

## The Commodore 8032 Business System

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Commodore has introduced a new microcomputer for the small-business market: the Model 8032. Inside the 8032 is a new operating system that makes up for some of the deficiencies of Commodore's old operating systems. Also available is a version of this new operating system for Commodore's older machines.

Commodore has also upgraded its dual floppy-disk system, now called the 4040. It is used with an improved disk operating system (DOS), which is more reliable and can now randomly access disk files. Commodore has also released the 8050, a dual 5¼-inch floppy-disk-drive system with 500K bytes of storage per drive. Although the 8050 drives are single-sided, they allow double density and 96 tracks per inch. The disk operating systems for the 4040 and the 8050 are similar and the commands are basically the same. Any comment about the 4040 is usually applicable to the 8050 as well.

The release of this new equipment is accompanied with new software that makes this Commodore Business Machine (CBM) truly a professional piece of equipment. With a combination of software packages (not produced by Commodore), this microcomputer system will find its way into both small and large businesses.

### New System Features

First, a look at the 8032. Its new 80-column, 12-inch video screen is the most obvious difference from Commodore's other systems. As before, the system's cabinet is

a one-piece housing for the main logic assembly (the circuit board on which the system is built), power supply, video display, and keyboard. The clean design makes the system aesthetically suited for residence in an office.

The main logic assembly runs the depth of the cabinet, with the power supply at the back left corner and the video circuitry mounted above. Heated air is allowed to rise upward, out of the cabinet, while cooler air enters through the bottom; a fan is unnecessary.

All interface circuitry is built into the system. It is accessible by way of three edge-card connectors at the back of the cabinet. This includes the famed IEEE-488 interface that allows the computer to control test equipment (among other things), the user parallel port, and one of two cassette ports. The memory-expansion port can be accessed through an opening in the side of the machine.

One of the features for which the old PET microcomputer was known was its real-time clock; thankfully, this feature is included with the 8032. For high-level-language use, this 24-hour clock reads out hours, minutes, seconds, and "jiffies" (sixtieths of a second). Through machine language, resolution down to 1 millisecond is available, making the system suitable as an instrumentation controller. Software has eliminated keyboard bounce. Of course, the 8032 has the unique CBM graphics characters and standard uppercase and lowercase letters.

The most dramatic improvement is in the video circuitry. Because the number of characters on the

80-column screen is double that of the old 40-column display (expanding the video buffer to 2K bytes), the time needed to perform screen-oriented functions (clearing the screen, scrolling, etc.) would be increased. However, the display is now controlled by a 6845 integrated circuit that frees the microprocessor from having to perform display functions. It also provides extra spacing between lines of text. Descenders on one line no longer touch the ascenders of the line below. By changing to the graphic mode, lowercase and uppercase characters are replaced by uppercase and graphics characters, respectively, and the extra spacing between lines is removed.

Turning on the system or moving the cursor past the seventy-fifth column rings the system's bell. The speaker

(actually a piezoelectric transducer) is connected to the CB2 line of the parallel port. Since this is the same line often used to create sound effects, these sounds can now be heard through the bell without an audio amplifier. The bell also rings when the ASCII bell code is printed.

## New Software

To accompany the hardware modifications, Commodore has updated the operating system to version 4.0 in a way that complements the DOS. It now includes a new screen-oriented text editor, commands to simplify disk operations, and better string handling. Because the major change in this operating system is the addition of disk commands, the new version of BASIC is known as Disk BASIC (see the text box "A Quick Reference"). Notice that the new commands only make it easier to perform disk functions—they do not add any new features. The system defaults to device number 8, drive 0 (if this default can be changed, it is not documented).

To make these features available on older 16K- and 32K-byte CBM computers (those using version 3.0 BASIC), Commodore has released a version 4.0 read-only memory (ROM) upgrade. This will give the user all the enhanced commands, but not an 80-column screen. One catch is that the RECORD command (for random-access disk files) can only be used with DOS 2.1 and a 4040 floppy-disk-drive subsystem.

