines exactly as they appear. Press [redacted] after each line. Then type RUN and press [redacted].

```
1 PRINT (5 + 6) * (8 - 5)
2 PRINT (13 - 6 / 2)* 2
3 PRINT 10 * (13 - 6 / 2) / (5 * 2)
4 PRINT 1 + 10 * (13 - 6 / 2) / (5 * 2)
RUN
 33
 20
 10
 11
```

How the Program Works

In line 1, the 5 and 6 are added, and then 5 is subtracted from 8. The results, 11 and 3, are multiplied to get the answer, 33.

In line 2, the complex calculation 13 − 6 / 2 is solved first according to standard priority rules: 6 is divided by 2, and the result, 3, is subtracted from 13. Then, the result of the parenthetical calculation, 10, is multiplied by 2.

Line 3 has the same parenthetical calculation as line 2 (13 – 6 / 2) and it is solved first. Then, the second problem in parentheses, 5 * 2, is solved. At this point, the problem looks like this: 10 * (10) /(10). Next, 10 is multiplied by 10, and the result, 100, is divided by 10.

In line 4, the complex problem from line 3 reappears, but this time we are also adding 1. The solution follows the same order as in line 3. After the result of 10 is multiplied by 10 and then divided by 10, 1 is added to the final result. The addition of 1 is the last step because it is the operation with the lowest priority in the problem.

Exercise: Using Nested Parentheses in Calculations

1. Press the [redacted] and [redacted] keys to clear the screen. Type NEW and press the [redacted] key to erase the computer memory.

2. Type the following program lines exactly as they appear. Press [redacted] after each line.

```
1 PRINT (( 13 - 6) / 2) * 2
2 PRINT 1 + (2 * (44 - 30) + 4)
3 PRINT 1 + (2 * (44 - (30 + 4)))
4 PRINT 1 + (2 * 44 - (30 + 4))
RUN
 7
 33
 21
 55
```

How the Program Works

In line 1, the problem in the innermost parentheses, 13 – 6, is solved first. Then the result, 7, is divided by 2. That result, 3.5, is multiplied by 2.

In line 2, 30 is subtracted from 44 first. Then the result, 14, is multiplied by 2. That result, 28, is added to 4. Finally, 32 is added to 1.

In line 3, the first problem to be solved is 30 + 4. The result, 34, is then subtracted from 44. That result, 10, is then multiplied by 2 and added to 1.

In line 4, again, 30 is first added to 4. Then 44 is multiplied by 2. Then the result of 30 + 4, or 34, is subtracted from the result of 44 * 2, or 88. That result, 54, is finally added to 1.

Understanding the Priority Rules for Solving Calculations

If you have a hard time understanding why the calculations were solved in this order, try writing the problem on paper. Then cross

out the parts of the problems as you solve them. Remember to look first for the innermost parentheses, and then solve the problems there according to the standard priority rules.

The Less-Than Sign

Functions: The <-sign key

1. Prints the standard less-than symbol.
2. When printed together with the greater-than sign, prints < >, the computer symbol for nonequality.

The Greater-Than Sign

Functions: The >-sign key

1. Prints the standard greater-than symbol.
2. When printed with the less-than symbol, prints < >, the computer symbol for nonequality.

Relational Operators

The greater-than (>) and less-than (<) symbols are known as *relational operators*. Relational operators are commonly used in BASIC programs, usually to control program flow and execution. The relational operators you can use to program the Plus/4 computer are given in Table 8-1.

Table 8-1. Relational Operators

Symbol	Meaning	Example
>	The value on the left of the symbol is greater than the value on the right.	9 > 1
<	The value on the left is less than the value on the right.	3 < 7
=	The values on each side of the symbol are equal.	4 = 4
= >	The value on the left is equal to or greater than the value on the right.	7 = > 6
< =	The value on the left is less than or equal to the value on the right.	7 < = 7
< >	The values on each side are not equal.	5 < > 2

USING RELATIONAL OPERATORS TO CONTROL PROGRAMS

You've already used the FOR . . . NEXT loop a number of times in the exercises in this book. As you may recall, the FOR part of the loop looks like this:

FOR variable = beginning count value TO ending count value

In the FOR loop, the equal sign is a relational operator. The equal sign relates the value of the variable to the values of the beginning through the ending count values. The number of times the commands in the FOR . . . NEXT loop execute depends on the value of the variable in relation to the two values on the other side of the equal sign. The FOR loop begins when the variable equals the beginning count value, and ends when the variable equals the ending count value.

The IF . . . THEN . . . ELSE Command Sequence

The IF . . . THEN . . . ELSE command sequence lets you use any of the relational operators to set conditions for execution. In this command, you tell the computer IF the relationship between the value on the left side of the relational operator and the value on the right side is *true*, THEN follow the instructions after the word THEN. For example, in this command:

```
IF X = 5 THEN PRINT "FIVE"
```

the message FIVE is printed only if X does equal 5. If X doesn't equal 5, then FIVE isn't printed.

If you want to, you can also tell the computer to do something ELSE if the relationship between the values is false. In an IF . . . THEN . . . ELSE command sequence, you use the THEN clause to put the instructions you want followed IF the relationship is true (e.g., IF it's true that X does equal 5). You use the optional ELSE clause if you want to tell the computer what to do IF the relationship is false (e.g., IF it's not true that X equals 5). If you don't include an ELSE clause, the computer will automatically execute the instructions on the following line. The THEN clause is not optional.

The example shown in the display in Fig. 8-1 shows how to use an IF . . . THEN . . . ELSE command sequence.

How the Program Works

The following 4-line program is the same program as in Fig. 8-1.

```
1 X = X + 4
2 PRINT "X = ";X
3 IF X > 10 THEN GOTO 4: ELSE GOTO 1
4 PRINT "VALUE PAST RANGE"
```

First, lines 1 and 2 execute normally. Then, in line 3, the computer checks to see IF X is greater than 10. Since X currently equals 4, this is not a true condition. Because X isn't greater than 10, the computer follows the ELSE instruction, which is to go back to line 1 and execute the program again. Line 4 is ignored.

