

Chapter 1

Introducing CBM Computers

This book describes the following Commodore computers:

1. The PET 2001/8K
2. The PET 2001/8N, 2001/16N and 2001/32N
3. The CBM 2001/16B and 2001/32B
4. The CBM 4000 series
5. The CBM 8000 series

In 1977, Commodore Business Machines released the first of the CBM series, the PET 2001 (Personal Electronics Transactor). The PET 2001 is a self-contained unit with a compact graphic keyboard and built-in tape cassette unit. The CBM 2001, which was released next, has an expanded, full-size graphic keyboard. Although functionally the same as the PET, the CBM 2001 and subsequent CBM models do not have a built-in cassette tape unit; instead they depend on external peripherals to store information. The CBM 2001/B business computer is a variation of the CBM 2001. The major physical difference between the CBM 2001 and the CBM 2001/B lies in the keyboard; the CBM 2001 has a full-size keyboard with graphic symbols, whereas the CBM 2001/B has a standard typewriter keyboard without graphic symbols on the keys. CBM 8016 and CBM 8032 business computers are the most recent introductions; they both have an 80-column CRT display, but are otherwise the same as the CBM 2001/B. The CBM 8032 has twice as much memory as the CBM 8016; in other respects these two models are identical.

Commodore has also released printers and disk drives. Continual updates for Commodore BASIC and disk operating system software are being released.

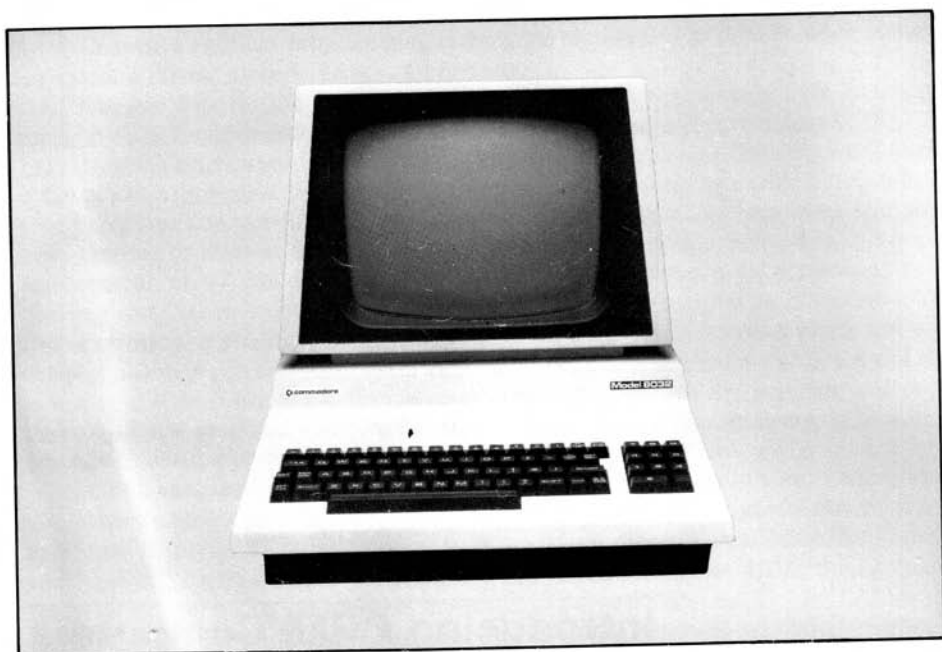


Figure 1-1. CBM 8000 Computer

Commodore's original computer was the PET, and this name became well known. But recently introduced computers have a CBM model designation. Therefore **this book will adopt the convention of referring to the entire computer product line as CBM computers, unless only the original PET is specifically referenced.** We will refer to both the CBM 8016 and CBM 8032 models using the general model name CBM 8000, unless one model or the other needs specific reference.

Currently CBM computers are available with 8K, 16K, or 32K bytes of memory. Only the original PETs had a 4K memory byte option. 1K means $1024 (2^{10})$. One byte holds one character of data. The 8K, 16K and 32K designations refer to the amount of usable read/write memory. Every CBM computer has additional memory that is inaccessible to users. It is important to know how much usable read/write memory is available to you. A CBM computer with more memory can run longer programs and handle more data.

CBM MODELS

The CBM 8000 (CBM 8016 and 8032)

The CBM 8000 is shown in Figure 1-1. Its main distinguishing feature is the enlarged 80-column Cathode Ray Tube (CRT) display, or screen. It has a full-size typewriter keyboard, some unique screen editing keys, and a numeric keypad to the right. The CBM 8016 has 16K bytes of read/write memory. The CBM 8032 comes with 32K bytes of read/write memory. The CBM model number correlates with the amount of available read/write memory. To complete the business system, an external cassette tape unit or CBM disk drive must be attached. A printer will also probably be needed.

THE CBM 2001/B

The CBM 2001/B, like the CBM 8000, is a business computer; it is shown in Figure 1-2. The CBM 2001/B CRT display is 40 columns wide; that is half the width of the CBM 8000 display. The CBM 2001/B has a full-size typewriter keyboard, with screen editing keys and a numeric keypad to the right. The CBM 2001/B is available with 16K or 32K bytes of read/write memory. Like the CBM 8000, a CBM 2001/B will need an external cassette tape unit or disk drive, and probably a printer as well.

THE PET 2001/N

The PET 2001/N series, shown in Figure 1-3, is a modified and improved version of the original PET computer. The CRT display is identical to the 2001/B. What separates the PET 2001/N from the business computers are the graphic symbols displayed on the front of the PET 2001/N keys. The PET 2001 is available with 8K (/8N), 16K (/16N), or 32K (/32N) bytes of read/write memory. The PET 2001/N and the CBM 2001/B have the same external device requirements (for cassette tape or disk, and printer).

THE PET 2001/8K

The PET 2001/8K was the first computer released by Commodore Business Machines. All of the CBM models have evolved from the PET 2001/8K. With the same CRT display as the CBM 2001, the PET 2001/8K can easily be differentiated from the other CBM models by its compact, multi-colored keyboard and numeric keypad. There are graphic symbols displayed on the top of the PET 2001/8K keys, shown in Figure



Figure 1-2. CBM 2001/B Computer



Figure 1-3. PET 2001/N Computer



Figure 1-4. PET 2001/8K Computer

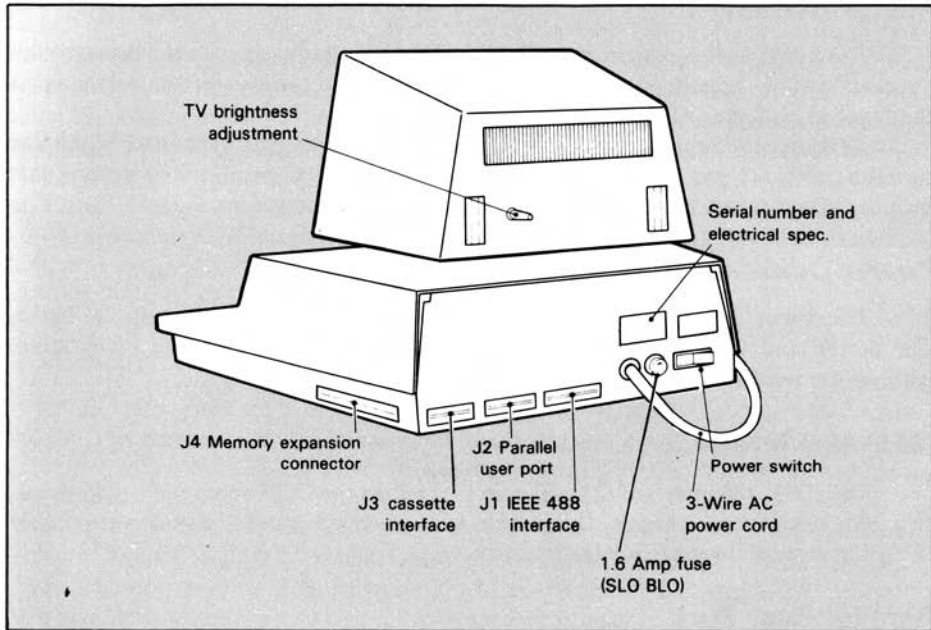


Figure 1-5. Rear View of CBM

1-4. Because of the keyboard's small size, a built-in cassette tape unit is located to the left of the keyboard. The PET 2001/8K is the only model available with a built-in cassette unit. The price you pay for having an internal tape unit is the compact keyboard. The PET 2001/8K has 8K bytes of read/write memory. 16K and 32K memory expansion options are available. A 4K version is available as a special order. The PET, like all other CBM computers, has additional read-only memory (or ROM) which is not available to users. This ROM holds permanent programs that give the computer its model personality. **Many PET computers have an "old" personality, characterized by an old set of ROMs.**

An external cassette tape unit may be connected to the PET computer. A printer and/or disk drives may be attached to a PET 2001/8K only if it has Revision level 3 ROMs.

CBM FEATURES

REAR PANEL

All switches, connectors and interfaces are located at the back of your CBM computer. Figure 1-5 shows a rear view of the CBM computer, with each component labeled, followed by a description of each part. It is important to know the location and function of each part so that you do not damage your CBM computer by using connections incorrectly.

Power Switch

The power switch is located on the left side of the back panel. It is a two-position "rocker" switch. Pressing on the outer side of the switch turns power on; pressing on the inner side of the switch turns power off.

As soon as you turn the power on, the CBM computer is ready for use. When you turn the power off, you lose anything stored in the computer's read/write memory; that includes all programs and data you entered after turning power on.

Power Cord

The 3-wire AC power cord connects the CBM computer to an electrical outlet. The power cord will connect directly to any household three-prong electrical outlet, without the need for intermediate transformer or adapter.

IEEE 488 Interface

The IEEE-488 interface (J1 in Figure 1-5) allows the CBM computer to communicate with external peripherals. IEEE cable will connect a printer, disk drive or other IEEE 488 device into the IEEE 488 interface.*

Parallel User Port

This interface (J2 in Figure 1-5) can be used instead of the IEEE-488 connector to attach peripherals to a CBM computer. You need not know anything about this port. If, by chance, you have a peripheral unit that uses this port, accompanying documentation will tell you how to connect to it.

Cassette Interface

This interface (J3 in Figure 1-5) is designed specifically for an external cassette tape unit. This interface is on the far right side, easily identifiable by its smaller size.

Memory Expansion Connector

Located on the back right side of the CBM (J4 in Figure 1-5), this is another connector that you need to know very little about. Extra read/write memory can be added to your CBM computer. Extra memory is attached to the Memory Expansion Connector.

TV Brightness Adjustment Knob

This knob controls the brightness of the CRT display. While facing the front of the computer, turn the knob to the left to darken the screen; turn to the right to brighten. Notice the change of character sharpness as you adjust the brightness.

*For detailed description of the IEEE 488 interface, refer to *PET and the IEEE 488 Bus (GPIB)* by E. Fisher and C.W. Jensen, Osborne/McGraw-Hill, 1980.

CRT DISPLAY

The CRT display is similar to a black and white television screen, but it has higher resolution, which means that you can see small images and characters with greater clarity. **Depending upon the model, either 1000 or 2000 character positions are displayed, in 25 rows of 40 characters, or 25 rows of 80 characters.** Characters are created by displaying appropriate dots within an 8×8 dot block (also called a matrix). This is illustrated in Figure 1-6.

The various CRT displays are described separately below. If you have the CBM 8000, read the following description and then skip to the keyboard section. If you have the CBM 2001/B, 2001 or PET skip the section on the CBM 8000.

CBM 8000

The CBM 8000 CRT display separates the CBM 8000 from the other CBM models. The screen is divided into 2000 equal spaces, arranged in 25 rows of 80 characters each. One character per space is displayed. Every space on the screen has a memory byte assigned to it.

Alphabetic and numeric characters, special symbols and graphic symbols can be displayed. The CBM 8000 normally displays lower and upper-case alphabetic characters using a character set that is usually referred to as the alternate character set. There is also a standard character set, which displays numerous graphic characters, but no lower case letters.

CBM 2001/B, PET 2001/N, PET 2001/8K

The CRT displays on the CBM 2001/B, PET 2001/N and the PET/8K are basically the same. The CRT is divided into 1000 spaces, arranged in 25 rows of 40 characters each. One character is displayed in each space.

All models display two types of characters: alphanumeric (alphabetic, numeric, special character symbol) and graphic symbols. The CBM 2001/B, like the CBM 8000, normally displays the alternate character set of lower- and upper-case alphanumerics; graphics are part of the standard character set. The PET normally displays the standard character set consisting of upper-case alphanumerics and graphics. Upper- and lower-case alphanumerics are in the alternate character set.