The disk commands are not the only change to BASIC, however. One other improvement is the string handling. When a string variable is used in a BASIC program, the BASIC interpreter sets aside memory space. As the string is reused, BASIC abandons the space and finds a new place in memory for the string's contents. Eventually, when all the free memory is used, the interpreter must collect and reuse the abandoned memory.

Garbage collection, as it is called, is also done when the system is asked to count the free memory locations. While garbage collection is going on, the system will not respond to the user. It therefore appears "dead" until the collection is done. The new version of the software does garbage collection in much less time. A collection that formerly might have taken as long as 21 minutes now takes only 0.64 seconds.

Commodore has also added disk-status flags to the new software. These special variables, DS and DS\$, contain the status of the last disk operation and disk error. Without these, it would be necessary for the user to write a three-line program to determine the nature of a disk error.

Three other improvements have been made:

- when sending data to a device via the IEEE-488 interface, the system will send only a carriage-return character; it will not be followed by a linefeed character
- it is now possible to append data to an existing disk file
- if the input string from a device is more than 80 characters long, the system will generate a trappable error with the message "?string too long error"

## At a Glance

### Name

CBM: 8032 computer system

### Manufacturer

Commodore Business Machines  
Computer Systems Division  
The Meadows  
487 Devon Park Dr.  
Wayne, PA 19087  
(215) 687-9750

### Price

\$2829.95 (suggested retail) including all required cables

### Dimensions

Computer: 35.5 by 41.5 by 46.5 cm, 22.5 kg (14 by 16.5 by 18.5 inches, 50 lbs)  
Disk drive: 16.5 by 38 by 36 cm, 12.5 kg (6.5 by 15 by 14.35 inches, 28 lbs)

### Description

CBM 8032 computer: 6502 MOS Technology microprocessor, 73-key business-style keyboard, 12-inch green-phosphor display (80 characters by 25 lines, 2000 characters, 8 by 8 dot-matrix characters), IEEE-488 bus, 8-bit bidirectional parallel port, and two Commodore cassette ports included. 3-MHz system clock. 32K bytes (1K used for operating system overhead) plus 2K-byte screen buffer  
4040 dual disk drive: Shugart 5¼-inch floppy-disk drives, single-sided, single-density, 174,848 bytes unformatted, 168,656 bytes formatted, 144 file entries per disk  
Controller: 6504 microprocessor  
Interface: 6502 microprocessor  
Disk buffer: 4K bytes  
CBM operating system included with 8032 computer: Microsoft BASIC, screen editor, and built-in IEEE-488 and disk commands (18K ROM)  
Disk operating system included with 4040 disk drive: Program load and save; sequential; User, Relative, and Program files; file utilities (Copy, Rename, Scratch, Duplicate, New disk); Disk Directory; and Error Recovery

### Software

Business software available (also see the Commodore Software Encyclopedia): Wordpro 4 Plus (word processing—Professional Software Inc.), Visicalc (electronic blackboard—Visicorp.), The Manager (database—Canadian Micro Distributors), BPI, and CMS accounting software

### Audience

This system is well suited for use in a modern office environment, as well as educational institutions and other business applications

This 80-character limitation becomes apparent during disk-file operations. Although a record written to disk can be as long as 254 characters, and a string can be as long as 255 characters, any record that is more than 80 characters long must be accessed one character at a time, using the GET# command.

### Better Editor

Although the editor has been improved, its operation is still the same. To change a line in a program, merely move the cursor to where the corrections are to be made, make the corrections (insert, delete, etc.), and push Return. The corrected line is entered as if you had re-typed the whole thing.

What makes the editor so easy to use are the keys designated to perform each of the cursor movements, insertions, and deletions. Whole sections of programs can be copied from one program to another by listing the lines to be transferred on the screen, calling in the new program (which clears out the old one), moving the cursor to the start of the lines to be transferred, and pressing return for every line. The cursor does not have to be moved over each line, nor even moved to the end of each line. It is as simple as that and saves a lot of typing.

Special characters have been added to the screen editor that perform functions by using the video controller. (I've found that the graphics characters can be accessed from

the keyboard if the 2 key is hit while pressing both shift keys.) The screen can now be scrolled up or down just by printing a special character; whole lines can be inserted or deleted, a line can be cleared to its end from any position, or from its beginning to any position.