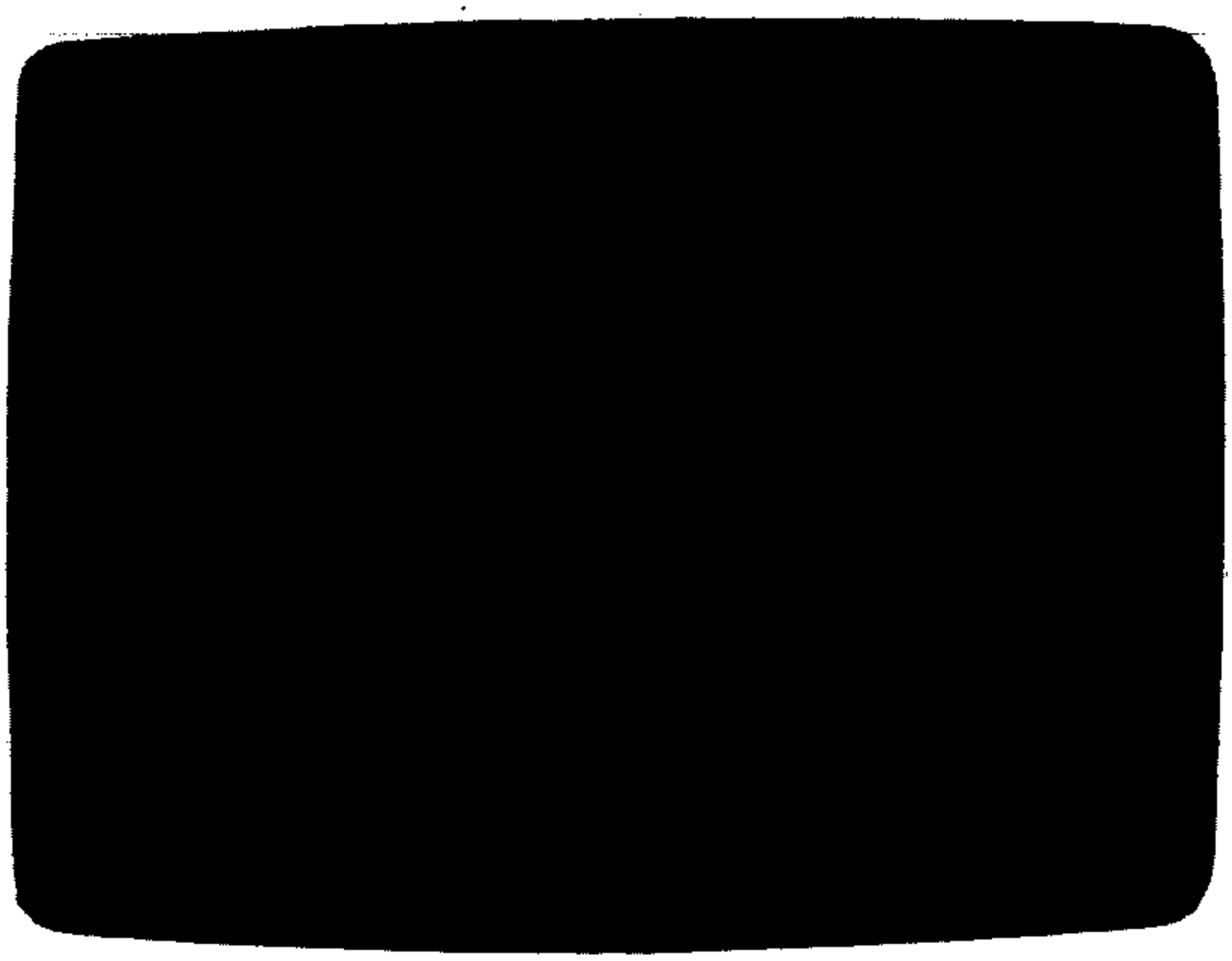


Fig. 8-1. The IF . . . THEN . . . ELSE command sequence.

Lines 1 and 2 are executed again. Now, X equals 8 (4 + 4). Again, in line 3, the computer checks the value of X to see IF it's over 10. It still isn't, so the ELSE command is followed again.

Lines 1 and 2 execute again. Now X equals 12 (8 + 4). In line 3, the computer checks X again. This time X is greater than 10, so the computer follows the THEN instruction, which is to go to line 4. The ELSE instruction is ignored this time.

Line 4 prints its message and the program ends.

The version of BASIC built into the Plus/4 computer contains more types of loops and conditional program controls than any other Commodore home computer. You can learn more about the other types of program control loops in the Commodore Plus/4 User's Handbook (Cat. No. 22390; Howard W. Sams & Co., Inc.).

SUMMARY OF CALCULATION RULES AND SYMBOLS

Use the operators given in Table 8-2 in a PRINT command when you want to solve equations and display the results.

The Plus/4 solves complex calculations in the following order:

First Priority:	Exponentiation
Second Priority:	All multiplications and divisions
Third Priority:	All additions and subtractions

If a problem contains more than one calculation from each priority group, the problems of the same priority are solved left to right.

Table 8-2. Mathematical Operators

Symbol	Meaning
+	Addition
–	Subtraction and negation
*	Multiplication
/	Division
↑	Exponentiation

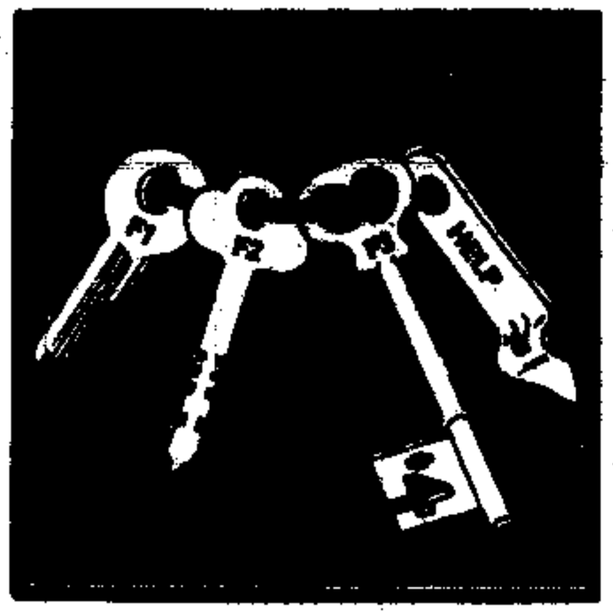
Using Parentheses To Alter Solution Priority

The Plus/4 computer solves the parts of the problem contained in parentheses before solving any other parts of a complex equation. If more than one operation appears in a set of parentheses, these operations are solved according to the standard priority order, but they are all solved before any operation outside the parentheses is solved.

When you put parentheses within parentheses, the innermost parenthetical operation is solved first. Table 8-3 lists relational operators and defines how they control program flow and execution.

Table 8-3. Relational Operators

Symbol	Meaning
>	The value on the left of the symbol is greater than the value on the right.
<	The value on the left is less than the value on the right.
=	The values on each side of the symbol are equal.
= >	The value on the left is equal to or greater than the value on the right.
< =	The value on the left is less than or equal to the value on the right.
< >	The values on each side are not equal.



UNDER-STANDING THE FUNCTION KEYS

The Plus/4 and the Commodore 16 computers are the first Commodore home computers to come with programmed function keys (Fig. 9-1) that let you perform tasks with the press of a key. The VIC 20 and the Commodore 64 have function keys, but they don't do anything unless you, or a software program, define functions for the keys.

