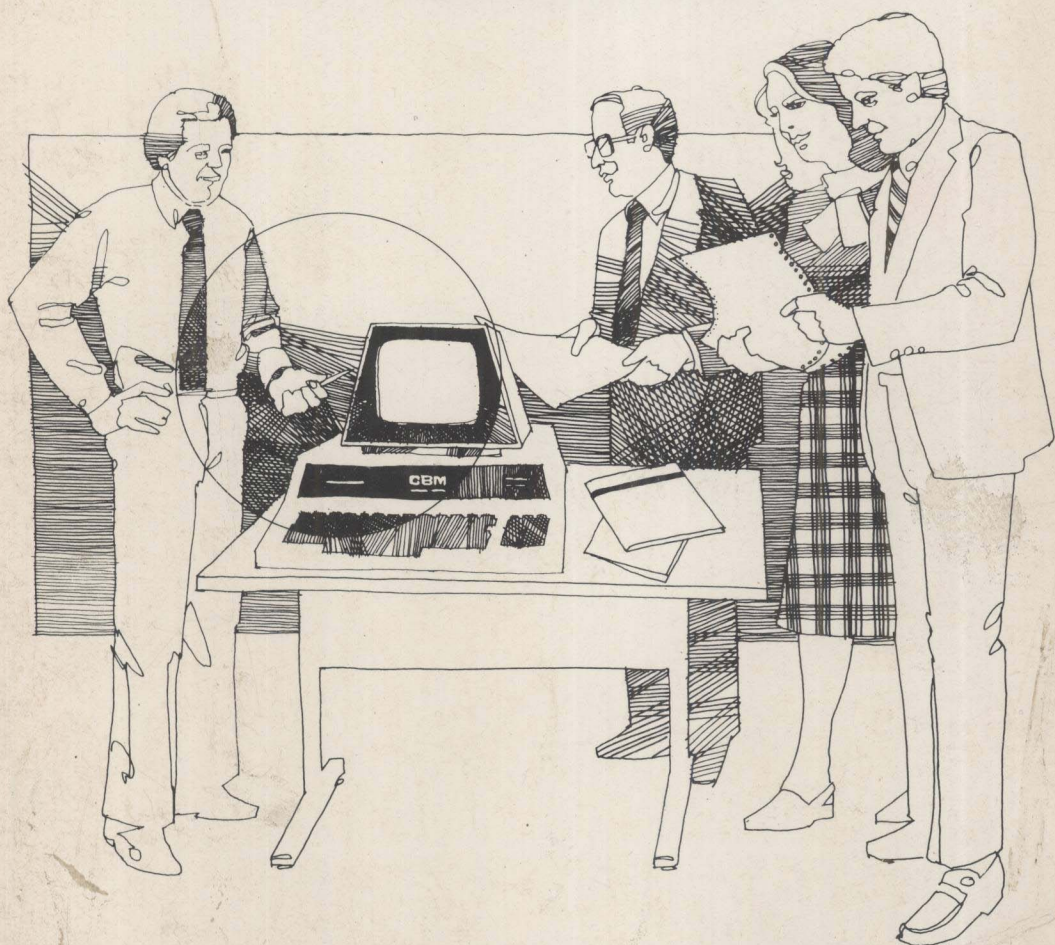# CBM™ PROFESSIONAL COMPUTER GUIDE

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CBM™

PROFESSIONAL COMPUTER GUIDE

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CBM™ PROFESSIONAL COMPUTER GUIDE

Acknowledgments

Preface

The purpose of the *CBM Professional Computer Guide* is to explain Commodore Business Machines CBM model computers and to help you use them effectively and reliably in the home, school, lab, or office. By the time you finish this volume, you should be able to write original programs for your special needs, and to convert programs from other Commodore or similar computers.

This third edition of the *Guide* has been published in two volumes. This volume, the *CBM Professional Computer Guide,* thoroughly covers all models of Commodore computers with "business" keyboards, along with their usual attachments. It includes enough information on Commodore's other models, the PET personal computers, to allow CBM users to utilize and adapt most programs written for PETs, past or present. However, if you primarily use a PET computer with graphic characters on the keyboard, you should probably get the companion volume to this edition, the *PET Personal Computer Guide.* If you use both types of Commodore computers regularly, you may want both volumes handy.