Two of the special characters define the upper-left and lower-right corners of a *scrolling window*—a portion of the screen in which the movement of the cursor is restricted to preset boundaries. For instance, if you wanted to simulate the older 40-column screen, you could set one special character at the top of the screen, indented 20 spaces; the second special character would be indented 60 spaces on the bottom line. The cursor movement would then be restricted to this area.

This is also useful for defining split screens to display information. The information will scroll in the window, leaving the rest of the screen untouched, no matter where on the screen the window is defined. Normally, when the computer is turned on, the entire screen is the scrolling window.

One problem occurs if tabs are used in the program. The tabs are always computed from column 1 regardless of the scrolling window. If the tab is before or beyond the scrolling window, the cursor will be placed on the nearest edge within the scrolling window. The window is cleared simply by printing the ASCII Home character or pressing the Home key twice. A complete list of special screen-

## A Quick Reference

*DOS 1.0 is the operating system of a 2040. DOS 2.1 is the operating system of a 4040. DOS 2.1 can read a DOS 1.0 disk and DOS 1.0 can read a DOS 2.1 disk; however, neither should write on a disk formatted by the other.*

<b>New Disk BASIC Commands</b>	<b>Operation</b>	<b>See Notes</b>
DSAVE	Saves current program in memory on disk	1
DLOAD	Loads specified program into memory	
CATALOG	Lists the programs stored on the disk	
DIRECTORY	Same as CATALOG	
SCRATCH	Scratches specified program from disk	1,2
RENAME	Renames a file on disk	1
CONCAT	Concatenates two files	1
COPY	Copies specified file on disk	3
BACKUP	Track-to-track duplication from one disk to another	1
COLLECT	Collects disk space from unclosed files and verifies disk	1
HEADER	Formats a new disk for file storage	2
DOPEN	Opens a disk data file	1
DCLOSE	Closes a disk data file	1
APPEND	Opens old disk file to append additional data	1
RECORD	Specifies what record in a file will be read or written	4

**Note 1:** These commands cannot be used with DOS 2.1 with a disk that has been formatted with DOS 1.0 because they perform write functions and cause the "72.cbm v2 dos error."

**Note 2:** These commands will ask, "ARE YOU SURE?" A response of "Y" or "YES" to this will then perform the desired function.

**Note 3:** COPY can copy all the files on one disk to another. Use COPY to convert DOS 1.0 disks to DOS 2.1.

**Note 4:** This command (as well as some versions of DOPEN and COPY) will not work with DOS 1.0.

*Continued on page 372*

Continued from page 370:

Screen-Control Function	Description	Decimal ASCII Code	Equivalent Control Character
BELL	Sounds bell for ¼ second	7	g
TEXT MODE	Sets TEXT mode (uppercase/lowercase and extra spaces)	14	n
SET TOP	Sets top left of scrolling window at position	15	o
DELETE LINE	Deletes current line and scrolls screen up one line	21	u
ERASE TO END	Erases from current position to end of line	22	v
SCROLL UP	Scrolls screen up from bottom, top line lost	25	y
GRAPHIC MODE	Sets GRAPHIC mode (uppercase/graphic no space)	142	N
SET BOTTOM	Sets bottom right of scrolling window at position	143	O
INSERT LINE	Inserts a line at current position, scrolls down	149	U
ERASE BEGINNING	Erases from start of line to current position	150	V
SCROLL DOWN	Scrolls screen down from top, bottom line lost	153	Y

Poking a 12 or 14 to location 59468 will not change the line spacing between lines. A function's code and inverse (i.e., DELETE LINE versus INSERT LINE or SCROLL UP versus SCROLL DOWN) are 128 apart (i.e., 21 (DELETE LINE) + 128 = 149 (INSERT LINE))