Fig. 9-1. The Function keys.

DEFINING THE FUNCTION KEYS

Table 9-1 describes what each Plus/4 function key does. These function-key definitions apply when the computer is in BASIC language. The definitions are different when you are using commercial software, however. The software manual that comes with the software explains the definitions used in the program.

Table 9-1. Function Key Definitions

Key	Message Displayed	Function Definition	Additional Action Needed
[redacted]	SYS1525: 3-PLUS-1	Automatically turns on the built-in software. Loads the word processor.	Just press the [redacted] key.
[redacted]	DLOAD "	Loads a program from disk.	Type in program name and closing quotes. Press the [redacted] key.
[redacted]	DIRECTORY	Displays a list of all files on a disk.	Nothing.
[redacted]	SCNCLR	Clears the screen in any mode.	Nothing.
[redacted]	DSAVE "	Saves a program on disk.	Type in program name and closing quotes. Press [redacted] .
[redacted]	RUN	Executes the current program.	Nothing.
[redacted]	LIST	Displays a copy of the current program.	Nothing.
[redacted]	HELP	Identifies an error in a command or a program by putting the error in reversed print.	Nothing.

Key [redacted]: Accessing the Built-in Software

When you want to use one of the four programs built into the Plus/4 computer, just press Function key [redacted] . When you press the key, the message **SYS1525: 3-PLUS-1** is displayed. The cursor flashes next to the closing quote in the message. To complete the loading procedure, just press the [redacted] key. The word-processing program is automatically loaded and is ready for your use. For more information about the built-in software, read Chapter 5.

Key [redacted]: Loading a Disk File

The BASIC command, DLOAD, lets you bring a program stored on a disk into the computer memory so you can use the program. DLOAD, which stands for *Disk LOAD,* works only when you are loading a disk file. Use LOAD to get a program from a cassette tape.

After you turn on the disk drive and insert the disk containing the program you want to load, just press [redacted] . The computer displays the message **DLOAD "**. Type in the program name and the closing quote (the opening quote is automatically displayed by the computer). Then press the [redacted] key. The computer displays the messages SEARCHING and LOADING while the program is being loaded into computer memory. At the end of the loading

procedure, which takes less than a minute, the program is ready to use.

Key [F2]: Displaying the Contents of a Disk

The BASIC command, DIRECTORY, lets you see a list of all the programs and files on a disk. After you turn on the disk drive and insert the disk whose program names you want to see, just press [F2]. The computer displays the names and file types for each program. You'll also see how much space is left on the disk. This information is stated in the number of "blocks free." *Blocks* are the basic space units on a disk. A new disk has over 600 blocks. As the number of blocks free gets close to zero, the disk is nearly full.

The directory of program names scrolls by on the screen when you issue the DIRECTORY command. To slow down the display, hold down the [C=] key. To stop the display temporarily, press [CONTROL] and the [F2] key. Then, when you press any key, the suspended display continues.

Key [F3]: Clearing the Screen

When you want to clear the screen in any text or graphic mode, you can press the [F3] key. After you press [F3], the screen clears and the cursor goes to the HOME position, which is the top left corner of the screen. Any immediate-mode commands are permanently lost when you clear the screen, but the programs currently in memory are not affected. To display the current program, press the [F4] key. To execute the current program, press the [F5] key.

Key [F4]: Saving a File Onto a Disk

The BASIC command, DSAVE, lets you store the current program onto a disk so you can reuse the program later by loading it back into computer memory. DSAVE, which stands for *Disk SAVE,* works only when you are storing a disk file. Use SAVE to store a program onto a cassette tape.

After you turn on the disk drive and insert the disk onto which you want to store the program, just press [F4]. The computer displays the message **DSAVE "**. Type in the program name and the closing quote (the opening quote is automatically displayed by the computer). Be sure to give each program a different name. Then press the [RETURN] key to execute the command.

At the end of the storing procedure, which takes less than a minute, the program is stored on the disk. The program is also still in computer memory until you clear it out by loading another program or by executing the NEW command.

Key [RUN] : Executing a Program

The BASIC command, RUN, executes the current program. After you type in a BASIC program, or load one you've stored on a tape or disk, just press the [RUN] key to execute the program. You generally don't have to issue the RUN command when you are using programs on cartridge or commercial programs on tape or disk. Commercial software usually executes automatically when you load the program.

Key [LIST] : Displaying a Copy of a Program

The BASIC command, LIST, displays a copy of the program currently in memory. When you want to display a fresh copy of the BASIC program that's currently in memory, you can press the [LIST] key.

If you've made changes to the program, the LISTed version will show all the changes. LIST also displays all the program lines in numerical order even if you've typed them out of order. LIST does not, however, correct any errors, such as misspellings or improperly used commands.

Key 8, The [F8] Key

You probably noticed that the [F8] key is listed as key 8 when you enter the KEY command. [F8] is the key function and 8 is the key number even though the number is not listed on the key itself. This might seem a little confusing since the other keys are named on the keyboard by number, not by function.

The main reason that this key (Fig. 9-2) is listed by function instead of by number is that software designers use the [F5] key in their programs, but they aren't likely to use the other built-in definitions of the function keys. Since the other keys are listed by number instead of by function, the Plus/4 function keys can be reused for a variety of software and programming applications with less confusion about what each key does.

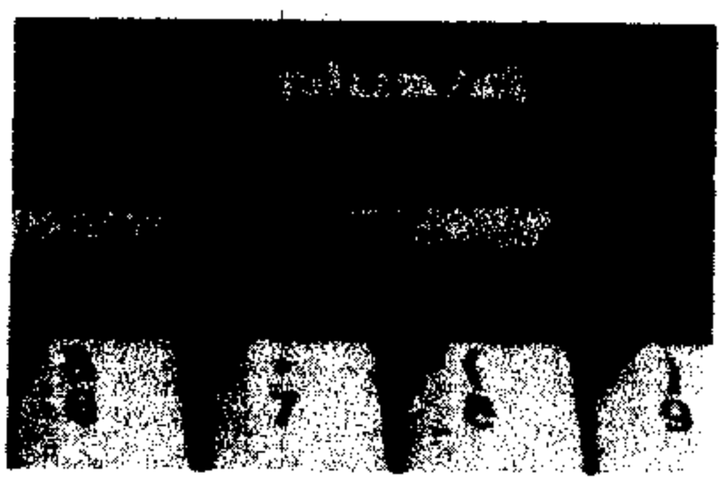


Fig. 9-2. The [F8] key.

Displaying the Function-Key Definitions

Any time you want to display a list of what each function key does, just type the command KEY and press the RETURN key. The computer displays a list of the key numbers and their definitions.