Included here are complete descriptions of the CBM models 8032 and 2001/B, and the 8050 disk, along with some information on the Tally 8024 and CBM 8023P dot matrix printers and the CBM 8300P letter-quality printer. The 9000 series SuperPet, Expansion Memory Board, and forthcoming CBM 8250 disk are also mentioned. The companion volume focuses on PET models 4032, 4016, and their predecessors, along with the 4040 and 2031 disks and the 4022 printer.

Three new chapters have been added to this third edition: one on other peripherals, such as the CBM 8010 modem and PET 4010 voice synthesizer; another on the machine-language monitor; and a third on hardware hints and upgrading former models.

Every attempt has been made to assure the accuracy of this third edition, based on the current editors' four years of experience in using and writing about Commodore computers. Our apologies for any inconvenience errors in the second edition may have caused. If you do find an error in this edition, please write to the publishers.

Several programs from this book, plus other public domain programs, are available on a HELP disk. Copies of this disk have been sent to the PET user groups listed in Appendix C and may be obtained from them, or directly from the editors at the following address for $15:

James and Ellen Strasma
Lincoln College
Lincoln, IL 62656 USA

The HELP disk includes the following programs from this book:

Chapter	Program	Description
8	ASCII.FIX	PET to true ASCII converter
5	BORDER.PRINT	Graphics print box around text
6	CONCATEST	Sequential file demonstration for CONCAT
6	DATE	Six-digit date entry demonstration
6	MINIMAIL30oc	Mail list using relative files
7	MODEM	Modem chat software
6	NAME & ADDRESS	Mail list entry information demonstration
6	SEQ.MAIL.B4	Mail list using sequential files
6	SEQ.NUM.B4	Numeric data using sequential files
6	WINDOW	Views data through window

The disk also includes the following exchangeable programs from PET user groups:

Program	Description	Main Author
BACKUP	COPY for Disk, with sort	TPUG
BAR GRAPH 2.4	Prints graphs to screen/ printer	John Easton
BASIC AID 4.0,	Programmer's aid	Commodore Canada
CASS.DATA.COPY	Read cassette sequential data to disk sequential file	Jim Strasma
CBM4032 V3	Run 40-column programs on 80-column screen	Chuan Chee
COPY/ALL	Copy from unit to unit	Jim Butterfield

DATAMAKER	Convert machine language to BASIC data	Jim Strasma
DRAW	"Etch-a-sketch" program	Penninsula School
EATER	Graphic game	Ann Arbor PUG
MAIL LIST 4040	Relative file mail list	Chris Bennett
MANDALA	Graphics for 40-column screen	
MICROMON & INSTR.	Powerful extended monitor	Bill Seiler
PETSONG 3.2	Bach tunes	*PET GAZETTE* Program Exchange
PROCEP EDITOR	Forms INPUT editor with extended math	Commodore France
RELREAD	Reads relative files	Jim Butterfield
TERM & TERMINAL	MODEM program exchange software	Steve Punter
WORDPRO READER	For users without WordPro	Robert Baker

Versions are included for current CBM products and for upgraded BASIC 2.0, but a few may not work in your particular machine (especially if it is a new variation or has less than 32K of memory). Specify whether you need 4040 or 8050 disk format when ordering.

Contents

Introducing CBM Computers 1

In 1977, Commodore Business Machines, a multinational manufacturer of calculators, watches, and office furniture, shocked the world of electronics by introducing the first "appliance" computer. At the time, the usual home computer was a homemade assortment of circuit boards that took a long time to assemble, and even longer to get working. A typical "cheap" system cost about $3000. The PET (an acronym for Personal Electronic Transactor), in contrast, came fully assembled in a single cabinet and worked as soon as you plugged it in and turned it on. You no longer had to understand electronic theory to have a home computer.

The price was another shock—$795, complete with built-in keyboard, cassette deck, and Cathode Ray Tube (CRT) monitor display. Commodore was able to achieve this price by personally manufacturing everything for the new computer, from the popular 6502 microprocessor to the sleek metal cabinet. Despite the low price, Commodore equipment was, and remains, among the best in the desk-top computer industry.