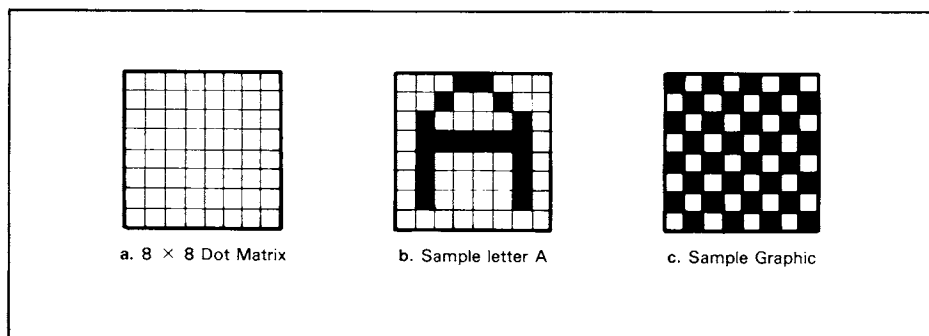


Figure 1-6. The 8×8 Dot Matrix

POWER UP

To “start up” your CBM computer follow these steps:

1. Plug the AC power cord, located on the console’s rear panel, into a three-hole grounded electrical outlet. Notice that the power cord has a three-prong power plug. *Do not attempt to plug the cord into a two-hole (ungrounded) outlet. Do not attempt to remove the ground prong.* If the unit is not properly grounded, you may receive an electrical shock. Grounding adapters that convert a two-prong outlet into a three-prong (grounded) outlet are available from your hardware store or electrical supply house. **CAUTION:** *Do not use a three-prong adapter unless you ground it properly when installing it.*
2. Switch power on. The power switch is located on the left side of the console’s rear panel. It is a two-position “rocker” switch. Pressing on the outer side of the switch turns power on; pressing the inner side of the switch turns power off.
3. Wait for READY display. About three seconds after switching power on, a message similar to the following one is displayed on the screen:

```
*** COMMODORE BASIC ***
XXXXXX BYTES FREE
READY.
*
```

The four lines of display have the following meanings:

*** COMMODORE BASIC ***	This line indicates that the BASIC language has been activated
XXXXXX BYTES FREE	This line shows how much memory is available to you. 3071 (or a similar number) will be displayed for a 4K PET system 7167 (or a similar number) will be displayed for an 8K CBM system 15359 (or a similar number) for a 16K CBM system 31743 (or a similar number) for a 32K CBM system
READY.	The CBM computer is ready to receive input from the keyboard
*	The flashing cursor is displayed at the position on the screen where the next character typed in from the keyboard will appear

If you do not get the display illustrated above after turning power on, then turn power off, wait a few seconds, and turn power back on. The display may first be filled with random characters for a second or so. This is normal; just ignore it. The random character display may appear whenever the CBM is turned off and then on again within about ten seconds.

CBM COMPUTER KEY GROUPS

The CBM computer keyboard is used to enter statements, programs and data required by programs. The type of keyboard depends on which model CBM you have. With a few exceptions, the same keys are present on both the compact and full size keyboards. Some keys have different locations on the various computer models.

Keys on the CBM computer keyboard can be grouped as follows: Alphabetic keys, numeric keys, special symbol keys, graphic keys, function keys, and cursor control keys.

Alphabetic Keys

The alphabetic keys provide the 26 letters of the alphabet, A to Z. Upper and lower-case letters are available on all CBM models.

Numeric Keys

The numeric keys provide the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9.

Special Symbol Keys

Special symbols and characters may represent standard punctuation marks and commonly used symbols. For example, there is a period, a comma, “+” for addition, “-” for subtraction, etc. Characters that have widely recognized interpretations include “\$” for dollar sign, “%” for the percent sign, etc.

Some characters represent a specific operation, or have special meaning in a BASIC statement. For details see Chapter 4.

Graphic Keys

The CBM keyboard contains 62 graphic symbols, accessed using shifted data keys. With so many graphic characters available on the CBM computer, you can create some rather sophisticated display drawings.

Graphic characters are listed in Table 1-1; each is given a name. Similar symbols are grouped to make graphic options immediately obvious. **Note that the square enclosing the graphic symbols in Table 1-1 is not part of the symbol; the square enclosure has been added to show the symbol’s location within a grid space.**

Function Keys

SHIFT. The SHIFT key is pressed simultaneously with any other key to access the key’s shifted character. All keys display different characters in shifted and unshifted modes. The lower key symbol is accessed when unshifted. The upper key symbol is accessed when shifted.

There are two identical SHIFT keys located on the main keyboard, one at the lower left and one at the lower right.

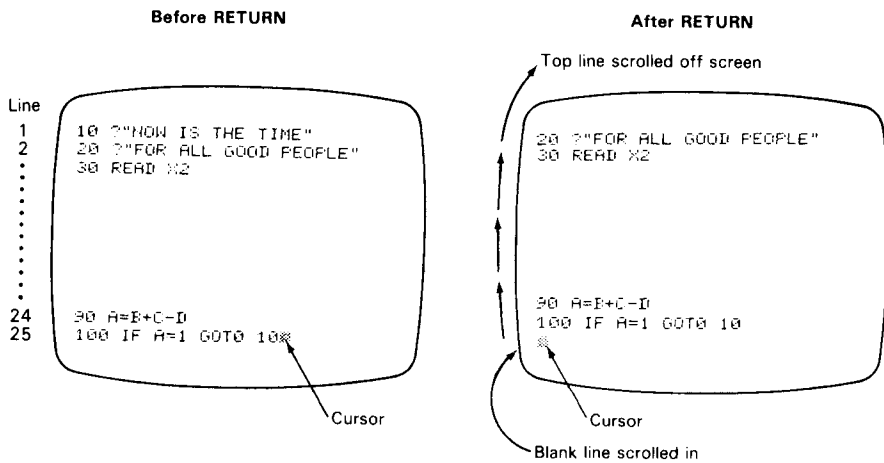
SHIFT LOCK (full size keyboard only). CBM computer keyboards have a SHIFT LOCK key located directly above the left-hand SHIFT key. Pressing the SHIFT LOCK key until it “clicks” into place holds SHIFT down so that both hands are free to type in shifted mode. Press the SHIFT LOCK key again to release it; both SHIFT keys return to their unshifted position.

RETURN. The RETURN key is the equivalent of a carriage return on a typewriter; when depressed, it **causes the cursor to move to the beginning of the next line on the screen.**

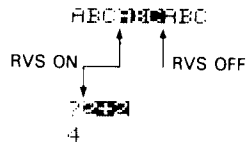
A RETURN given anywhere on the last line of the screen causes all of the screen text to move, or scroll, up one line. The top line rolls up off the screen and a blank line rolls onto the bottom line of the screen, with the cursor left at the beginning of the blank line.

Table 1-1. Graphic Character Keys

Line Horizontal	Thin Bar	Quarter Block Solid	T
Top	Top	Top Left, Top Right	Top
3/4 Top	Bottom	Bottom Left, Bottom Right	Bottom
2/3 Top	Left	Diagonal	Left
Middle	Right		Right
Near Middle		Quarter Block Open (Angle)	
2/3 Bottom	Thick Bar	Top Left, Top Right	Symbol
3/4 Bottom	Top	Bottom Left, Bottom Right	X
Bottom	Bottom		Cross
	Left	Corner	Diagonal Acute
Line Vertical	Right	Top Left, Top Right	Diagonal Grave
Left		Bottom Left, Bottom Right	
3/4 Left	Half Block		Grid
2/3 Left	Left	Rounded Corner	Full
Near Middle	Bottom	Top Left, Top Right	Half Left
Middle		Bottom Left, Bottom Right	Half Bottom
2/3 right	Triangle Solid	Suit	Circle
3/4 right	Top Left	Spade, Heart	Solid
Right	Top Right	Diamond, Club	Outline



REVERSE ON/OFF. The Reverse key allows you to reverse the black and white parts of characters; REVERSE is like the negative of a photograph. The normal mode for this key is "off." To activate the REVERSE key, press it in unshifted mode. The next character keys you press will be displayed in reverse field. REVERSE ON stays in effect until you either press REVERSE OFF (the REVERSE key shifted) or until you press the RETURN key.



Note: Reverse field terminated by carriage return

RUN/STOP. STOP is the unshifted half of the RUN/STOP key. STOP stops any program that is being executed by the computer and reconnects the computer with the keyboard. If you want to test the STOP key, try entering the following one line program, without trying to understand what it means. Key in the shaded line. When you press the RETURN key, a vertical column of numbers will be displayed, as shown. When you press the STOP key, the display will "freeze."

```
FOR I=1 TO 100:PI NEXT I
1
2
3
4
5
6
7
8
9
10 ← Press STOP key
```

```
BREAK
READY.
*
```

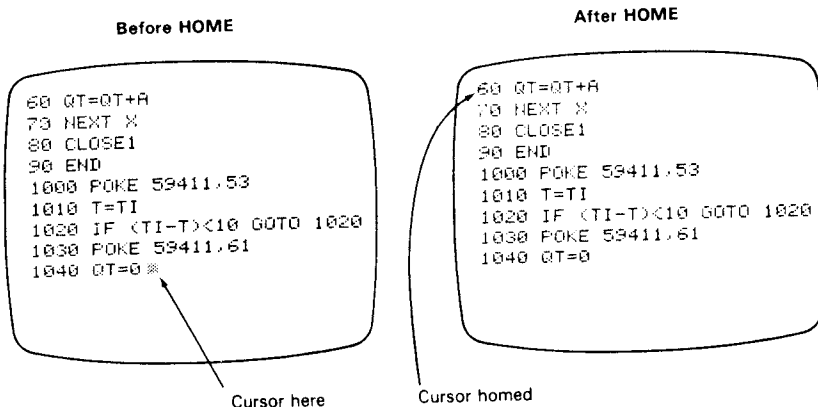
The STOP key does nothing if there is nothing to stop, i.e., the CBM computer is not running a program.

RUN is the shifted half of the RUN/STOP key. **RUN loads and executes a program from an external peripheral (tape unit or disk drive).**

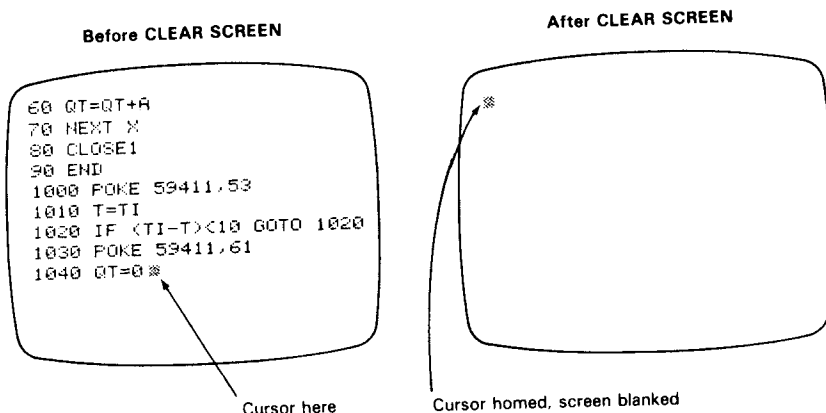
Cursor Control Keys

The remaining four keys are cursor control and edit keys. They include CLEAR SCREEN/HOME, CURSOR UP/DOWN, CURSOR LEFT/RIGHT, and INSERT/DELETE.

HOME is an unshifted cursor control key that moves the cursor to the "home" position at the upper left-hand corner of the screen.

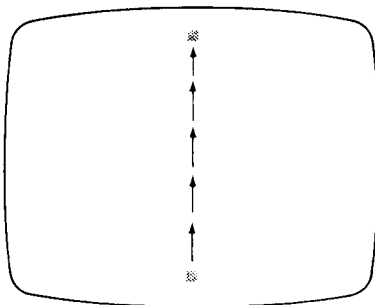


CLEAR SCREEN, obtained by pressing the CLEAR SCREEN/HOME key in shifted mode, **homes the cursor and blanks the entire display screen.**



CURSOR UP, obtained by pressing the CURSOR UP/DOWN key in shifted mode, **moves the cursor up one line within the same physical column of the screen.**

CURSOR UP

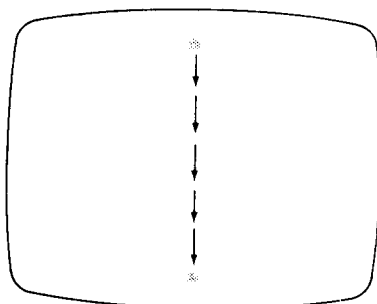


If the cursor is on the top line of the display, CURSOR UP has no effect.

The cursor moves over characters without changing them.

CURSOR DOWN, obtained by pressing the CURSOR UP/DOWN key in unshifted mode, **moves the cursor down one column.**

CURSOR DOWN

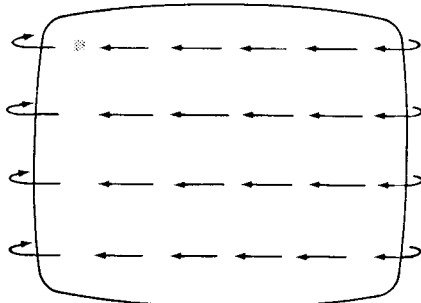


Blank lines scrolled onto screen
when cursor is at bottom line

If the cursor is on the bottom line of the screen, CURSOR DOWN scrolls the display up one line.

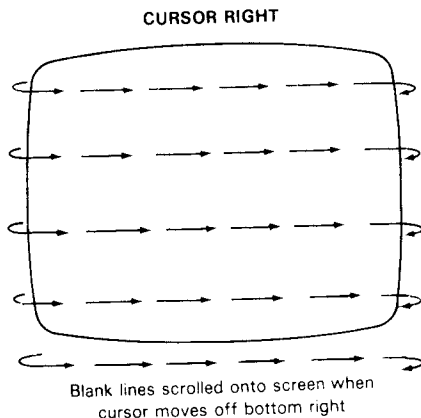
CURSOR LEFT, obtained by pressing the CURSOR LEFT/RIGHT key in shifted mode, **moves the cursor left one position within the same horizontal row.**

CURSOR LEFT



CURSOR LEFT has no effect if the cursor is in the **HOME** position.

CURSOR RIGHT, obtained by pressing the **CURSOR LEFT/RIGHT** key in unshifted mode, moves the cursor right one character position within the same row.



CURSOR RIGHT and **CURSOR LEFT** "wrap around," moving from the end of one line to the beginning of the next, or vice versa.

If the cursor is at the end of the bottom line, **CURSOR RIGHT** will scroll the screen up one line and move the cursor to the start of the bottom line.

CURSOR LEFT/RIGHT are used to type over text. When editing, the cursor does not alter the display as it moves. This is equivalent to backspacing or spacing forward on a typewriter.