The list looks slightly different from what is displayed when you just press the function keys themselves. This is because the KEY command shows you *how* the keys are programmed, while pressing a function key displays just *what* the key is programmed to do.

REPROGRAMMING THE FUNCTION KEYS

The Plus/4 function keys are not only programmed for you, but they can be easily reprogrammed. Reprogramming the Plus/4 function keys is much easier than programming the Commodore 64 and VIC 20 function keys because reprogramming the Plus/4 keys requires only one simple BASIC command, the KEY command. This command isn't part of the BASIC language version built into the other computers.

THE KEY COMMAND

You have already seen that the KEY command can display a listing of the definitions of all the function keys. The KEY command is also used to reprogram the function keys. You can program a function key to do simple or complex tasks. Follow these steps to reprogram a function key:

STEP 1. Type the command KEY and don't press the RETURN key.

STEP 2. Type the number of the key you want to reprogram. Then type in a comma.

STEP 3. Use correct BASIC syntax to type in what you want the key to do.

If you want the key to display what it does on the screen, put the BASIC command(s) in quotes. For example, to tell the computer to print the next line number automatically after you enter each program line, you can use the definition: **KEY 3,"AUTO"**.

If you want the cursor to remain on the same line as the printed command so you can add additional information before you issue the command, just type the BASIC command in quotes. For example, **KEY 5,"PRINT"** will display the BASIC word PRINT with the cursor just to the right of PRINT. As soon as you press the function key, the BASIC word PRINT is displayed, the cursor

remains next to it, and you can type what you want printed.

If you want the command to be followed by a quotation mark, type in **+ CHR$(34)** after the BASIC command. Adding CHR$(34) to the command definition leaves the cursor on the same line as the command so you can add more information.

The definitions for Function keys 2 and 5 print a quotation mark. The only reason to add this to the definition is if the BASIC command is always, or generally, followed by something, such as a file name, that must be in quotes.

If you want the command to be followed by an automatic [RETURN], type in **+ CHR$(13)** after the BASIC command. The definitions for several of the function keys, such as the [LIST] key, contain the automatic [RETURN]. The only reason to add this to the definition is if the BASIC command is never, or almost never, followed by any additional information, such as a file name.

For example, you can qualify a RUN command with a starting line number if you don't want to RUN the program from the beginning, but from some certain point in the program. This is the exceptional case. You almost always RUN a program from the beginning of the program. RUNning a program from the beginning requires no line number; just type the BASIC word RUN and press the [RETURN] key.

If you want the key to do more than one thing, join the BASIC commands with plus signs (+). For example:

```
KEY 4, "RUN"+CHR$(13)+"LIST"+CHR$(13)
```

This command string defines key 4 to RUN a program and then LIST it. CHR$(13) is the code for an automatic [RETURN].

USING THE CHR$ FUNCTION

We have used CHR$ several times in the KEY definitions. CHR$ is a BASIC function, similar to a BASIC command. Every key on the keyboard has a unique *character-string code.* The character-string code, abbreviated CHR$, is another way of identifying a key to the computer. For example, to the computer, CHR$(13) means the same thing as the [RETURN] key.

To use the CHR$ function, type:

```
CHR$ (the code for the key)
```

To find the numeric code for each key, type in:

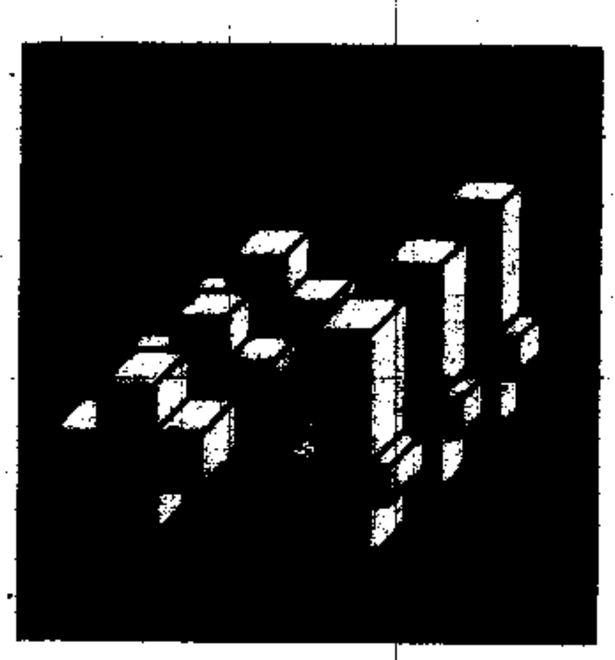
```
PRINT ASC("Key")
```

The key must be enclosed in quotes inside parentheses. For example, PRINT ASC ("+") will return the number 43, which is the

CHR$ code for the plus sign. Press the key itself, with the SHIFT, CONTROL, or C= keys, if required. When the ASC function returns a number, this is the CHR$ code for the key. ASC (the abbreviation for ASCII) and CHR$ are complementary functions.

A complete table of ASCII and CHR$ codes appears in the appendices of the *Commodore Plus/4 User's Handbook** and also in the *Commodore Plus/4 User's Manual* that comes with the Plus/4 computer. A complete list of the BASIC functions also appears in these manuals. The functions are listed without explanation at the end of Appendix A in this book.

*The Commodore Plus/4 User's Handbook (Cat. No. 22390), by Sarah C. Meyer, is published by Howard W. Sams & Co., Inc.



BASIC VERSION 3.5

COMMANDS

AUTO
Numbers BASIC program lines automatically.

BACKUP
Makes a copy of a disk.

BOX
Draws a box in any of the graphic modes.

CHAR
Displays text anywhere on any screen.

CIRCLE
Draws circles, arcs, ovals, triangles, and other polygons.

CLOSE
Closes a data file or access to an open peripheral device.

CLR
Erases variables in memory without affecting the current program.

CMD
Redirects output from the screen to a different device.

COLLECT
Removes improperly closed files from a disk and its directory.

COLOR
Changes the color of the screen, the characters, the border, and the multicolor area.

CONT
Restarts a halted BASIC program.

COPY
Makes a copy of a disk file.

DATA
Lists values assigned to variables by READ commands.

DEF FN
Defines any calculation as a function.

DELETE
Deletes BASIC program lines.

DIM
Sets the number of elements in an array of variables.

DIRECTORY
Displays a directory of files on a disk.

DLOAD
Loads a program from a disk.

DO
Sets the conditions for executing the commands between DO and LOOP commands.

DRAW
Draws dots, lines, and shapes.

DSAVE
Stores a program onto a disk.

ELSE
Tells the computer what to do when an IF condition is false.

END
Terminates a program.

EXIT
Ends a DO . . . LOOP sequence.

FOR . . . TO . . . STEP
Tells the computer how many times to repeat some lines of a BASIC program.