Only the PET's woefully inadequate early documentation—initially no more than a list of allowable BASIC (an acronym for Beginner's All-purpose Symbolic Instruction Code) commands—and Commodore's intense focus on the highly profitable world market kept the new computer from sweeping the United States market.

Commodore is now providing much better manuals and devoting more attention to the U.S. market than in the past. Quality programs for Commodore equipment have long been available through user groups. But now excellent programs are

1

appearing in abundance, often sold directly by Commodore dealers. The best of these bear the label "Commodore Approved." For nearly all practical purposes, Commodore computers are equal to or better than other popular microcomputers.

Commodore computers come with a built-in version of the BASIC computer programming language. Developed at Dartmouth College, BASIC is by far the most popular computer language for microcomputers, and is likely to remain so for years to come.

The dialect of BASIC used by Commodore is called Microsoft BASIC, and is also used in Apple, Radio Shack, and many other computers. Many programs written in Microsoft BASIC for other computers can be used easily on Commodore computers. Similarly, the 6502 microprocessor, made by Commodore, is used not only on PETs and CBMs, but also by Apple, Ohio Scientific, Atari, and several other brands of computers. Thus, even machine language programs for competing brands can often be adapted to work on the Commodore computers.

This book is specifically for Commodore's CBM models, focusing primarily on the series 8000 and 9000 equipment. The companion volume, *PET Personal Computer Guide,* covers Commodore's 4000 and 2001 series computers, as described in the Preface.

CBM Models

Since the first PETs were released, there have been four generations of Commodore computers. Each new generation added some necessary features, but also required changes in many user programs. This volume not only describes the current third and fourth generations of Commodore computers, but also includes details on variations in earlier generations.

Much confusion has arisen among Commodore users, and even within Commodore itself, about what to name the various generations of Commodore BASIC. The first generation is called the "old read-only memories (ROMs)," "original ROMs," "∗ BASIC," "BASIC 1.0," and "BASIC 2.0." Following a long-standing tradition in the computer software industry, the first release version of Commodore BASIC will be referred to as "BASIC 1.0."

BASIC 1.0 is distinguished from later generations of BASIC by the first line of its message on the screen when its power is first switched on. Notice the asterisks, and the absence of a version number.

```
*** COMMODORE BASIC ***
 xxxxx BYTES FREE
READY.
■
```

Before describing later generations of Commodore BASIC, we will explain the rest of the power-on message to help you understand some of the names given to Commodore BASICs and computers.

The rest of the power-on message tells how much user memory space is currently available for programs. Each "byte" is equivalent to a single typewritten character.

Usually, this space is referred to in "K's" of memory, with each K representing 1024 available memory locations. The user-changeable memory is Random-Access Memory (RAM). Read-Write memory would be a more descriptive name, since the alternative is Read-Only Memory (ROM).

ROM is permanent. In Commodore computers, it contains the BASIC language interpreter and an operating system for accessories. It is the ROM's permanent memory that allows the computer to retain its "personality" when turned off. In contrast, user RAM is erased whenever the computer is turned off. That is why you will need a cassette or disk unit to retain any program you want to keep and use again.

The word "READY" and the flashing square, which is called the "cursor," are messages to you from the BASIC interpreter. The "READY" message means no user program is running. The flashing cursor means that it is your turn to do something and the computer is waiting for you. Beginning with Chapter 2, you will put the computer to work.

Commodore's Next Generations

The second generation of Commodore computers has been called the "new ROMs," "upgrade ROMs," "# BASIC," "BASIC 2.0," and "BASIC 3.0." It is easily distinguished from all other versions of CBM BASIC by the pound sign (#) in its power-on message.

```
### commodore basic ###
 xxxxx bytes free
ready.
■
```

Also notice the lower-case message (on CBM models).

A nearly identical version of BASIC is used in the new Commodore VIC-20 (Video Interface Chip) computer. Although the VIC will not be described fully in this volume, we will point out differences between VIC and CBM BASIC, in case you want to use a VIC program in a CBM computer. Following VIC's lead, this second generation of CBM BASIC will be referred to as "BASIC 2.0." (VIC's power-on message includes the version number, "V2.")