#### Further Notes (Some known bugs in the disk operating system)

1. Sometimes when the pointer is moved from the middle of one record, it does not go to the beginning of the next record as it should. The RECORD command should be used to position the pointer before each I/O to the file.
2. The save and replace also found in DOS 1.0 has not been corrected.
3. When DS is less than 20 (but greater than 1), DS\$ is blank.
4. Opening a data file without specifying the drive number causes a "FILE TYPE MISMATCH ERROR" by the DOS (this is taken care of in Disk BASIC).
5. The BLOCK-ALLOCATE command does not function properly.
6. The pattern matching with trailing '?'s does not match properly. "A???" will match the file "A", "AA", "AAA", or "AAAA", but not "AAAAA".
7. The D\$ variable does not always match the ST variable after a disk operation.
8. SCRATCH will not remove a recently used data file because it finds that was used and believes that the file is still open.
9. The work-space buffers are not reclaimed when a disk file is not properly closed.
10. Scratching an open file will give the file a "DELETED" file type in the directory and garbles DS\$.
11. Relative files cannot be copied with the COPY command. They must be rewritten or the disk they are on must be duplicated (backed up).
12. When drive 1 is automatically initialized, DS\$ becomes incorrect.

control characters can be found in the text box "A Quick Reference."

The screen editor also gives the space-bar and the cursor-control keys an automatic repeat and enables both the Repeat key and the Tab key. Holding down the Repeat key while pressing any other key will cause that key to repeat. The Tab key causes the cursor to move to the next tab stop. By pressing a Shift/Tab combination, a tab stop will be set (or cleared if one already exists) at the current cursor position. Since a tab stop can be set for each column, a total of 80 tabs can be set at any one time.

The ESC (Escape) key has also been given a function. One wants cursor controls to function while the program runs, but the same controls should be visible as special characters in a listing (it would be difficult to read the listing if the screen would clear each time a Clear Screen character was used). To avoid this problem, Commodore decided that if an odd number of quotes were typed on a line, the system would be in quote mode and a screen-control character would appear as a white-on-black character. The quote mode is also initiated when spaces have been inserted into a line with the Insert key. To end quote mode, you have to type another quote (unless it was initiated by the Insert key) or hit Return (and accept a line that should possibly not be accepted). By hitting the ESC key, you will escape from quote mode and the cursor keys will function normally.

The Run/Stop key has also been changed. In the old OS, it would load the next program from tape and run it. Now, it automatically loads and runs the first file from disk drive 0. This makes it easier for inexperienced operators to use software packages.

## The Rest of the Story

Disk BASIC (OS version 4.0) was primarily designed to be used in conjunction with the new DOS 2.1. Though it can be used with the older DOS (version 1.0), the full potential of the system cannot be realized. Although access is the major and most important improvement to the DOS, Commodore has made other improvements.

The reliability of the disk drives has been improved by the removal of one sector (256 bytes) from each of the inner seven tracks on the disk. Because one of these sectors came from the directory track, there is now a maximum of 144 entries to the directory. This change also resulted in the loss of six data blocks from the disk. Because of this change, the disks made by the different DOSes are *not* compatible: but one can read disks made by the other (note that an 8050 can read only an 8050 disk). DOS 2.1 will generate a "CBM DOS V2" error if you try to write on a disk formatted by a version 1.0 system; however, if you write to a 2.1 formatted disk with DOS 1.0, the directory track will be disturbed and subsequent operations will cause disk errors.

Other changes to DOS 2.1 include an error counter in the BACKUP (a track-by-track duplication that destroys any data originally on the destination disk) command. To back up a disk now takes 2 minutes and 15 seconds

instead of 6 to 7 minutes. Also, if the system encounters an error during a COLLECT (verify), the system will restore a bad Block Availability Map (which tells the DOS what blocks are free for use as storage). This was not available under DOS 1.0.

Another improvement is in the COPY command, which will now copy all the files on one disk to another. Trying to copy a file to disk where that file is already in use will produce the "FILE EXISTS" error message, and the COPY will be halted. When converting disks from DOS 1.0 to DOS 2.1, the COPY command is the one to use.

With random-access files, each record must be the same length, making it important to inform the DOS how large each record will be when the file is created. This is so that the DOS can compute where to position the disk's head for the next appropriate record. The maximum record length is 254 characters, with a maximum of 65,535 records in a file. (The disk would not be able to hold all 65,535 records if the record length was more than two characters.)