GET
Lets you enter data by typing a single character at a time.

GETKEY
Tells the computer to wait for you to type a single character.

GET#
Inputs one character at a time from an OPENed device or file.

GOSUB
Tells the computer to execute a subroutine.

GOTO
Tells the computer to continue execution at the line named.

GRAPHIC
Selects one of the five graphics modes and can clear a 10K area devoted to graphic modes.

GSHAPE
Retrieves a saved graphics screen area in any graphics mode.

HEADER
Prepares a new disk for use.

HELP
Shows an error in a BASIC program.

IF . . . THEN . . . ELSE
Sets the conditions for executing program lines.

INPUT
Asks you to type in a value while the program is running.

INPUT#
Assigns data from an OPEN file or device.

KEY
Displays the definitions of the function keys and lets you reprogram them.

LET
Assigns a value to a variable. The word LET is optional.

LIST
Displays BASIC program lines.

LOAD
Loads a program from cassette tape.

LOCATE
Moves the pixel cursor (PC) to a point on the graphics mode screen.

LOOP
Works with DO to set conditions for a repeated sequence of program lines.

MONITOR
Calls the built-in machine-language monitor.

NEW
Clears the current program from memory.

NEXT
Continues a FOR loop and updates the value of the counter variable.

ON
Conditionally sends program control to a line (with GOTO) or a subroutine (with GOSUB).

OPEN
Gives the computer access to a peripheral device.

PAINT
Colors in a screen area in a graphics mode.

POKE
Puts a value into a specific RAM location.

PRINT
Displays text entered inside quotes and displays answers to calculations.

PRINT#
Prints items to a device or to an opened file.

PRINT USING
Defines the output format of text and numbers.

PUDEF
Redefines up to four of the symbols displayed by a PRINT USING command.

READ
Assigns DATA list values to variables.

REM
Lets you include unexecutable explanatory comments in your program.

RENAME
Lets you give a new name to a disk file.

RENUMBER
Renumbers BASIC program lines.

RESTORE
Resets the DATA list pointer so that the items in the list can be reREAD.

RESUME
Returns to the current program after an error is found by the TRAP command.

RETURN
Ends a subroutine and returns program execution to the proper line after the last GOSUB command.

RUN
Executes the current BASIC program.

SAVE
Stores a BASIC program onto a cassette tape or a disk.

SCALE
Changes the scaling of the bit maps in graphics modes.

SCNCLR
Clears the screen in any mode.

SCRATCH
Removes a file from a disk.

SOUND
Makes a sound.

SSHAPE
Saves part of graphics screens in any graphics mode.

STEP
Tells the computer how much to add to or subtract from the counter variable in a FOR . . . TO . . . NEXT loop.

STOP
Stops program execution so you can debug the program.

SYS
Tells the computer to go to a machine-language program at the location named.

THEN
Tells the computer what to do when an IF condition is true.

TO
Sets the ending count in a FOR . . . TO . . . NEXT loop.

TRAP
Can catch program errors during execution so that the execution can continue.

TROFF
Turns off the error-tracing functions that are turned on by the TRON command.

TRON
Turns on the error-tracing functions of the Plus/4 computer.

UNTIL
Sets a closing condition in a DO . . . LOOP sequence.

VERIFY
Compares the current program to a program on tape or disk.

VOL
Selects the volume for sounds, including all voices.

WAIT
Suspends program execution until the value of the memory location named equals the value(s) of the WAIT parameters.

WHILE
Sets the continuation conditions in a DO . . LOOP sequence.

FUNCTIONS

BASIC language Version 3.5 also contains the following functions. These are explained in greater detail in the *Commodore Plus/4 User's Handbook*.*

ABS	ASC	ATN	CO$
DEC	EXP	FN	FRE
INSTR	INT	JOY	LEN
LOG	PEEK	PI	POS
RCLR	RDOT	RGR	RLUM
RND	SGN	SIN	SPC
SQR	TAB	TAN	USR
VAL	CHR$	ERR$	HEX$
LEFT$	MID$	RIGHT$	STR$

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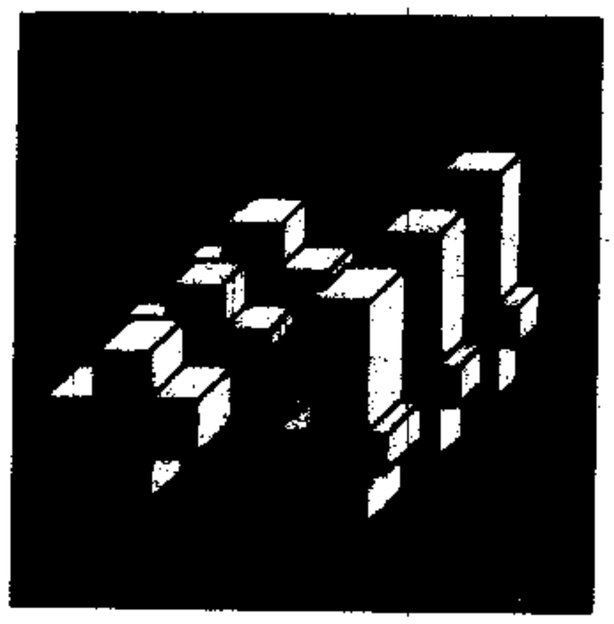


WRITING PROGRAMS IN MACHINE LANGUAGE

Besides writing programs in BASIC language, you can also write programs in *machine language,* which is also called *assembly language.* Although machine language is more difficult than BASIC, its execution speed is much faster. Machine language lets you communicate more directly with the computer because the computer does not have to spend so much time coverting your commands into the binary code that actually programs the computer.

Unlike BASIC, machine language is not English-like and is, therefore, not as easy to learn. Machine language is essentially a structured series of numbers, so you can't easily understand a program just by looking at its lines — even if you know machine language. This may sound discouraging, but it's not as hard as it sounds. You can teach yourself to read machine language and can learn to write machine-language programs.

Because machine-language programs are hard to read, you need a machine-language monitor to help document programs. Unlike most other home computers, the Plus/4 computer contains a built-in machine-language monitor. The monitor is made up of 13 commands that help clarify the machine-language programs. You can run machine-language programs independently or as BASIC subroutines. Enter this built-in software by typing the BASIC command, MONITOR.

MONITOR COMMANDS

The following list gives the built-in machine-language commands.

A

Assembles one program line (6502 code).

C

Compares and discloses the differences between two memory segments.

D

Disassembles one program line (6502 code).

F

Fills a memory location by putting a byte value there.

G

Goes to a memory address and begins execution.

H

Hunts for locations of specified bytes in memory.

L

Loads a disk or tape file.

M

Displays memory location values (hexadecimal).

R

Displays the registers (6502).