There was another version of BASIC after BASIC 2.0, which Commodore did not release. This BASIC was known within Commodore as BASIC 3.0. Therefore, when the current third generation of CBM computers was released, the number 3.0 was bypassed.

There is no question about what to call the BASIC in current CBM computers. BASIC 4.0, like VIC BASIC, includes its version number in its power-on message.

```
*** commodore basic 4.0 ***
 31743 bytes free
ready.
■
```

A fourth generation of Commodore computers is currently being released. Unlike earlier generations, these new models do not include a new version of Commodore BASIC. Instead, they operate identically in one mode to the current

CBM model 8032. The series 9000 SuperPet uses BASIC 4.0 in the 8032 mode. In other modes, the series 9000 uses several other computer languages, including a version of Waterloo BASIC which is identical in syntax to the one used on IBM mainframe computers. The series 9000 also uses interpreted versions of Pascal, APL, and FORTRAN, plus 6809 assembly language. The non-Commodore languages of the fourth generation CBM computers are explained fully in manuals included with the computers.

Commodore's Family Tree

Before describing the CBM computers and accessories in detail, it may be helpful to trace their roots back to the original PET computer. Each model of computer along the way had its unique features. Sooner or later, you will need to know how to identify the various models, if only to trade programs of varying vintages.

The PET 2001

The PET 2001 was the first computer sold by Commodore Business Machines (see Figure 1-1). First shipments began in the summer of 1977. Over the next two years, more than 50,000 were sold. They are still available on the used market, and are an excellent value, if you can find one. The PET 2001 had a small, calculator-style keyboard that was durable, popular with children, and very well arranged for use in BASIC programming. Touch typists, however, disliked its tiny keys and nonstandard layout.

This first PET had a built-in digital cassette. Although it requires a small fix in user programs to write data files reliably, it remains one of the most reliable and usable computer cassettes on any microcomputer. It also included a 9-inch, 40-column by 25-row, black-and-white CRT monitor. It featured 64 graphic characters and a screen editor still unmatched by competitors. The 2001 even included a built-in self-test diagnostic.

A few PET 2001s were made with 4K of user memory, but most had 8K, of which 7167 bytes were usable for BASIC programs. This was a smaller number than competing computers had, but then, as now, Commodore computers used memory very efficiently. Most programs that ran in 16K on other computers of that era can be adapted to fit into an 8K PET. It used BASIC 1.0, upgradable to BASIC 2.0 (free to buyers of the Commodore 2040 disk).

In text mode, it displayed lower-case letters with the SHIFT key down, unlike later models. PET 2001s with 24-pin character generators can be upgraded to match later models, but most have 28 pins. Programs to be used on both this and later models should probably avoid text mode. User programs can identify this model by its unique ban on "peeking" at its ROM. In late 1978, Commodore released a free, cassette-based machine-language monitor for the PET which bypassed the ban on viewing ROM contents.

The PET 2001 is still prized by many for its well-shielded, all-metal cabinet and easily portable construction.

FIGURE 1-1. PET 2001 original computer

The New ROM Models, Spring And Summer 1979

BASIC 2.0, released in the spring of 1979, allowed the use of the new CBM 2040 disk drives. BASIC 2.0 included a built-in machine-language monitor in place of the diagnostic tester, which is now a more sophisticated clip-on device available through any authorized Commodore dealer. All errors in BASIC 1.0 known at the time were fixed in this upgraded version.

The second generation included three models, all upgradable to BASIC 4.0. Each included three empty ROM sockets for plug-in programs, and was available with up to 32K of user memory "on board." Because of the built-in intelligence of the Commodore disks and printers, 32K Commodore computers are able to handle most programs that fit into their competitors' 48K computers. Beginning in the summer of 1979, easy-to-read, green phosphor monitor screens were incorporated into all models.

PET 2001/C

BASIC 2.0 first appeared in the familiar, calculator keyboard cabinet, continuing the built-in cassette. It was briefly available with 8K, 16K, and 32K of memory.