The **INSERT/DELETE** key in unshifted mode selects **DELETE**. It deletes the character to the immediate left of the cursor and moves any characters to the right of the deleted character, headed by the cursor, one character position to the left.

```
NOW IS THE TIME~
NOW IS THE TIM
NOW IS THE TI~
```

The **INSERT/DELETE** key in shifted mode selects **INSERT**. It opens a single character space in the line at the current position. You can then insert an additional character into the space.

```
NOW IS THE TIME
NOW IS THE TIME
NOW IS THE TIME
```

CBM computers treat all text as a sequence of 80-character lines. You can delete up to, but not beyond the start of an 80-character line. You can insert until current text reaches the end of the 80-character line.

THE CBM 8000 and CBM 2001/B KEYBOARDS

The **CBM 8000** and **CBM 2001/B** keyboards are similar to a standard typewriter keyboard, with a numeric keypad to the right as shown in Figure 1-7. The keyboard may be used in two typing modes to produce two character sets.

In **Alternate Mode**, unshifted keys produce lower-case alphanumerics on the CRT, and shifted keys produce capital, or upper-case alphanumerics. The alternate character set is active on power-up.



Figure 1-7. The CBM 8000 and 2001/B Keyboard

Standard Mode (forced by typing a system command) displays upper-case alphanumeric when keys are pressed unshifted; shifted keys display graphic characters. **To activate the standard character set, type in:**

```
POKE 59468,12 (RETURN)
```

or on the CBM 8000 only:

```
?CHR$(142)
```

This will immediately change character sets. **To bring back the alternate set, type in:**

```
POKE 59468,14 (RETURN)
```

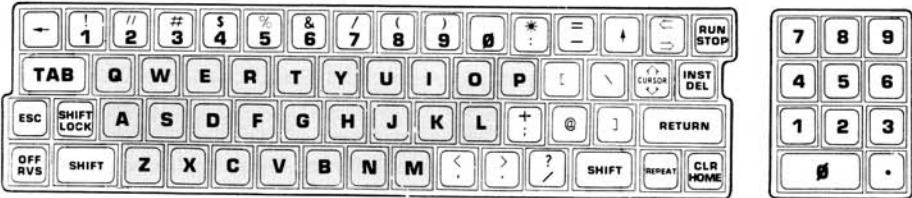
or on the CBM 8000 only:

```
?CHR$(14)
```

Unless stated otherwise, we will assume that the standard character set is being used. Also we will assume that every statement ends with a RETURN, as shown above.

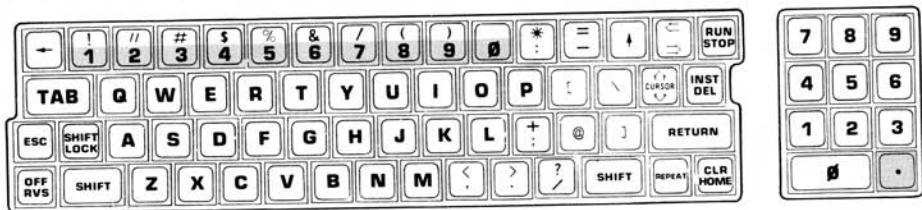
In the following key descriptions, the keyboard is illustrated by key groups, with the particular key group shaded.

Alphabetic Keys



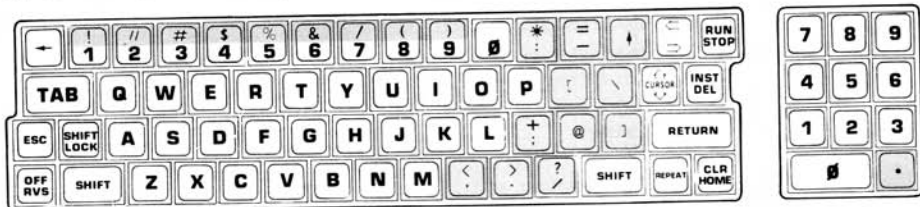
Alphabetic keys are shaded in the illustration above. In alternate mode, alphabetic keys display lower case letters unshifted, and upper case letters if shifted. In standard mode, alphabetic keys display upper case letters unshifted, and graphic characters if shifted.

Numeric Keys



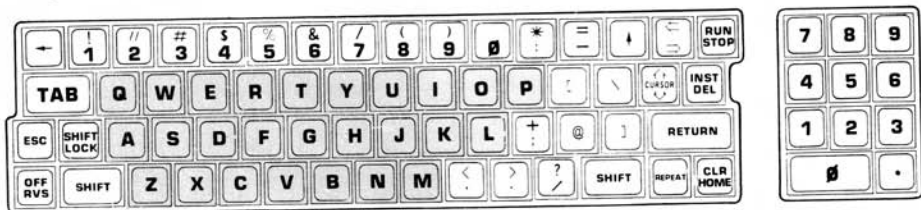
The numeric keys (shaded) occur twice, on the top row of the typewriter keyboard, and on the numeric keypad to the right. The number keys on the top row are accessed in unshifted mode only. The numeric keypad may be accessed in standard and alternate mode. For touch typing, key number 5 has a small bump in the center of the key.

Special Symbol Keys



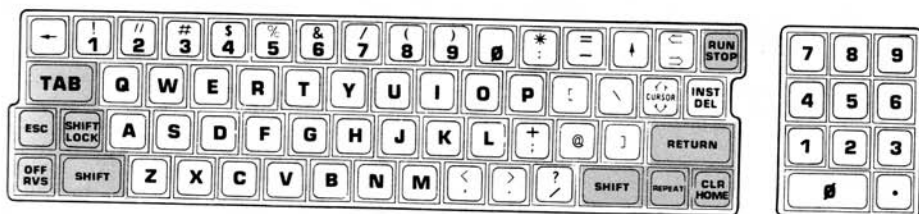
Special symbols are shaded in the illustration above. Symbols located on the top half of the numeric keys are accessed in shifted alternate mode. Other symbol keys are accessed in shifted or unshifted mode.

Graphic Keys



Graphic symbols are not shown on the business keyboards, but they are available. **Select the standard mode with POKE 59468,12. Keys depressed in shifted mode then access and display graphic symbols.** The illustration above shows where graphic characters available from the keyboard are located on a business keyboard.

Function Keys



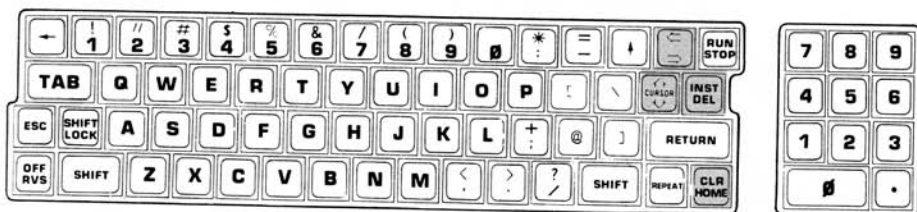
The CBM 8000 and 2001/B have three extra function keys not described in the “CBM Key Groups” section; the TAB, ESCAPE (ESC), and the REPEAT keys.

TAB. This key is used to set and clear tabs, and to jump to the next tab set column.

ESC. (CBM 8000 series only). This key has two uses: it cancels the effect of an insert, reverse character or text entry condition; it also is used in conjunction with certain other keys to create special editing functions (described in Chapter 5).

REPEAT. This key causes repeated entry of any key that is pressed simultaneously.

Cursor Control Keys



These keys are described in the “CBM Key Groups” section.

THE PET 2001/N KEYBOARD

The PET 2001/N keyboard has a full-size typewriter keyboard with graphic symbols on the front of the keys (see Figure 1-8). This keyboard also has two typing modes: standard and alternate. **Standard mode** is selected when you first turn power on. To activate alternate mode, type in:

POKE 59408,14

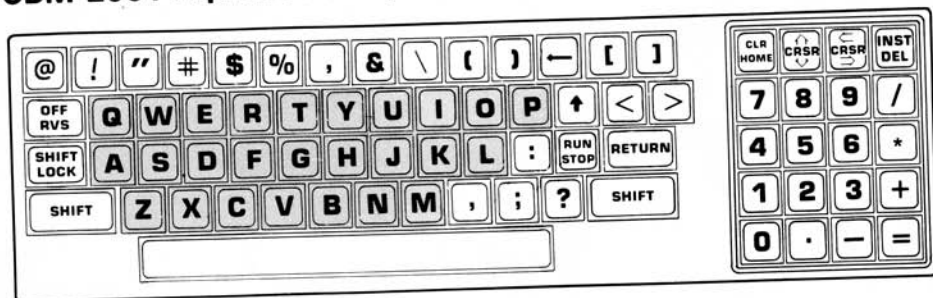
To change back to the standard character set, type in:

POKE 59408,12



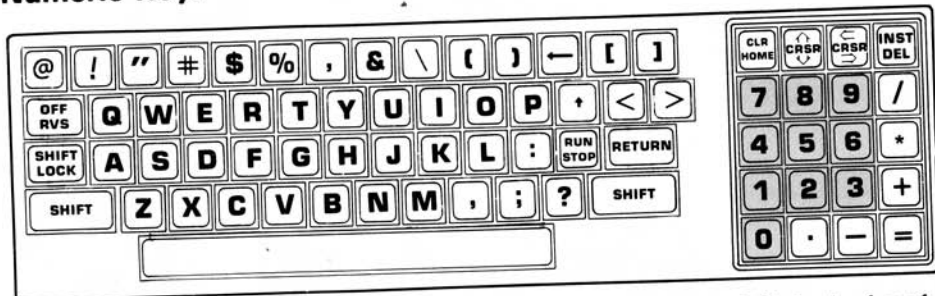
Figure 1-8. PET 2001/N Keyboard

CBM 2001 Alphabetic Keys



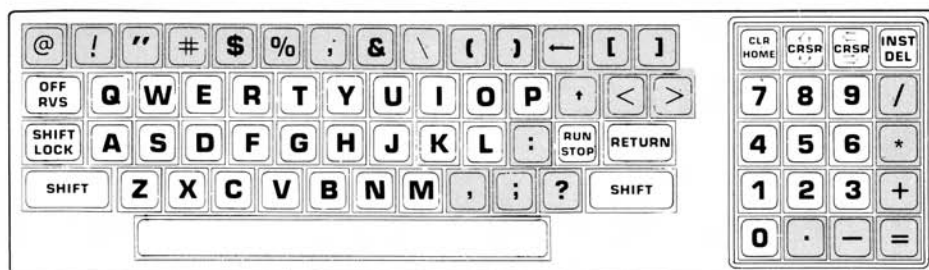
The alphabetic keys shaded above access upper case alphabetic in unshifted standard mode. Lower and upper case alphabetic are accessed in alternate mode.

Numeric Keys



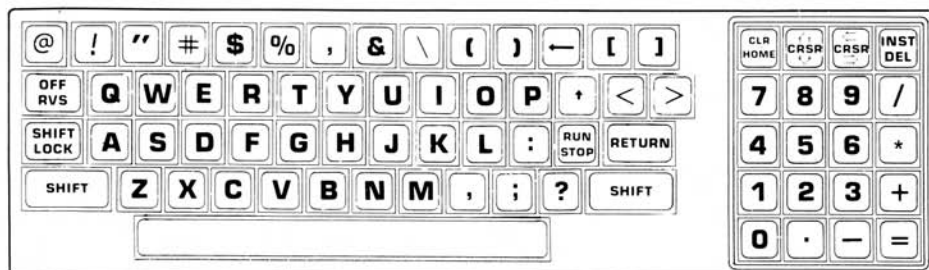
The numeric keys are on the numeric keypad to the right of the full-size keyboard. Numbers are accessed in unshifted mode only.

Special Symbol Keys



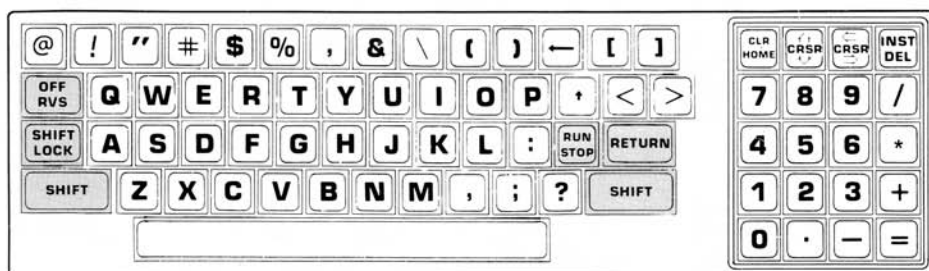
The special symbols are located on the typewriter keyboard and on the numeric keypad. These are only available as unshifted keys.

Graphic Keys



The graphic symbols are located on the front of all non-function keys and cursor keys. **Graphics are only accessed in shifted standard mode.**

Function Keys



The CBM 2001 has Pi (π), a function key not on the business keyboards. It is located on the \uparrow key.

Pi (π) is a circle's circumference, divided by its diameter. **When this function key is depressed, the value 3.14159265 is accessed.** To check this out, type in the shaded line; end with a RETURN and see the display:

π
3.14159265

READY.

π is not evaluated as 3.14159265 if it appears within quotation marks. Then it is treated as a graphic character. To check this out, type in the shaded line again, as follows:

" π "

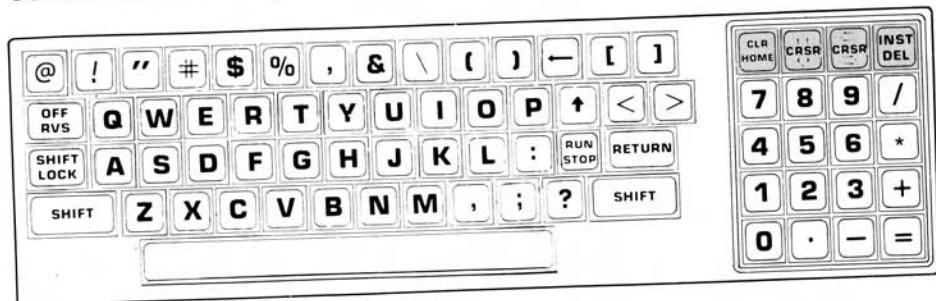
π

READY.