S

Saves a file on disk or tape.

T

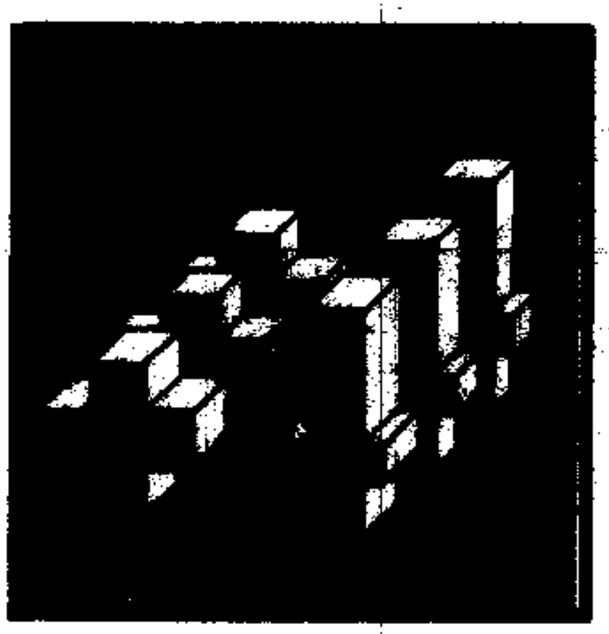
Transfers code to a new memory location.

V

Verifies a saved file with the current memory contents.

X

Leaves the machine-language monitor program and returns to BASIC.



BUILT-IN SOFTWARE COMMANDS

This appendix lists and briefly describes all the commands that can be used in each of the built-in programs. The commands are divided into groups under the program in which they run. Graph-generator programs are entered through the spreadsheet.

GENERAL COMMANDS

The following key commands can be used in most of the built-in programs.

Ctrl C
Turns on command mode.

Ctrl Q
Repeats the previous command.

Ctrl @
Erases a [redacted] key symbol.

The following commands are organized by the program in which they are used. All commands are typed after you first press Ctrl and [redacted] together, which is how you enter the command mode.

FILE-MANAGER COMMANDS

CA
Lists a CAtalog, or directory, of files on a disk.

DS
Sorts records on a disk by a field (or fields) that you name.

HIGHRC
Sets an upper limit for the record number in working with a file.

NEWTF
Lets you enter a new file design.

NR
Automatically updates the current record. Lets you enter records quickly.

PI
Creates a subfile so you can search for a range of entries.

RC
Lets you enter a new record, or retrieve a stored record.

RESETLIST
Cancels subfiles but doesn't affect any data.

RV
Lets you quickly see all records in the current file.

SR
Searches for a word or phrase.

TC
Goes to the spreadsheet.

TF
Displays the status of the current file.

TW
Goes to the word processor.

UD
Stores the current record entry.

SPREADSHEET COMMANDS

Key commands

Ctrl keys or key
Moves the cursor one cell to the right.

Ctrl keys or key
Moves the cursor one cell to the left.

Ctrl keys
Lets you enter a formula into a cell.

Ctrl keys
Lets you enter a number into a cell.

Ctrl keys
Lets you enter text into a cell.

= key

Precedes a number when you are entering a formula.

Typed commands

ABS

Figures the absolute value of a number in a cell.

ATN

Figures the arctangent of a number in a cell.

AUTO

Automatically calculates all formulas.

BLKMAP

Transfers spreadsheet data to the word processor.

CA

Lists a CAtalog, or directory, of files on a disk.

CCO

Copies data from one column to another.

CDEL

Deletes the entries in a column. Columns to the right move over to the left.

CINS

Lets you insert a column.

CM

Clears the memory by erasing the current spreadsheet work area.

COLOR

Changes the screen color.

COPY

Copies the entry in one cell into another cell.

COS

Figures the cosine of a number in a cell.

DF

Permanently deletes a disk file.

DIV

Divides a series of cell numbers.

EXP

Raises the constant *e* (2.71827183) to a power.

FIT
Copies a formula from one cell to another, and adjusts the formula to the new cell.

FL
Cancels IN (and $$) by returning numbers to floating-point format.

FORMAT
Prepares a blank diskette for use. Do not use on a disk that already contains information unless you are willing to erase all the contents.

FRE
Freezes the current value of a cell so changes and formulas do not affect it.

FU
Cancels an HA (half screen) command by returning the work area to full screen.

GOTO
Moves the cell cursor to a specified cell.

GR
Goes to the graph generator.

HA
Splits the screen in half so that a word-processing work area and a spreadsheet work area can appear on the screen simultaneously.

HOME
Moves the cell cursor to row 1, column 1.

ID
Initializes the disk.

IFTRUE
Enters a value in a cell IF a condition is true. Similar to the BASIC IF statement.

IN
Displays numbers as integers, without decimal parts.

LEFTJ
Left justifies numbers in cells.

LF
Loads a file from disk.

LOG
Figures the logarithm of a cell.

MAN
Turns off AUTO so calculations are performed cell-by-cell only.

MAP
Transfers data from the spreadsheet to the word processor.

MAX
Finds the largest number in a row.

MIN
Finds the smallest number in a row.

MLT
Multiplies a series of numbers.

OFF
Cancels a MAP command.

RCO
Copies a row into another row.

RDEL
Deletes the current row.

RESET
Clears memory and erases data. Returns the Plus/4 computer to the built-in programs' title screen and resets to the beginning of the word processor.

RIGHTJ
Turns off LEFTJ by right justifying a number in a cell.

RINS
Inserts a row.

SF
Saves the current file to disk.

SIN
Figures the sine of a number

SUB
Subtracts a series of numbers.

SUM
Adds a series of numbers.

TAN
Figures the tangent of a number.

TF
Goes to the file manager.

THAW
Cancels a FRE command, allowing the value in a cell to be subject to change.

TRANSFER
Moves the value in one cell to another cell.

TW
Goes to the word processor.

$$
Turns on dollar formatting, which means numbers are displayed with two decimal points.

WORD-PROCESSOR COMMANDS

Key commands

Ctrl keys or Alt key
Moves the cursor to column 41.

Ctrl keys or Alt key
Moves the cursor to column 1.

[redacted]
Sets and cancels a tab.

[redacted]
Turns on reversed-image mode, which is used for formatting commands.

[redacted]
Turns off reversed-image mode.

[redacted]
Acts as a tab key.

Typed commands

CA
Lists a CAtalog, or directory, of files on a disk.

CB
Creates a block of text up to sixteen lines long. You can move or delete an entire block with one command.

CM
Clears the memory by erasing the current word-processing document.

CP
Clears all pointers set with the SP command.

CT
Clears tabs set with the [redacted] command.

DB
Deletes a block of text.

DF
Permanently deletes a disk file.

DL
Deletes a line of the word-processing work area.