FIGURE 1-2. PET 2001/N computer

PET 2001/N

The second model to contain BASIC 2.0 had a large graphic keyboard, similar in layout to the original, but easier for adult typists to use (see Figure 1-2). The cassette became a separate option, at extra cost, which plugged into the rear left of the computer. Like the calculator keyboard 2.0 version, it was available in 8K, 16K, and 32K versions. After some dealers began buying the cheaper versions, adding memory and selling them as 32Ks, Commodore began drilling holes in the circuit boards of the smaller capacity models, making them difficult to upgrade to 32K. Keep this difficulty in mind if you are considering buying a used one. In early 1980, Commodore stopped using metal cases on its computers, and switched to lighter, but durable, structural foam cabinets. The change made it easier to ship CBM computers via the United Parcel Service in the U.S. Earlier units had exceeded UPS size and weight limits.

CBM 2001/B

This was the first model to be labeled "CBM." It was also called the "business PET." It had an industry-standard business keyboard, including numeric keys on the top row, plus TAB, ESCAPE, and REPEAT (see Figure 1-3). It was available until the fall of 1980 in 16K and 32K versions. It was upgradable to BASIC 4.0, but was never sold that way. It will be fully described in this volume.

FIGURE 1-3. CBM 2001/B computer

VIC-20

Though not a PET or CBM model, the new, inexpensive Video Interface Computer is very much a part of the Commodore family (see Figure 1-4). It uses CBM BASIC 2.0, with extensions for eight-color graphics and four-voice sound. With optional planned extensions, it is expected to be able to use PET and CBM accessories. Except for its narrow 22-column display, and small 3.5K of free memory at power-on in the standard unit, it is able to run CBM BASIC programs with little or no change. Likewise, CBM computers can run many VIC programs (as long as they do not use the color and sound commands) after a bit of adjustment when loading tapes.

CBM owners who need color displays or fancy sound should consider adding a VIC to their system. It is no more expensive than some other interfaces available for CBM, and it does a great deal more. There are already inexpensive programs available to allow the VIC and CBM to pass programs and data back and forth at extremely high speed.

The Disk-Based Models, Summer 1980

Commodore BASIC 4.0 adds several new disk-handling commands, and features much faster character-string handling than former BASICs and those of competing brands of computers. With the new BASIC came three new computers.
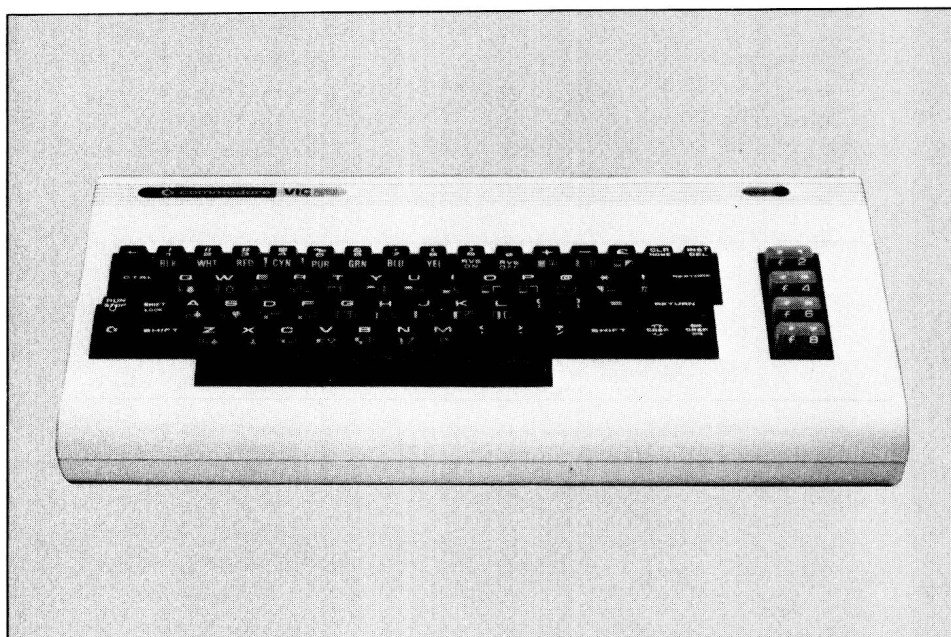
FIGURE 1-4. VIC-20 computer
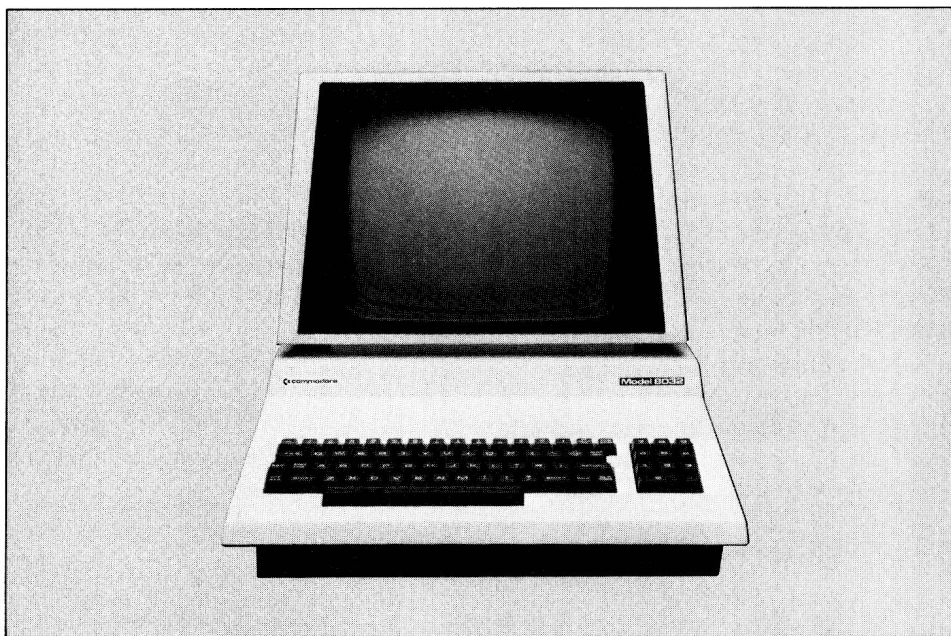
FIGURE 1-5. CBM 8032 computer