✱

π will be displayed, as shown above, when you press the RETURN key.

Cursor Control Keys



Cursor control keys operate as described earlier in this chapter.

PET 2001/8K KEYBOARD

The PET 2001 has a compact, multi-colored keyboard; like all other keyboards, this one accesses different character sets in standard and alternate modes. Like the PET 2001/N, standard mode is selected when you turn power on. To activate the alternate character set, type in:

POKE 59468, 14

To return to standard character, set type in:

POKE 59468, 12

Figure 1-9 illustrates the PET 2001 keyboard.

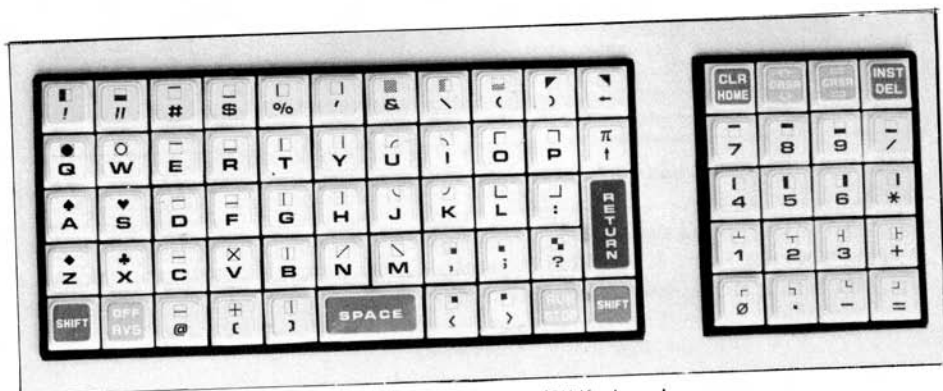
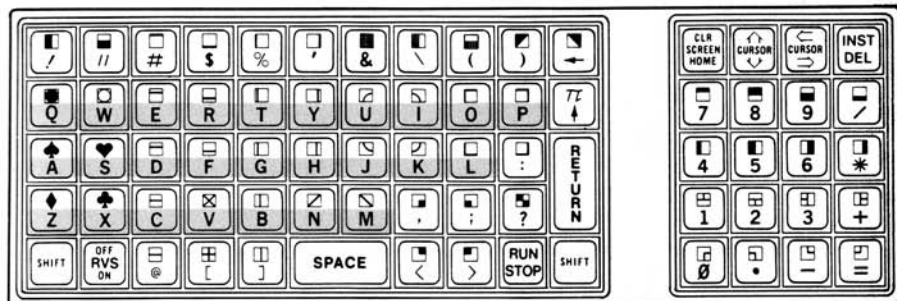


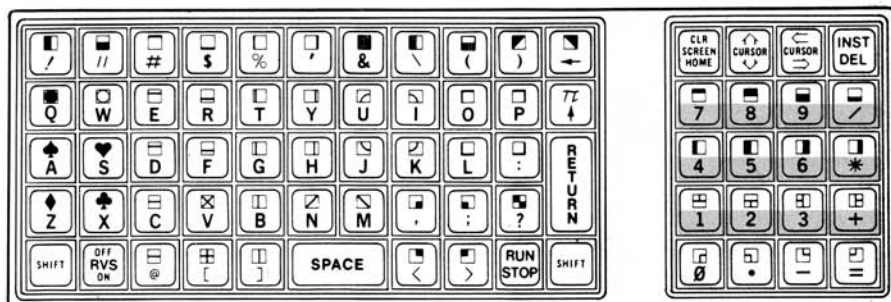
Figure 1-9. PET 2001/8K Keyboard

Alphabetic Keys



Letters of the alphabet are located on the silver-color keys; they access upper-case letters in unshifted standard mode. The alternate set accesses upper-case letters when unshifted and lower-case letters when shifted.

Numeric Keys



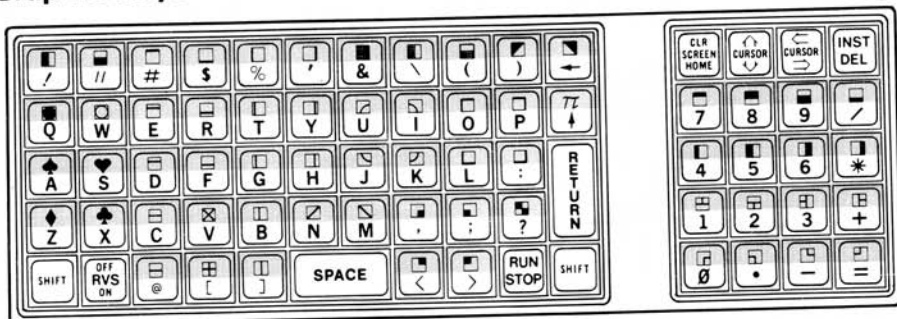
The numeric keys are silver-colored, on the keyboard to the right. Numbers are displayed in unshifted mode.

Special Symbol Keys



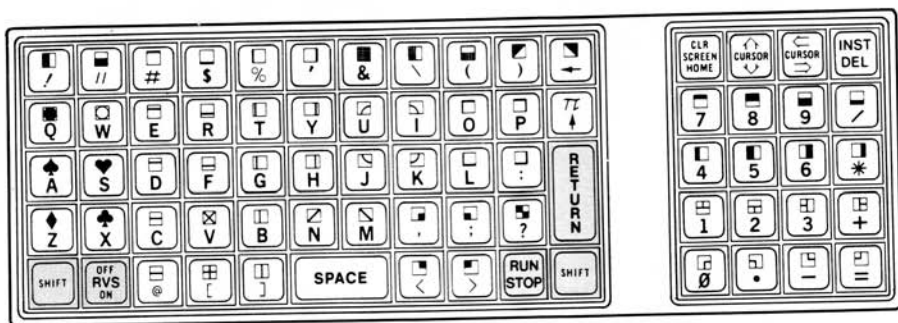
The special symbol keys, shaded above, are light blue on the keyboard and numeric keypad; special symbol keys are grouped together along the top, bottom and right side of the keyboard, and along the right side and bottom of the numeric keypad. These symbols are available only in unshifted mode.

Graphic Keys



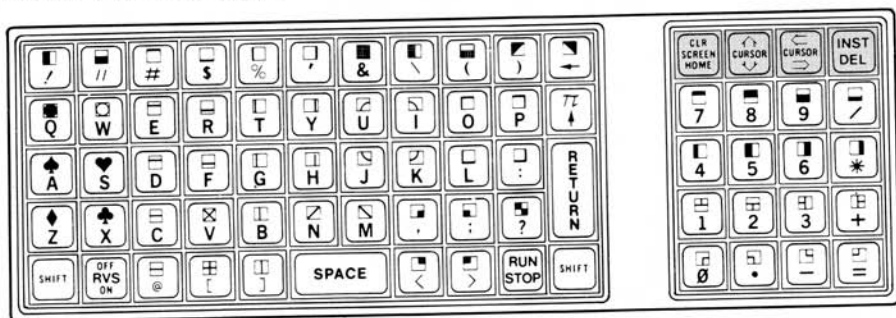
The graphic symbols are located on the front of all non-function and cursor control keys. **Graphics are displayed in shifted standard mode only.**

Function Keys



PET 2001 function keys are either red or blue. **The PET is missing the SHIFT/LOCK key, normally located above the left shift key. However, like the PET 2001/N it has a pi (π) symbol located on the \uparrow key.** For a description of the pi key see the PET 2001/N description.

Cursor Control Keys



The four cursor control keys are the red and blue keys located on the top row of the numeric keyboard.



Figure 1-10. PET 2001 Internal Tape Drive

THE CASSETTE TAPE UNIT

The cassette tape unit is built into the PET console but must be connected separately to CBM models. The internal and external cassette units are basically the same. The tape drive allows you to store programs and data on cassette tape. You can also load stored programs and data from cassette tape into computer memory.

The computer can connect to more than one cassette tape drive, but only one of the tape drives is the “primary” or “console” cassette tape drive. For the PET the console tape drive is the built-in tape unit (see Figure 1-10). For CBM computers the console tape drive is the tape unit connected at the J1 interface port.

The External Tape Drive

The external tape unit is shown in Figure 1-11.

A maximum of two cassette drives may be used at one time. On the PET that has a built-in cassette drive next to the keyboard, a second cassette drive may be attached at cassette interface J3, shown in Figures 1-5 and 1-13a. On all other models, the first cassette drive is externally connected at the J3 interface. For the 2001 models, a second external cassette drive may be attached to a connector inside the computer as shown in Figure 1-13b. For the CBM 8000, see Figure 1-13c.

Other peripherals such as the printer or disk drives may be connected to the IEEE 488 interface without affecting the operation of the cassette drives.

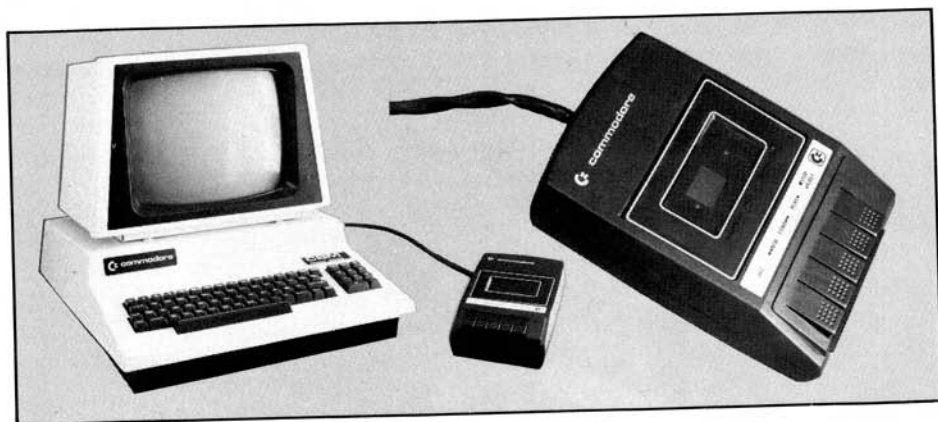


Figure 1-11. An External Tape Drive

Cassette Tape Operation

When attaching an external cassette to any connector, you can either connect the cassette correctly, or you can break the connector. This is because the connector has an acentric slot:



The cassette drive plug has a divider that fits into the slot:



So long as the divider slides into the slot, you can be sure that a proper connection has been made.

The procedure to plug an external cassette drive into an *outside* cassette interface (such as the J3 connector) is given below.

1. Turn the power off.
2. Hold the connecting plug at the end of the cable so that the "blue" wire is on the right.
3. Gently push the plug onto the interface as in Figure 1-12. *Do not force the connection.*
4. Make sure the connection fits securely.
5. Turn on power.

To plug a cassette drive into the printed circuit board connector *inside* the CBM computer, follow these steps:

1. Turn the power off and unplug the computer.
2. Move the front of the computer out from the supporting surface so that you can see the four retaining screws on the bottom. With a screwdriver unscrew the four retaining screws.

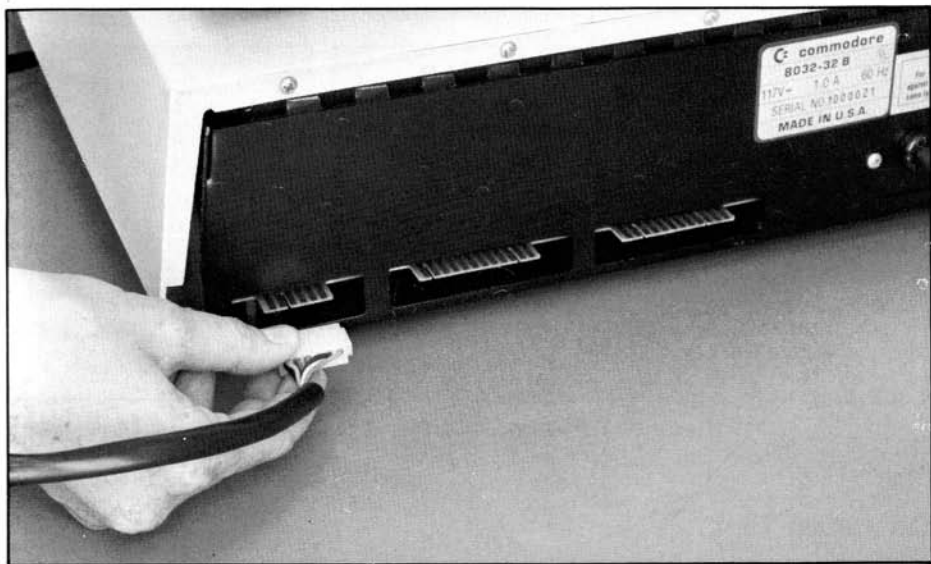


Figure 1-12. Connecting Second External Cassette Unit to CBM Computer

3. Lift the cover all the way up, being careful not to move it so far back that it pulls any of the cords.
4. Locate the supporting rod on the inner left side of the computer (if available on your model). Push the rod up to disengage it from its holder, then move it forward and secure it in the back screw hole on the left side. This holds the cover up so you have both hands free.
5. Locate the cassette interface on the left edge of the printed circuit board as shown in Figure 1-13b.
6. Hold the connecting plug at the end of the cable so that the off-center slot on the circuit board matches the off-center divider on the cassette plug.
7. Gently push the plug onto the connector as shown in Figure 1-13b. *Do not force the connection.*
8. Make sure the connection fits securely.
9. Put cover down; screw in retaining screws.
10. Plug the CBM computer in. Turn on power.