EP
Erases one pointer set with the SP command.

FU
Cancels an HA (half screen) command by returning the work area to full screen.

HA
Splits the screen in half so that a word-processing work area and a spreadsheet work area can appear on the screen simultaneously.

IB
Inserts a block of text anywhere in a document.

ID
Initializes a disk.

IL
Inserts a blank line between two text lines.

LF
Loads a file from disk.

MF
Merges a disk file with the file currently displayed in the work area.

***P**
Prints the file currently in the work area.

PR
Saves the document currently in the work area. Then lets you load and print linked files.

RE
Searches for a word or phrase and replaces it with something else.

SF
Saves the current file to disk.

SP
Sets a pointer that identifies the end of a block of text.

SR
Searches for a word or phrase.

TF
Goes to the file manager.

TC
Goes to the spreadsheet.

COMMANDS FOR FORMATTING PRINTOUTS

Asc
Sends an ASCII character to the printer so you can print boldfaced text.

Center
Centers a line when the file is printed.

fld
Prints a specified field from the file manager into the word processor.

eof?
Checks to see if the last file manager record has been printed.

Justify
Right justifies a line when the line is printed.

Linkfile
Links files so they can be printed as a continuous document.

Lmarg
Sets the left margin when the file is printed.

Nextpage
Tells the printer to start a new page.

NoJustify
Turns off the *Justify* command.

Nowrap
Turns off word wrap (*Wrapon*) so you can print spreadsheets.

No#page
Turns off the *#Page* command.

Other
Tells the computer you're using a non-Commodore printer.

#Page
Prints the page number at the bottom of the page.

Pagelen
Sets the number of lines to be printed on a page. Default = 6Ø.

Pagepause
Stops the printout at the end of each page.

Papersize
Tells the computer you're printing on a page that is different from the default of 66 lines long.

Pause
Stops a printout. Restart by pressing [redacted].

#rc
Prints the record number.

Rmarg
Sets the right margin when the file is printed.

Set#pg
Used with *#Page* to set the page number to be printed on each page.

tf;:rc;
Begins a list of items to be printed from file-manager records. Used in a word-processor file.

ttl
Prints the name of a file-manager field.

Wrapon
Turns word wrap back on after a *Nowrap* command.

GLOSSARY

Array—A collection of data treated as a unit. An array, sometimes also called a matrix, can be one-dimensional (just a row of data), two-dimensional (rows and columns of data), and three-dimensional (rows and columns with depth). When you store data in compact form in an array, you can then access each element in the matrix by using a variable that names the whole array, and a subscript that names the specific row and column (e.g., A(4,3) refers to the value at row 4, column 3 in array A).

Bar Graph—An illustration that compares amounts by showing them in different-length bars. The graph generator built into the Plus/4 computer can draw bar graphs.

BASIC—An easy-to-learn computer language that is built into the Plus/4 computer. You use BASIC commands to tell the computer what to do.

Block—In a word processor, a block is a line or group of lines. You can identify the block and then move it elsewhere on the screen, delete it, etc.

Built-in Software—The Plus/4 computer has software programs built into the computer on memory chips. You don't need any additional computing equipment, storage media, or cartridge to run this software. This software is in addition to the BASIC language that is also built into the Plus/4 computer.

Cartridge—Some software, particularly games, is recorded on cartridges, which contain a program on memory chips. Cartridges do not require any additional computing equipment, but you cannot store your own software on cartridges.

Cassette Tape—A magnetic medium for data storage and retrieval, cassette tapes for computer use are just like the cassette tapes on which music can be stored. Software on cassette tapes runs in a special cassette tape recorder.

Cassette Tape Recorder—A piece of peripheral computing equipment that runs and records software on cassette tapes. The Commodore cassette recorder that works with the Plus/4 computer is called the Model 1531 Datassette. A cassette recorder is less versatile than the other type of home-computer memory drive — the disk drive. The cassette recorder device number is 1.

Cell—A position on a spreadsheet work area where a data item or formula can be entered. A cell is the intersection of a row and a column. Each cell is known by its *row; column* number. For example, the top left cell is *row1;column1.*

Character—This term is used to refer to any of the letters, numbers, punctuation marks, graphic symbols, or other special symbols your computer can display.

Computer Information Service—If you have a modem, you use your telephone to connect your computer to services, which offer a variety of information sources, free software, etc.

Copy-Protected—Some software is designed to prevent users from making a copy of it. If you buy copy-protected software, you cannot make a back-up copy.

Daisy-Wheel Printer—Refers to the type of print wheel used in many letter-quality printers. These print wheels are not used in dot-matrix printers.

Data Bank—A large store of information accessible by computers, usually through modems.

Database—See File Manager.

Device Number—Each piece of peripheral computing equipment has a device number that identifies it to the computer. For example, the cassette recorder is number 1, the tv or monitor screen is number 3, the printer is number 4, and the disk drive is number 8. These device numbers are used to tell the computer where to send or look for information.

Diskette—A medium for storing computer programs and information. Software on diskettes is run and stored on a disk drive. The Plus/4 disk drives use 5¼-inch floppy diskettes. Diskettes are commonly called "disks," and sometimes "floppies."

Disk Drive—A piece of peripheral computing equipment that runs and records software on diskettes. A disk drive is more complex and more versatile than the other type of home-computer memory drive — a cassette tape recorder. The disk drive device number is 8.

Dot-Matrix Printer—A relatively high-speed and inexpensive type of printer whose type quality is not as good as a letter-quality printer. Dot-matrix characters are printed as a series of close together dots rather than as a whole character.

Electronic Spreadsheet—See Spreadsheet.

Enhanced Print—Some dot-matrix printers can print a darker type face that makes the printed characters look more like letter-quality type. This darker print is called *Enhanced, Emphasized,* or *Double print.*

Fanfold Paper—Most printers can print on either standard letter or legal-sized paper, or on connected sheets of paper called a *Fanfold Roll.* This type of paper lets you print more than one page continuously.

File Manager—Also called a database manager, this type of program lets you define and organize groups of data into files. You can get access to the data records via categories that you name. The Plus/4 computer has a built-in file manager.

Floppy Disk—Another name for the 5¼-inch flexible diskettes that are used in disk drives.

Graph Generator—A program that creates a graphic illustration to compare a group of numbers. The graph generator built into the Plus/4 computer can draw bar and point graphs.

Hard Copy—A paper copy of computer-produced material, printed on a computer printer.

Hardware—Any piece of equipment, such as a computer, a printer, a disk drive, etc. The opposite of hardware is *Software,* the name for the instructions, or programs, that are run by the hardware.

IEEE-488 Interface—An adapter cable that plugs into the memory expansion port so you can attach IEEE peripherals. Since the Plus/4 computer does not have an IEEE port, the only way to use IEEE peripherals is by connecting an IEEE interface cable.