Part of the beauty of Commodore's system using intelligent peripheral devices is that they can be doing one thing while the microprocessor is doing another. For instance, when the disk drive sends out a record, it automatically does a "look-ahead" operation and gets the next record (this makes sequential operations faster) while the microprocessor busies itself with computations.

Software availability for any system is quite important. Usually, after the introduction of any new computer, it normally sits around for a time before any good software is available. For the CBM 8032, however, this is not the case. Any software written in standard BASIC or for Commodore computers should run on the 8032 without modification. It does, however, depend on how the program was written.

Because the 8032 uses the new version 4.0 OS (meaning different ROMs), any program that has machine-language calls to the operating system probably won't work without some modification. For instance, in the 8032, the interrupt vector points to a different location than in the older CBMs.

The other major difference that will cause a compatibility problem is the difference in the screen sizes. Programs (mostly games) that peek and poke at the screen buffer won't work due to the difference of line lengths on the screens and the additional 1000 bytes in the screen buffer of the 8032.

Since the 8032 is ostensibly a business computer, it is more important to have professional business software available than games. Fortunately, some very powerful business programs are on the market. One is Professional Software's Wordpro 4 Plus. This is possibly the most powerful word-processing software available for a stock microcomputer.

Another powerful software package available for the system is Visicalc. On the 80-column screen, you can lay out spreadsheets of all types (i.e., budgets, balance

sheets, etc.) to see how changing one element affects the rest.

## Documentation

One area in which Commodore has made a remarkable improvement is documentation. In the past, documentation for Commodore computers has been quite poor, lacking both in content and approach. The 8032 comes with a *User's Reference Manual* that explains in a clear, concise manner the capabilities of the system and the entire command set. The command set is presented in a form used by other technical manuals showing the command format and syntax, in which version of Commodore BASIC it can be used, its purpose, remarks about the command, and detailed examples. The manual included with the 4040 explains the operation of the disk and the disk organization, as well as how to use the various disk commands.

I believe, however, that some documentation is lacking. From past experience, I know that a command can be abbreviated to the first few letters (i.e., goto = gO, gosub = goS, print# = pR, etc.). This time-saver is not mentioned in any of the manuals. The screen-control characters and the use of the screen editor (one of the nicer programming features on the system) are also completely missing from the documentation.

In the *User's Guide* is a system memory map by 1K-byte blocks. Included in that manual's appendix is a list of more than 20 system calls, plus the missing machine code needed to perform the listed function. All these system calls are common to all versions of Commodore's operating system. This is quite helpful for those who wish to do machine-language programming; however, Commodore omits the zero-page memory map, one of the most important memory maps for a 6502-based machine. My interpretation is that Commodore wants other people to write software for its machines that is in-

dependent of the model it was written on.

The upgrade ROM for Model 2001 computers will give you all the features and improvements of Disk BASIC, without an 80-column screen. Though the new operating system uses an additional ROM, helpful commands such as TRACE and RENUMBER were not included. (The request for "Programmer's Aid" routines has been answered by Power, a 4K-byte ROM from Professional Software Inc., 51 Fremont St., Needham, MA 02194.) Likewise, Commodore is offering an upgrade for the 2040 disk drive that makes it a 4040. This set of three ROMs and one controller will give an old 2040 random-access capability and increased reliability. Remember that if you upgrade to a 4040, your 2040 disks must be converted to the new DOS 2.1 format *before* you can write on them.

## Conclusions

The CBM 8032 computer and 4040 disk drive form a good business system for the small to medium-size business. The lack of a marketing strategy by Commodore, as well as its past nonchalant attitude toward the encouragement and development of good software, has hurt its credibility, especially in comparison to the other systems on the market.

The available business software, Wordpro and Visicalc, make excellent use of the capabilities of the CBM 8032 and coincide with the environment in which it is best suited. The recognition of the companies who market these types of programs will keep this computer in a business atmosphere.

With an increasing number of competitive machines being brought to the marketplace, Commodore appears to be now providing better support and documentation on its systems. The documentation included with the CBM 8032 and the 4040 disk drive has improved over the documentation provided with past Commodore computer systems. ■