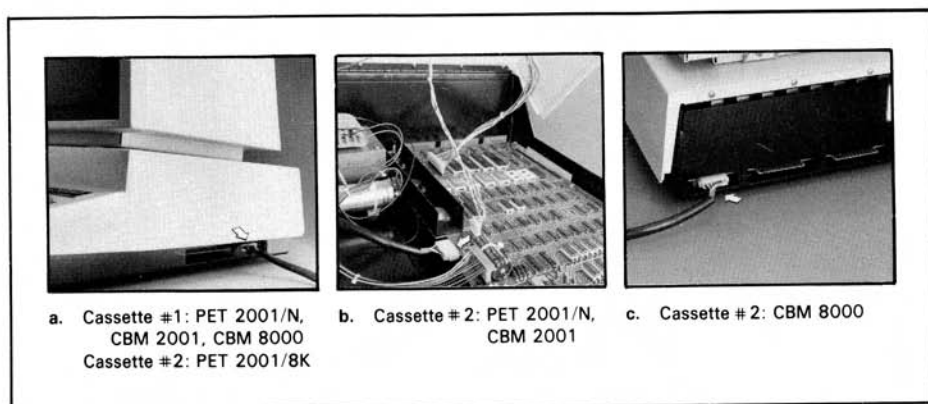


Figure 1-13. Plug External Cassette into Circuit Board

Operation Test

Before continuing further, you should check the mechanical operation of the cassette unit(s). Below is a simple test to make sure that all control keys and inner mechanical components are functioning correctly.

1. Turn the CBM computer on. Make sure none of the cassette keys is depressed and that the cassette drive motor is not running.
2. Open the cassette door on the top of the unit by pressing the STOP/EJECT key (or manually on the older models). While looking inside the unit, press the PLAY key. You should see the tape heads move out toward the spindles. The pinch roller should simultaneously move out, touch and rotate the capstan in a counterclockwise direction. The inside of the unit should look like Figure 1-14.
3. Press the STOP/EJECT key once. The tape heads should draw back out of view and the spindles should stop rotating.
4. Press the FFWD (Fast Forward) key. The tape heads should remain hidden and the take-up spindle on the right should move counterclockwise very fast.
5. Press the STOP/EJECT key once. The take-up spindle should stop rotating.
6. Press the REW (Rewind) key. The tape heads should remain hidden. The supply spindle on the left should move clockwise very fast.
7. Press the STOP/EJECT key once. The supply spindle should stop rotating.
8. Very gently press the REC (Record) key. The key should remain locked and not move. This key will not move unless the PLAY and REC keys are simultaneously pressed with a cassette tape inserted in place.

If all the above steps worked correctly your cassette unit is ready to begin operation. If some or all of the above steps do not work, check the following: make sure that power is on, that you did not try to press two keys simultaneously (i.e., holding down the STOP key accidentally) and that you pressed the keys down until they clicked and stayed in place. If the cassette unit is still not functioning correctly, contact your Commodore dealer.

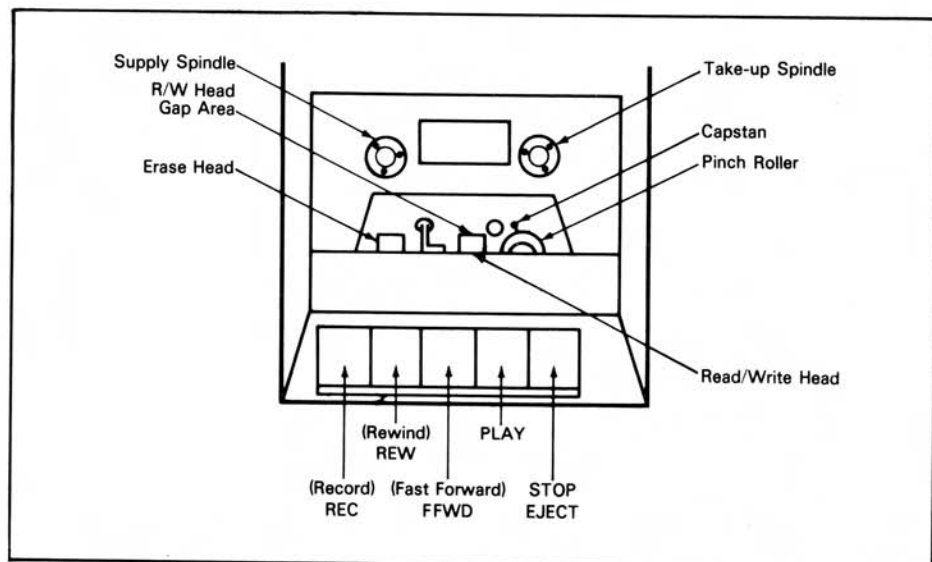


Figure 1-14. Mechanical Components on Cassette Unit

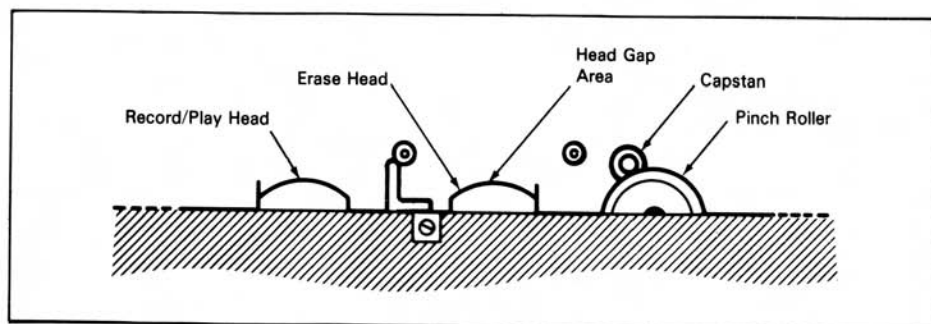


Figure 1-15. Cassette Drive Tape Head

Cleaning and Demagnetizing the Tape Head

The head area of the cassette drive can be seen by opening the cassette drive door with power *off* and depressing the PLAY key. This juts the tape head mount out where it is marginally reachable for maintenance. **The tape head is shown in Figure 1-15**

The tape head is the portion of the cassette unit that the magnetic tape contacts when you record or play back. The oxide coating on the magnetic tape gradually deposits a film on the tape head and surrounding area; this deposit must be removed periodically by cleaning the tape head to assure reliable operation of the cassette unit. **To clean the tape head, use a cotton swab soaked with a commercially formulated tape head cleaner (e.g., Nortronics brand). Do NOT use tri-chloroethylene, plastic solvent, or rubber cement. Alcohol may be used occasionally, but it is not recommended for regular use.** Clean both heads and also the capstan and pinch roller. Allow the area to dry completely before closing the cover.

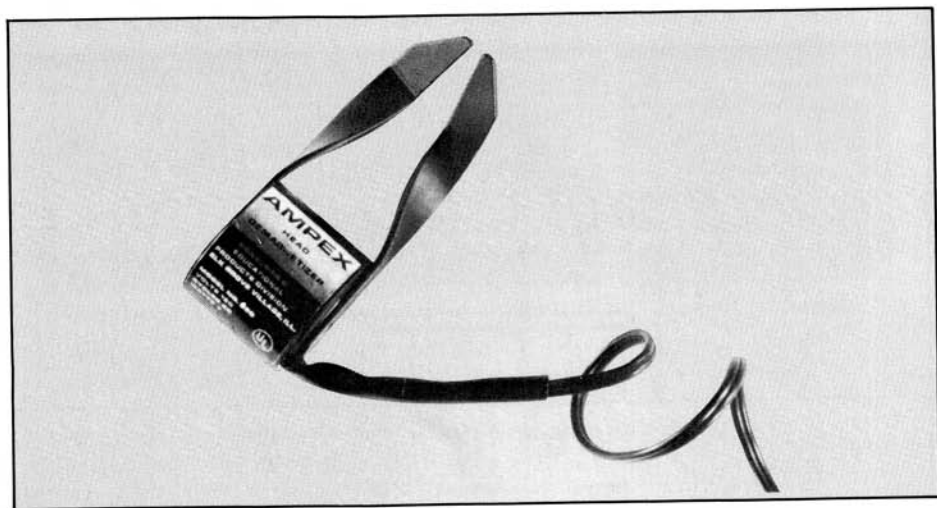


Figure 1-16. A Typical Tape Head Demagnetizer

The tape head also needs to be demagnetized periodically. The tape heads gradually become magnetized through use. This affects recording fidelity and eventually causes recording errors. To demagnetize the tape heads, you will need a tape head demagnetizer (Figure 1-16); this is an inexpensive unit that can be purchased at most audio equipment stores.

To demagnetize the tape heads, have the cassette drive door open and the PLAY key depressed. To use the demagnetizer, have it at least two feet away from the cassette drive before plugging in the demagnetizer (the cassette drive should be *off*). *Slowly* bring the demagnetizer towards the cassette drive until it contacts the head surface; carefully move it around on one head surface, then the other head surface, then all metal surfaces that are directly adjacent to the heads. *Slowly* move the demagnetizer back at least two feet before unplugging it.

Caution: Keep your pre-recorded cassette tapes away from the demagnetizer. The demagnetizer is an effective tape eraser. Keep it at least five feet away from any pre-recorded cassettes.

The more you use your cassette drives, the more often the drive will need to have the tape heads cleaned and demagnetized. Do it at least once a month — more often if you are experiencing load problems or tape degradation.

Cassette Tape Drive Controls

The cassette tape control keys are located at the forefront of the cassette drive. **RECORD (REC).** The RECORD key lets you write from computer memory onto the magnetic tape cassette.

REWIND (REW). The REWIND key rewinds the magnetic tape at high speed, to its beginning. To rewind the tape, depress the REWIND key.

You will use REWIND often to rewind tape cassettes back to their beginning point before removing them from the tape drive. You will also use REWIND any time you want the computer to start searching for information beginning at an earlier point on the magnetic tape.

FAST FORWARD (FFWD). FAST FORWARD winds the magnetic tape forward at high speed.

Computers write onto magnetic tape, read from the tape, and search for information on the tape all at **PLAY** speed, which is slower.

PLAY. The **PLAY** key enables the computer to search the tape for a program, and to load the program from the tape into computer memory. You also use **PLAY** to write from computer memory to tape if the **RECORD** key is also pressed.

STOP/EJECT. The tape **STOP** key disengages any of the other control keys. If one of the other keys does not respond, press the tape **STOP** key and press the other control key again.

EJECT. The **EJECT** key automatically opens the tape drive door so that a cassette tape may be inserted or withdrawn. The **Eject** option was not available on the earliest PET tape drives.

Loading/Unloading a Cassette Tape

Use the following procedure to insert a cassette into a tape drive (refer to Figure 1-17):

1. Press **EJECT**. The tape drive door will lift up automatically.
2. Holding the magnetic tape cassette as shown, push the cassette along the glide paths on the underside of the tape drive window until the cassette clicks into place.
3. Push down the tape drive door. This aligns the path of the exposed magnetic tape with the tape drive head area.

To remove a cassette tape, lift up the tape drive door or push the eject key if the drive has one. Pull the cassette tape out of the tape drive, then close the tape drive door.

CASSETTE TAPES

You will probably buy cassette tapes that have prerecorded programs on them. You will probably also buy blank tape cassettes on which to record your own programs or data.

The cassette tape that fits into the cassette drive and stores your information is shown below.

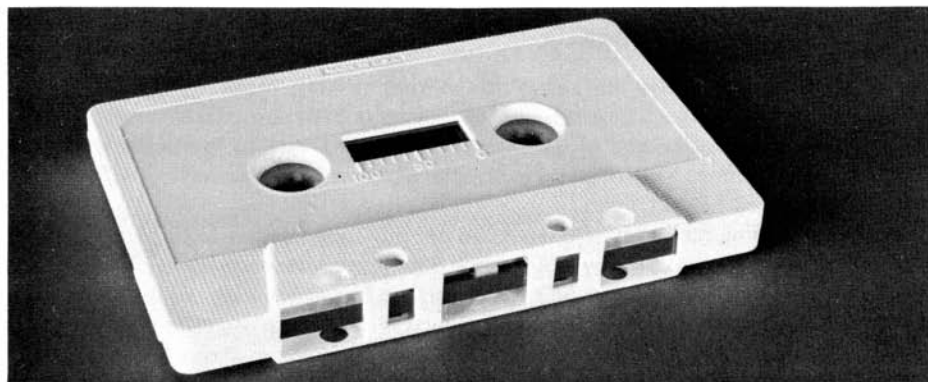




Figure 1-17. Inserting a Cassette Tape

Care of Cassette Tapes

Below are a few tips on taking care of your cassette tapes.

First, when you get a new cassette tape (blank or prerecorded), balance its tension by fast forwarding to the end of the tape and rewinding back to the beginning before loading the first time. This is just a precautionary measure that may prevent reading errors (also called LOAD errors).

When buying blank cassette tapes, do not buy long ones — 15 to 30 minutes are sufficient. This not only cuts down the search time, but gives you tape that is thicker and stronger than long-playing tapes. Select high quality, low noise, high output, ferric oxide tapes; bargain brands are generally less satisfactory. Store the cassettes in a cool place away from magnets and electronic equipment.

Be careful not to touch the oxide coated surface when handling tapes.