Input—Information sent to the computer memory from a peripheral device, such as the disk drive or the keyboard. Any instruction you type is "input."

Interface—Generally used to identify anything that serves as a go-between. We use the term in this book to mean a cable or card that acts as an adapter to let you use peripherals you couldn't otherwise attach to the computer.

Letter-Quality Printer—A computer printer whose type quality is equivalent to that of a typewriter. Letter-quality printers are more expensive and are usually slower than dot-matrix printers, but they print a much better quality output.

Loading—The term for retrieving a stored program for cartridge, cassette tape, or disk and bringing the program into the computer memory where it can be used. Cartridge software is automatically loaded when you install a cartridge and turn on the computer. The command for loading software on cassette is *LOAD "program name"*. The command for loading software on disk is *DLOAD "program name"*. You can also use the LOAD command to load software from a disk but, if you do, you must also give the disk drive device number, which is 8.

Logical File Number—The temporary and arbitrary number associated with a BASIC file during its use. You first give the logical file number when you address the file in an OPEN statement. Then you use the same number in other commands to refer to the file.

Logo—A programming language designed for children.

Loops—Repeated execution of a sequence of commands within a program. Program flow control commands that create loops include: FOR...NEXT...STEP, IF...THEN...ELSE, and DO...LOOP...WHILE...UNTIL...EXIT.

Luminance—The brightness of a color. The Plus/4 computer lets you select one of eight luminance levels for each of the 16 basic colors (except black) listed on the color/number keys.

Matrix—A form composed of rows and columns, like a chart. Computers let you store data in compact form in matrixes (also called *Arrays*). You can then access each element in the matrix by using a variable that names the whole matrix, and a subscript that names the specific row and column (e.g., A(4,3) refers to the value at row 4, column 3 in matrix A).

Matrix also refers to a type of printer (a dot-matrix printer) that prints each character as a series of dots from a matrix of rows and columns of dots. The dimensions of the matrix are equal to the widest and tallest character the printer can print.

Memory—All the information the computer "knows" without having to search a peripheral device, including the keyboard. Memory is the computer's current information base.

Memory Drive—A peripheral that loads and stores information into and from a computer. The memory drives you can use with a Plus/4 computer are a disk drive and a cassette tape recorder.

Modem—A peripheral that attaches to a computer and to a telephone to enable you to connect your computer to another computer, including a computerized information service, such as *The Source*℠ or *CompuServe*™.

On-Line—Refers to the relationship of a terminal and a host computer connected by phone lines. When you use a modem to connect your computer to another computer, or to a computer information service, your computer becomes an on-line terminal. *On-line* also refers to the information that can be transmitted to and from another computer.

Operators—The mathematical symbols (e.g., + and /) and relational symbols (e.g., < and =) used in BASIC language to construct calculations and relationships, such as X > 3.

Outout—Information sent from the computer to a peripheral device, such as the printer, the screen, or a memory drive.

Parallel Printer—A computer printer that is connected to a computer by a parallel outlet and cable. The Plus/4 computer has a serial outlet, but not a parallel outlet. You can, however, use a parallel printer by using a parallel-to-serial interface cable.

Peripheral—A piece of computing equipment other than a computer. Peripherals are those devices that are added onto the computer. Examples are disk drives, printers, modems, and speech synthesizers.

Plotter—A peripheral that plots designs and prints text.

Point Graph—An illustration of the relationship of a group of values, a point graph shows the highest points of each item being compared. The built-in graph generator can draw point graphs.

Port—A computer outlet where a peripheral, such as a modem or disk drive, can be attached.

Printout—Information from the computer printed on paper by a printer.

Program—A set of instructions written in a computer language, such as BASIC, that tells the computer what to do. Programs are also called software.

Prompt—A message, question, or symbol that the computer displays to tell you to input some information. For example, a program containing an INPUT command displays a question mark to prompt you to enter information during program execution. The built-in programs contain many prompts that help you use the software. For example, OK TO FORMAT DISK? Y/N asks you to respond Y (for Yes) or N (for No) to tell the computer whether to go ahead and prepare a new disk.

RAM—One of the two types of computer memory. Random-access memory is the type of memory that can both write to (send information to) and read from (get information from), while you can only get information from ROM (read-only memory). For example, when you load a program, it is placed into RAM.

Read-Protected Software—A feature of a program designed to prevent you from loading and viewing the program. You can execute a read-protected program, but you just can't read the program lines.

Relational Operators—The symbols used to show a relationship, such as equality, between two values. These symbols are: < (less than), > (greater than), = (equal), < > (not equal), < = (less than or equal to), > = (greater than or equal to). Relational operators are often used in program control loops. Also called *comparison operators.*

ROM—One of the two types of computer memory. Read-only memory is the type from which you can only get information. You cannot write to it. For example, the computer operating system is stored in ROM.

RS-232—A communications standard for a type of serial connection to a computer.

Serial Bus—The port on the back of the Plus/4 computer where you plug a printer or the Model 1541 disk drive.

Serial Printer—A printer that has a serial connector and can usually be plugged directly into the serial port on the Plus/4 computer.

Software—A set of instructions that tells your computer what to do. Software is also called a *program.*

Speech Synthesizer—A device that plugs into the Plus/4 computer and produces simulated speech. You can program the synthesizer yourself, and you can buy talking software.

Spreadsheet—A spreadsheet program, such as the one built into the Plus/4 computer, combines the features of a row-and-column ledger sheet with the diverse mathematical operations of a calculator. You can use a spreadsheet to figure budgets, make estimates, and answer "what-if" questions about groups of numerical data.

Storage Device—A memory drive (cassette recorder or disk drive) that can store and recall information from a storage medium (tape or disk).

Switchbox—The attachment to a tv set and a computer that lets you switch control of the tv screen between the tv set and the computer.

Terminal—A keyboard and screen used to communicate with a computer. Often this term refers to a computer that has traded its independent computer status in order to connect to a host computer that controls the terminal. When you connect your computer to a computer information service, your computer becomes a terminal of the host-computer service.

Terminal Emulator—A program that is used in conjunction with a modem to turn your computer into a terminal when you connect to another computer or to a computer information service.

User Port—Another name for the RS-232 port on the back of the Plus/4 computer.

Variable—One or two characters that stand for another value or values. The values may be numbers or text, and they can change throughout a program execution. There are a variety of ways to assign values to variables in a BASIC program.

Word Processor—A program with features that let you write and format documents. For example, a word processor lets you move blocks of text, make instant corrections, delete or insert letters, words, paragraphs, and pages of text, etc. The software built into the Plus/4 computer includes a word processor.

Write-Protected—A feature in a program that is designed to prevent the user from saving anything into the program.

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