CBM 8032

This is the current, top-of-the-line production model (see Figure 1-5). It has an 80-column display on a large 12-inch screen, and features built-in extended screen editing features, repeat functions on all keys, plus a small built-in speaker for music. As of summer 1981, it has a low-profile case, treated to avoid electrical interference. It comes only with 32K of memory, and will be thoroughly described in this volume.

PET 4032 and PET 4016

These models are named for their use of BASIC 4.0, and their memory size, 32K and 16K respectively. Until late spring of 1981, they looked just like the PET 2001/N models they replaced. They now use the CBM 8032 circuit board and cabinet, 12-inch display, repeat function, and speaker, but continue PET's 40-column format and graphic keyboard. These 12-inch PETs are popularly known as "Fat 40s."

The 9000 Series, May 1981

At the National Computer Conference in Chicago, in May 1981, Commodore Business Machines announced a fourth generation of business computers, to be known as the 9000 series. This series has two models, each with 96K of user memory. Details are subject to change, but it appears the line will consist of the following models.

CBM Expansion Memory Board

Originally slated to be called the 8096, this board uses a technique called bank-selecting to give the user a choice of four separate 16K work spaces, in addition to the usual 32K RAM (see Figure 1-6). The added work spaces may be swapped under program control. With suitable user programming, these can provide a huge work space for such memory-consuming applications as word processing and data base management. The simplest member of the new line is an add-on memory board for current models.

SuperPet

The SuperPet was developed independently by Waterloo University in Ontario, Canada, a highly respected source of programming languages for IBM computers. The SuperPet is already in use at Waterloo for instructional purposes. Like the Expansion Memory Board, it features 96K of user memory, bank-selected in a different way, through a 4K block of memory. It also contains a 6809 microprocessor, a new chip that emulates a 16-bit computer.

Unlike all previous models of Commodore computers, SuperPet is designed for total compatibility with other computers, particularly IBM mainframes. SuperPet uses true ASCII codes throughout (described in Appendix A), and communicates with other computers through both an RS-232 serial port capable of 9600 baud and a 200K baud coaxial cable.