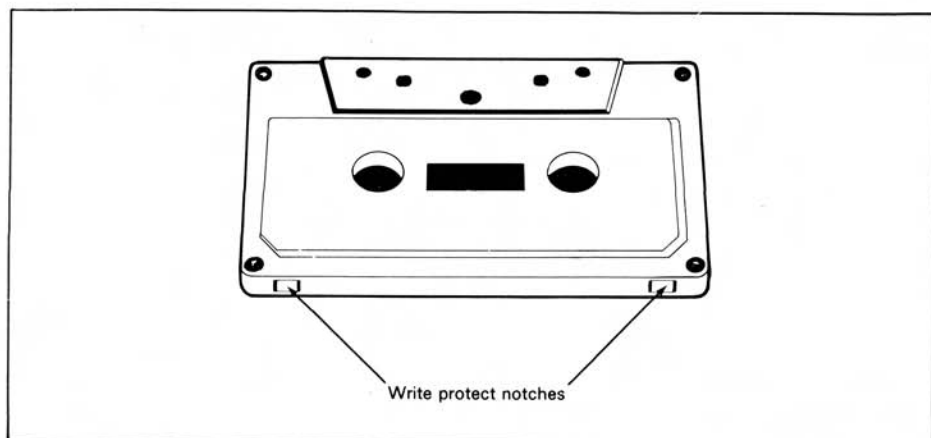


Figure 1-18. Write Protect Notches

Cassette Tape Write-Protect

You can prevent any cassette from being recorded on by “write-protecting” it. A cassette tape has two write-protect notches, one for each side to the tape, located on the side opposite the tape access opening (see Figure 1-18). When you buy pre-recorded tapes, or when your own tapes have information stored on them, you can protect these tapes from accidentally being written on by punching out the write-protect tabs. To write-protect just one side of the tape, punch out the tab that is on the left when you have the side you want to write-protect facing upward.

If you write-protect a tape and then decide you want to reuse it, just place a piece of scotch tape over the write-protect opening.

CBM DISK DRIVE

Commodore has two dual-drive floppy disk units available: the CBM 8050 and the CBM 2040. Disk drives store programs and data on diskettes. A diskette is a flexible disk, approximately the size and shape of a 45 rpm record.

The CBM 8050 and 2040 are shown in Figures 1-19 and 1-20. The CBM 2040 stores approximately 171,500 bytes of data on a diskette; it is called a “single density” drive in computer jargon. The CBM 8050 is a “double density” drive in computer jargon, and stores approximately 522,000 bytes of data per diskette. Disk drive specifications are given in Tables 1-2 and 1-3.

Connecting the Disk Drive to the CBM

To connect a disk drive to your CBM computer, follow these steps:

1. Disconnect the computer's AC power cord from the electrical outlet.
2. Using a CBM to IEEE cable, plug the small end into the interface slot on the upper left rear panel of the disk drive (see Figure 1-21). Secure the connector by turning the two screws clockwise until tight.



Figure 1-19. CBM 8050 Dual-Drive Floppy Disk Unit



Figure 1-20. Model 2040 Dual-Drive Floppy Disk Unit

3. Gently push the “flared” connector into the center interface slot (J1 in Figure 1-5) on the back of the CBM console. Make sure the connector side with “Commodore” stamped on it is facing up. The hookup should look like Figure 1-21.
4. Plug the disk drive’s AC power cord into an electrical outlet.
5. Plug the CBM computer’s AC power cord into an electrical outlet.

Having connected the disk drive to the computer, proceed to the power-on test.

Table 1-2. Model 8050 Dual-Drive Floppy Disk Specifications

Physical:		Electrical:	
Material:	18 gauge steel	Power requirements:	
Dimensions:		Voltage	100, 117, 220 or 240 VAC
Height	6.5"	Frequency	50 or 60 hertz
Width	15"	Power	50 watts
Depth	14.35"		
IC's:		Drives:	
Controller:		Shugart	SA390 (2)
6502	Microprocessor	Diskettes	Standard mini, 5¼"
6530	I/O, RAM, ROM		
6522	I/O, interval timers	Storage (each disk):	
Interface:		Total capacity	533,248 bytes
6502	Microprocessor	Sequential	521,208 bytes
6532 (2)	I/O, RAM, interval timers	Relative	464,312 to 517,398 bytes, depending on file size
6564 (2)	ROM	Sectors per track	23 to 29
Shared:		Bytes per sector	256
6114 (8)	4 × 1K RAM	Tracks	77
		Blocks	2083

Table 1-3. Model 2040 Dual-Drive Floppy Disk Specifications

Physical:		Electrical:	
Material:	18 gauge steel	Power requirements:	
Dimensions:		Voltage	120 VAC
Height	6.5"	Frequency	60 Hertz
Width	15"	Power	50 watts
Depth	14.35"		
IC's:		Drives:	
Controller:		Shugart	SA390 (2)
6504	Microprocessor	Diskettes	Standard mini, 5¼"
6530	I/O, RAM, ROM		
6522	I/O, interval timers	Storage (each disk):	
Interface:		Total capacity	176640 bytes
6502	Microprocessor	Sequential	170180 bytes
6532 (2)	I/O, RAM, interval timers	Random	170850 bytes
6332 (2)	ROM	Sectors per track	17 to 21
Shared:		Bytes per sector	256
6114 (8)	4 × 1K RAM	Tracks	35
		Blocks	690

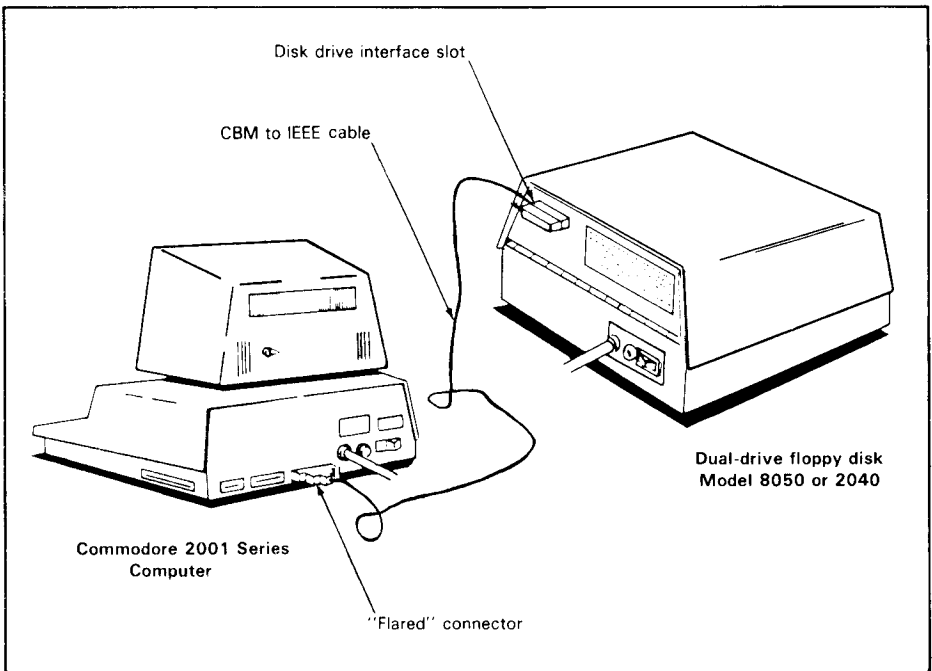


Figure 1-21. CBM-Floppy Disk Drive Connection

Power-On Test

1. Turn on power to the CBM computer. Make sure the console is working correctly.
2. If you have Model 2040 disk drives, open both drive doors by placing your forefingers under the drive doors and gently pulling your fingers forward until the doors spring open. If you have model 8050 disk drive, skip this step.
3. Make sure both disk drives are empty.
4. Turn on power to the disk drive by pressing the rocker switch on the left rear side of the disk drive.

Model 8050: All three green indicator lights on the front panel should flash twice. The left and right lights above the drives should go out. The center light should remain lit.

Model 2040: All three red indicator lights on the front panel should flash on briefly and then go out. Some disk drives may make a soft "purring" noise during initialization.

If several indicator lights remains lit, turn off the disk drive. Wait five minutes and power up the disk drive again. If the lights still remain lit, contact your Commodore dealer.

Indicator Lights

Both disk drive models have three indicator lights on the front panels (see **Figure 1-22**). These indicator lights are called LEDs (Light Emitting Diodes). Drive 0



Figure 1-22. Dual Drive Floppy Disk LED Indicator Lights

and drive 1 have their own LEDs that turn on when that disk drive is in operation. The center light is an error light.

The 8050 has three *green* LEDs. As previously stated, the lights above the disk drives turn on when that drive is in operation, and turn off when the operation is complete. The center LED turns on when the 8050 is receiving power; this light is also used as an error indicator. **When an error occurs the center LED changes to red and remains lit until the error is corrected.**

The 2040 has three *red* LEDs. The lights above the disk drives specify when that drive is in operation. They glow red until the operation is complete. **The LED in the center is an error indicator only. It lights up when an error occurs and remains lit until the error is corrected.**

Loading and Unloading Diskettes

Each diskette comes in a storage envelope. *Remove the diskette from the envelope before loading it into the disk drive.*

The circular diskette is held in a square protective jacket as shown in Figure 1-23. This jacket guards the diskette from foreign substances and breakage or bending. *Do not remove the jacket. When buying diskettes for any CBM computer, buy soft-sectored 5-1/4" diskettes.* If you are unsure whether your diskette is soft-sectored, here is a simple test (see Figure 1-24):

1. Take the diskette out of its envelope (not the jacket) and hold it by the jacket.
2. Insert two fingers inside the center hole.
3. Locate the small hole next to the center hole (see Figure 1-23).
4. *Carefully* rotate the diskette with your fingers until you align a small hole in the diskette with the outer small hole in the jacket.

If you find only one hole in the diskette the diskette is soft-sectored. If you find multiple holes, it is not soft-sectored.

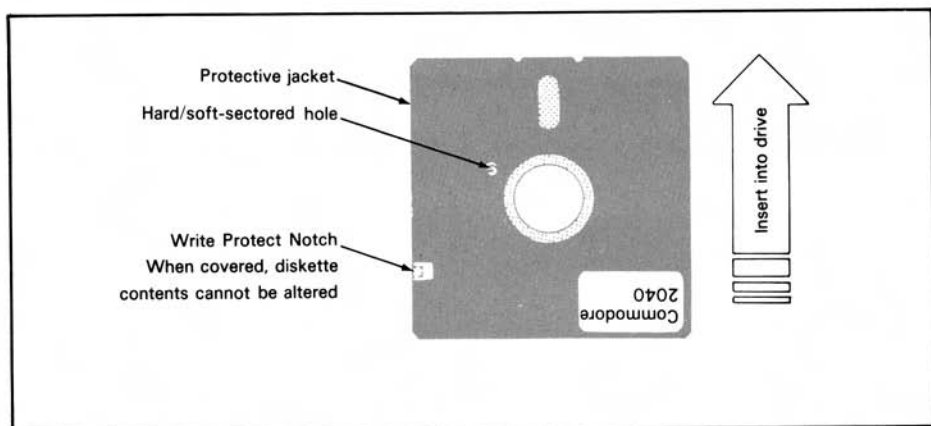


Figure 1-23. Floppy Diskette

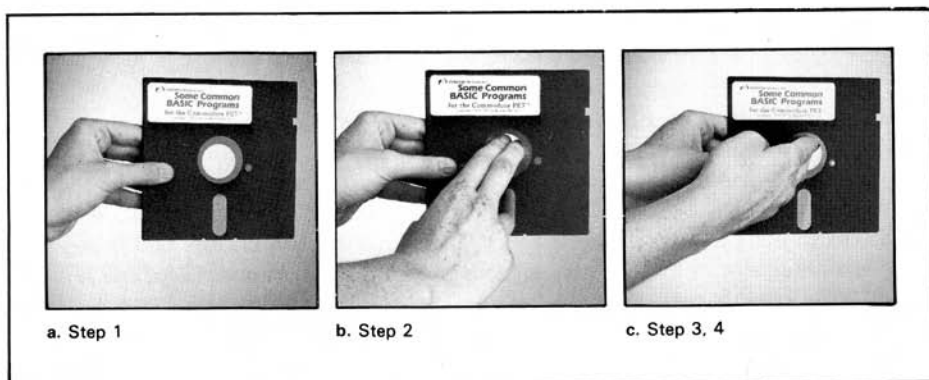


Figure 1-24. Test for Soft-Sectored Diskette

Model 8050 Load

1. Hold the diskette by the plastic jacket. *Do not touch the exposed sections of the diskette.* The diskette should be facing up with the write-protect notch on the left side.
2. Carefully guide the diskette into one of the slots (Figure 1-25) until you hear a loud click. Do not push the diskette further in. If it doesn't slide in smoothly, immediately withdraw it and try again. *Do not force the diskette* or you may damage both the diskette and the disk drive.
3. With two fingers, press down firmly on the lever in the disk drive door until the lever stays down.

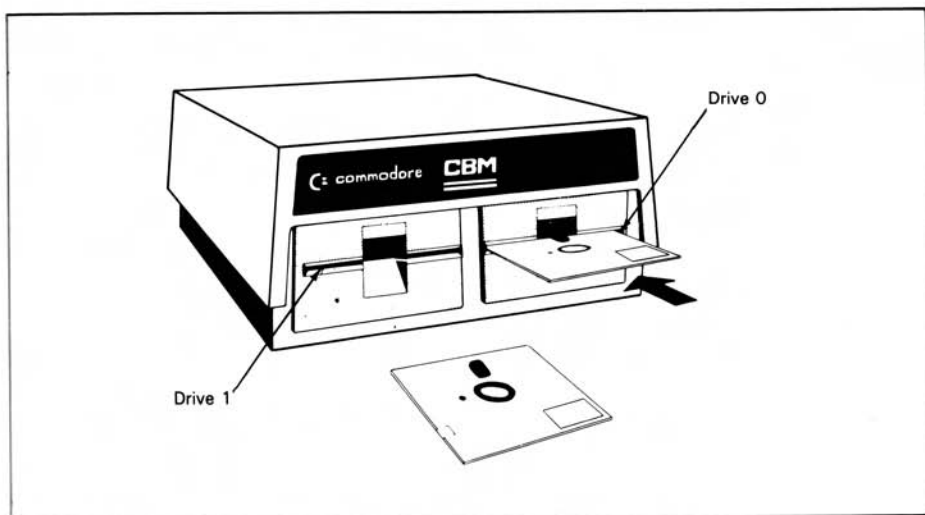


Figure 1-25. Inserting the Diskettes (Model 8050)

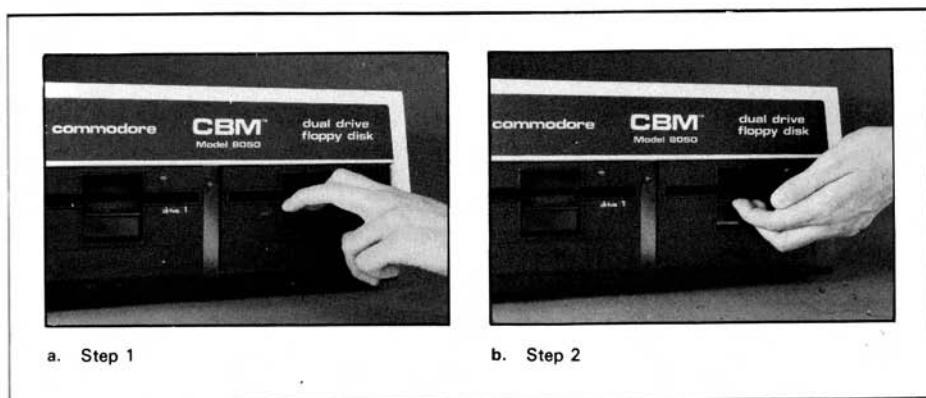


Figure 1-26. Removing the Diskette (Model 8050)

Model 8050 Unload

Never remove a diskette when the LED is lit for that particular drive.

1. The disk drive lever should already be in the down position. With two fingers, give the lever a quick press downward and release the lever. The diskette should pop up from inside the drive (Figure 1-26a).
2. To eject the diskette, place your forefinger under the lever and gently push it upward and forward. This will eject the diskette out of the drive (Figure 1-26b).
3. Grab the diskette with your thumb and forefinger and gently withdraw the diskette. *Do not bend or force the diskette.*
4. Insert the diskette into its envelope.



Figure 1-27. Opening Disk Drive Door (Model 2040)

Model 2040 Load

1. Hold the diskette by the plastic jacket. *Do not touch the exposed sections of the diskette.* The diskette should be facing up with the write-protect notch on the left edge.
2. Place the forefinger of your free hand under the drive door and gently pull your finger forward until the door springs open (Figure 1-27).
3. Carefully guide the diskette into one of the slots as illustrated in Figure 1-17 until you hear a faint click. Do not push the diskette further in. If it doesn't slide in smoothly, immediately withdraw it and try again. *Do not force the diskette* or you may damage both the diskette and the disk drive.
4. Close the drive door by pressing down on the door until it shuts completely.

Model 2040 Unload

Never remove a diskette when the LED is lit for that particular drive.

1. Place your forefinger under the drive door and gently pull your finger forward until the door springs open (see Figure 1-27).
2. Grab the diskette with your thumb and forefinger, and gently withdraw the diskette. *Do not bend or force the diskette.*
3. Close the drive door by pressing down on the door until it shuts completely.
4. Insert the diskette into its envelope.

FLOPPY DISKS

Care of the Diskettes

You must handle diskettes with care. All of your information will be stored on them. Once a disk is damaged, there is no way to recover data stored on it. Follow the hints below to protect your diskettes:

1. After removing the diskette from the disk drive, return it promptly to its storage envelope.
2. *Do not remove the diskette from its plastic jacket.*
3. When labeling a diskette, use the labels provided with the diskette. Do not write on the label with a lead pencil or ball point pen; use only a felt tip pen.
4. Do not touch or try to clean the diskette surface or you will damage the diskette.
5. Do not smoke when using diskettes. Tobacco ash or smoke residue on the diskette surface may damage it.
6. *Keep diskettes away from magnetic fields.* Exposure to a magnetic field will destroy the stored data.
7. Do not expose diskettes to heat or sunlight.

Diskette Write-Protect

You can prevent any diskette from being written on by “write-protecting” it. Each diskette has a write-protect notch on its outer edge, as illustrated in Figure 1-15. **When the write-protect notch is covered, the diskette cannot be written on.** You can use scotch tape to write-protect a diskette, but special adhesive tapes are available, and they are preferable. **If you remove the notch cover, you can write on the diskette again.**

THE CBM PRINTER

Two printers are available for the CBM computer: the CBM 2022 Tractor Feed (Figure 1-28) and the CBM 2023 Matrix or Friction Feed (Figure 1-29). The difference between the two models lies in their paper feed mechanisms. The Model 2022 has a tractor feed mechanism that pulls the paper through using sprocket holes on the paper edges. The Model 2023 uses a friction feed mechanism similar to a typewriter. Any type of paper may be used with this model.

Both models print characters using a 7×6 dot matrix (similar to the way characters are generated by the CRT display). Both printers print a maximum of 80 characters per line, at a speed of one line per second (60 lines per minute). Both printers have a ribbon mechanism and use purple or black nylon ribbon with stop eyelets that reverse ribbon direction. **Table 1-4 provides printer specifications.**



Figure 1-28. Model 2022 Printer

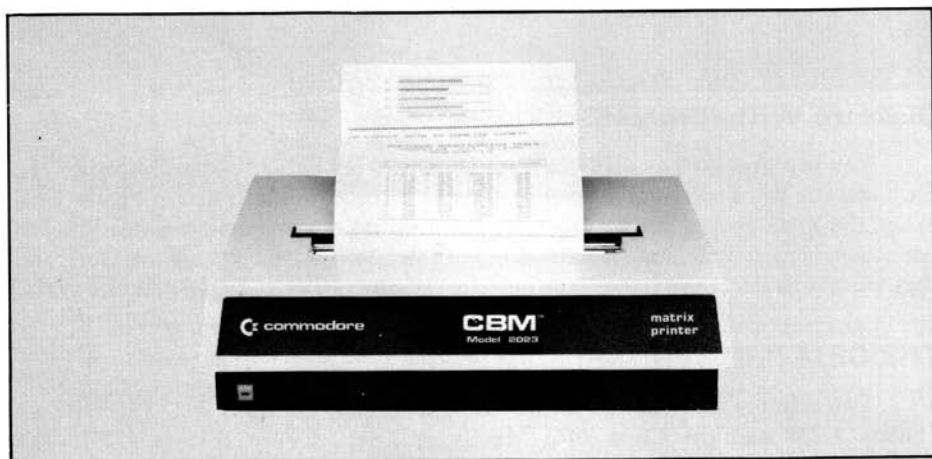


Figure 1-29. Model 2023 Printer

Connecting the Printer to Your CBM Computer

Connect your printer to the computer as follows:

1. Disconnect the computer's AC power cord from the electrical outlet.
2. For *direct* hookup of the printer to the CBM computer follow these steps:
 - a. Using a CBM to IEEE cable, plug the small end (standard IEEE connector) into the right interface slot in the back of the printer (see Figure 1-5). Secure the connector by turning the two screws clockwise until tight.
 - b. Gently push the "flared" connector into the center interface slot on the back of the CBM computer console. Make sure the connector side with "Commodore" stamped on it is facing up. The hookup is illustrated in Figure 1-30.

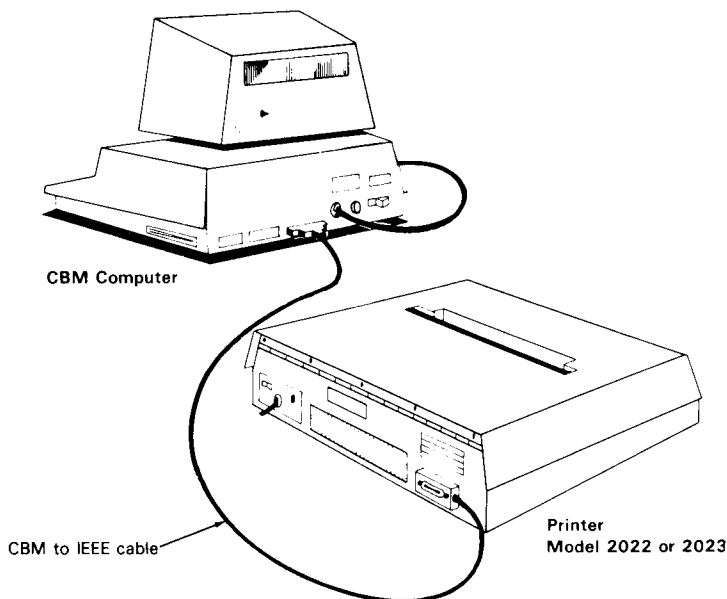
Table 1-4. Model 2022 and 2023 Printer Specifications**Model 2022 Printer Specifications**

Printing Method	Serial Impact Dot Matrix
Print Rate	70 lpm or 150 cps (Maximum)
Print Direction	Unidirectional
Column Capacity	80
Character Font	6 × 7
Column Spacing	1/10" 10 characters per inch
Line Spacing	Programmable
Character Size	0.11" high 0.10" wide
Copies	3 - including original
Ribbon Type	Nylon-fibered with eyelets
Ribbon Life	2 × 10 ⁶ characters
Ribbon Spool Type	Underwood
Paper Width	10" computer folded paper
Forms	8.5 + 0.5 × 2 (Sprocket margins)
	Pin to pin distance: 0.5" longitudinally
	9.0" laterally
	5/32" diameter

Model 2023 Printer Specifications

The specifications for the Friction Feed Model 2023 are the same as for the Tractor Feed Model 2022, except for the following items:

Line Spacing	1/6" six lines per inch
Forms	Not applicable

**Figure 1-30. Printer to Computer Connection**

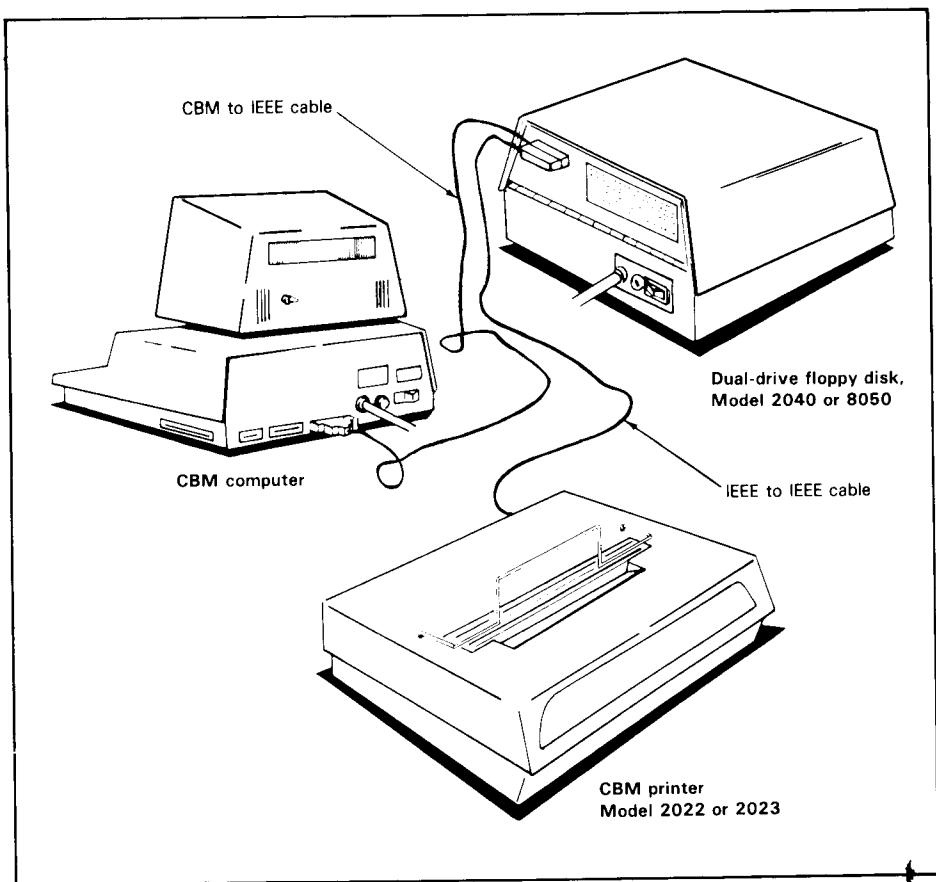


Figure 1-31. Multiple Hookup: Printer to Disk Unit to Computer

3. *Multiple peripherals hookup:* Because the CBM has only one IEEE interface slot to connect the peripherals, if you use both a disk drive and printer you must connect the printer to the disk drive and the disk drive to the CBM computer. Follow these steps:
 - a. Using an IEEE to IEEE cable, plug one end into the right rear interface slot of the printer. Secure the connector by turning the two screws clockwise until tight.
 - b. Plug the other end of the cable into the connector already attached to the back of the disk drive from the CBM computer as shown in Figure 1-31. This "daisy-chaining" passes the data from the CBM computer through the two-cable connection to the printer. Secure the connector by turning the two screws clockwise until tight.
 - c. Plug the printer's AC power cord into an electrical outlet.
 - d. Plug the CBM computer's AC power cord into an electrical outlet.
 - e. Turn the CBM computer power on. Make sure the console is working correctly.

- f. Turn on power to the printer by pressing the rocker switch on the right back side of the printer, so that the white dot is visible. When the printer receives power, the print head moves all the way to the right and back again.

If the print head does not move, turn off both the CBM computer and printer. Re-check all connections to make sure they are securely connected into the correct interface slots. Turn on the power to the CBM computer and try again. If nothing happens, contact your Commodore dealer.

Installing the Ribbon

1. Lift up the printer cover until its inner mechanisms are exposed.
2. Hold the ribbon so that the empty reel with stop eyelet is in your right hand and the full reel is in your left (Figure 1-32).
3. Push the right ribbon reel onto the right sprocket (position number 1 in Figure 1-33) until it clicks firmly into place.
4. With the left reel, unroll enough ribbon to guide the ribbon through positions 2, 3 and 4. At this point, stop and make sure that the ribbon stop eyelet is situated between position 2 and the reverse gate (position 3). Continue guiding the ribbon through positions 5 and 6. *Do not twist the ribbon.*
5. Unroll the ribbon past the print head, dropping the ribbon down behind the print head and around position 7. It is very easy to accidentally twist the ribbon at this step, so be very careful not to do so.
6. Guide the ribbon around positions 8, 9, 10, and 11.
7. Turning the ribbon reel until the ribbon is taut, push the left reel onto the left sprocket until it clicks firmly into place (position 12). Make sure the ribbon and reel are not loose.
8. Close the printer lid. The ribbon is now ready.

Loading Printer Paper

Each printer has a different load procedure due to its different paper feed mechanism.

Loading Paper Into Printer Model 2022

The tractor drive accepts standard fan-folded pin feed paper of various widths. The largest width acceptable is 10".

To load the paper follow these steps:

1. With both hands, hold the tractor feed housings (see Figure 1-34) and gently pull them forward. This will move the tractor feed mechanism out of the way.
2. Guide the paper into the top of the printer behind the roller and along the inner plate. Figure 1-35 shows the paper path. Push the paper in gently as it moves down under a bottom roller and back up in front of the main roller and sprockets.
3. With the tractor feed housings, push the tractor feed mechanism back.
4. Pull the sprocket retainers on each sprocket up to the open position.

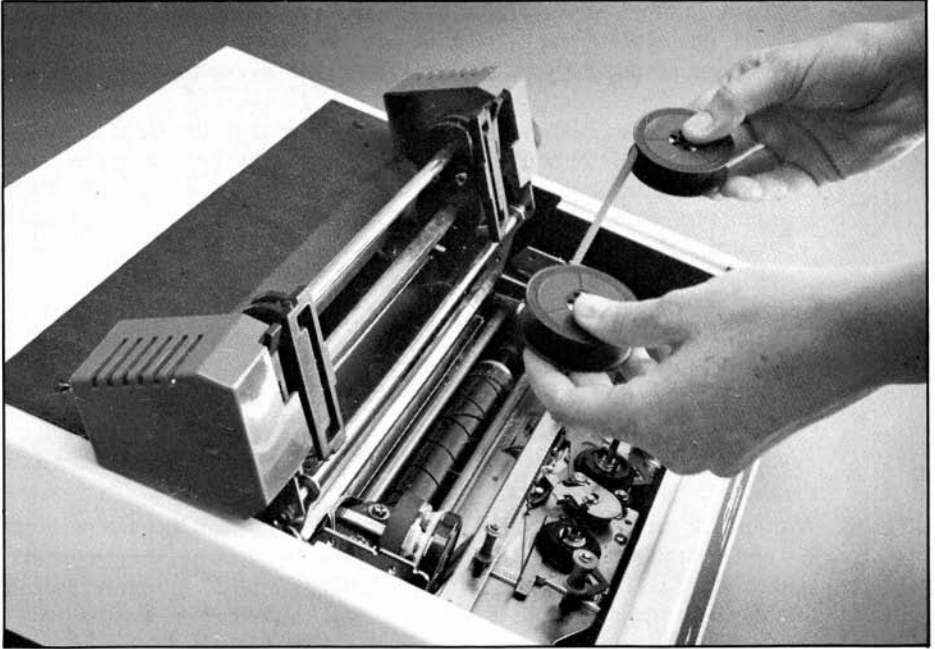


Figure 1-32. Installing the Ribbon

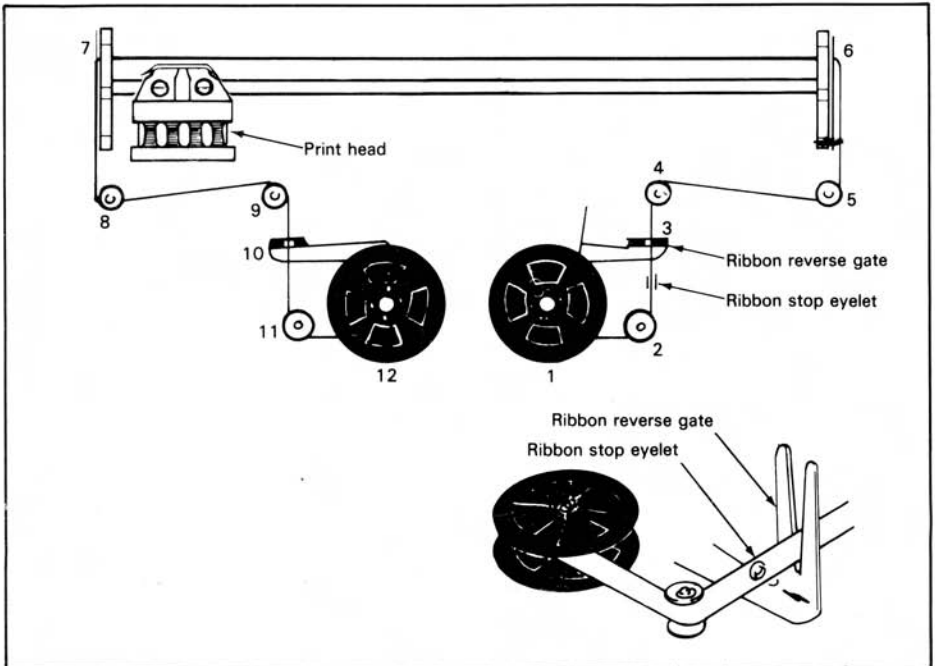


Figure 1-33. Printer Ribbon Path



Figure 1-34. CBM 2022 Printer

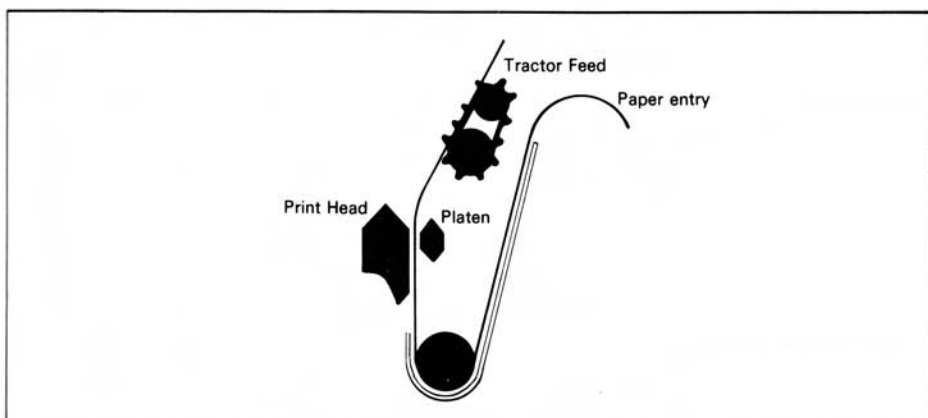


Figure 1-35. CBM 2022 Printer Paper Path

5. Pull the paper over the sprockets until the sprocket holes in the paper fit over the sprockets. If the sprockets do not match the paper sprocket holes, adjust the sprockets by:
 - a. Lifting the lever to the side of the sprocket mechanism towards you.
 - b. Sliding it to fit the tractor sprocket to the paper sprocket holes.
 - c. Locking the lever by pushing it back to the original position.
6. When the paper sprocket holes fit snugly over the sprockets, push the sprocket retainers down to hold the paper in place.
7. Turn the printer power on. The power switch is on the lower right back panel.
8. The paper may be advanced by either:
 - a. Pressing the paper feed button at the lower left front of the printer.
 - b. Manually rolling the paper up with the roller knobs on each side of the tractor mechanism.

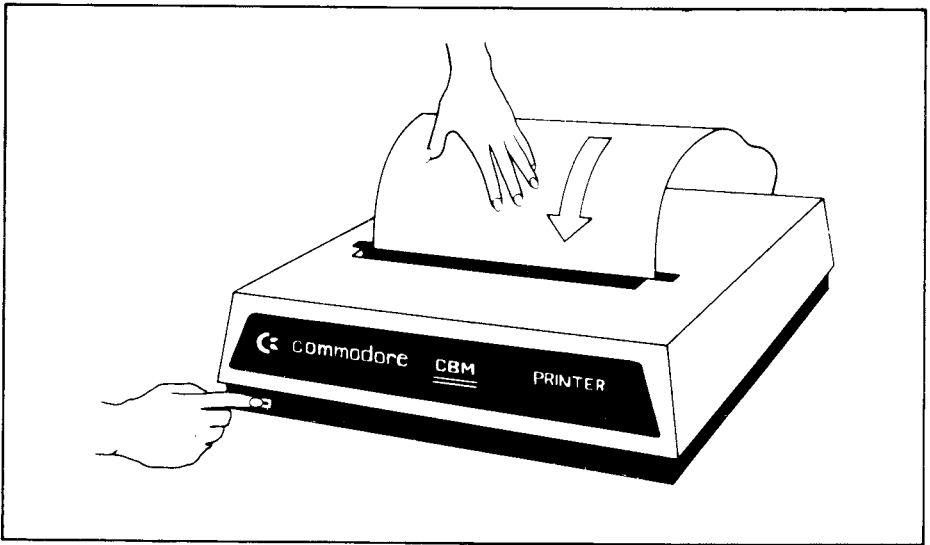


Figure 1-36. Loading Paper into Model 2023 Printer

Loading Paper Into Printer Model 2023

The friction feed model accepts paper up to 10" wide. No sprocket holes are needed. Paper may be the long fan-folded type or individual sheets of paper.

To load the paper follow these steps:

1. Turn the printer power on. The power switch is on the lower right back panel.
2. Guide the paper into the paper feed (on the top inside of the printer) as far as it will go.
3. While guiding the paper into the paper feed, press the paper feed button on the lower left front of the printer until the top of the paper has rolled out of the printer (see Figure 1-36).
4. To adjust or remove the paper, lift the paper release bar to loosen the friction feed mechanism (see Figure 1-37). Remove or adjust the paper, and push the bar back to its original position.

Print Head Test

Once the ribbon and paper have been properly installed, you should perform a print head test to make sure that everything is working correctly. *Do not perform this test or print anything if paper is not loaded;* you may damage the print head. To do the test follow these steps:

1. Turn printer power *off*. The power switch is located on the lower right back panel.

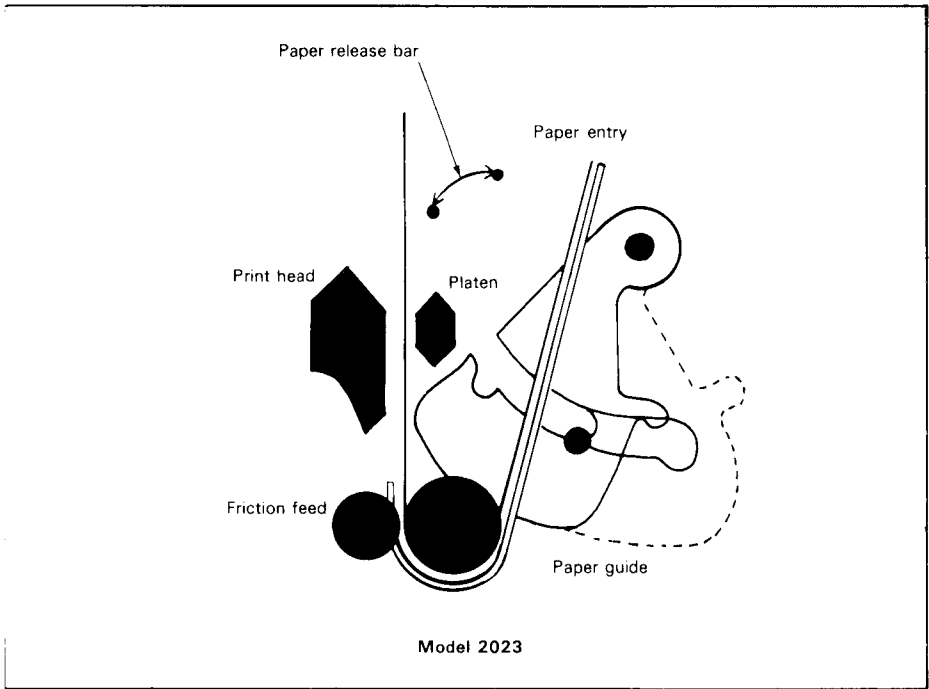


Figure 1-37. CBM 2023 Printer Paper Path

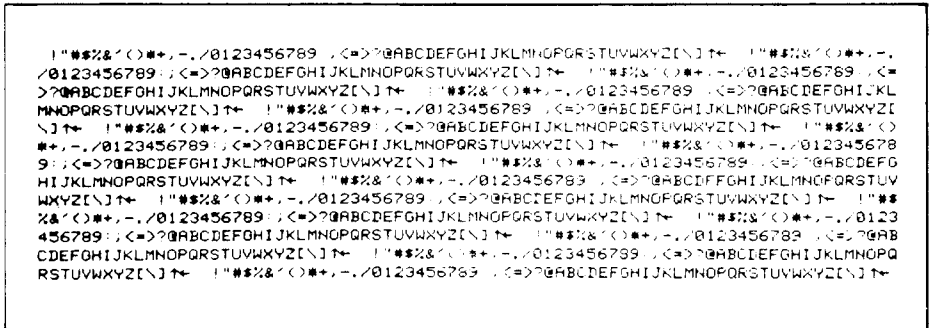


Figure 1-38. Print Head Test

2. Turn printer power back *on while pressing the paper feed button* (lower left front corner). The printer should rapidly print out a repeating sequence of all special symbols, numbers and letters available (no graphics). An example of the test is shown in Figure 1-38.
3. To stop the test, turn the printer off.

If the printer malfunctioned, or the printout has defects, contact your Commodore dealer. Otherwise, your printer is ready for use.