

Commodore Launches A Winner

*The C-64 is all that it is cracked up to be.
It features exceptional graphics, color and sound;
compatibility with VIC peripherals; and 64K—
all at a price that's difficult to beat.*

By Robert W. Baker

The Commodore-64 looks like a VIC-20 in a light brown case, but there's really a world of difference between the two machines.

Once you start looking closer, you'll notice a number of external changes, but you really have to see it running to appreciate the new world of the Commodore-64. It's not just a 40-column VIC—it's a whole new machine.

C-64 Housing

The Commodore-64 has the same plastic housing as the VIC-20, but additional ventilation slots have been added to the bottom. The new case even looks good, with its slightly pebble grain touch. The Commodore's keyboard has the same layout as the VIC's, but it's more contoured and has a nicer feel to it.

Two connectors for game controllers are on the right side of the machine, next to the power switch and the power supply connector. The power supply is still an external box similar to that used on the VIC-20.

On the back of the Commodore-64, the User Input/Output, Cassette Interface, Serial I/O and Audio/Video connectors are in the same place as on the VIC; just be aware that several pins have been redefined on the Commodore-64's User I/O and Audio/Video connectors. The RF modulator for the

television interface is now built-in, and there's an extra RCA-type connector for the cable to the television antenna/game switch. There's also a small switch on the back for selecting the desired television channel.

The cartridge expansion slot on the Commodore-64 is about half the size of the VIC-20 cartridge slot, even though there are exactly the same number of pins in the new connector. The cartridge slot has guides that appear to make it easier to insert the cartridge, which is about the size of those used in the Atari 400 and 800 systems.

The Commodore-64 will accept cartridges made for the new Max Machine once it's available, but you cannot use VIC-20 cartridges in the Commodore-64.

Commodore Memory

As the name implies, the Commodore-64 does have 64K bytes of internal RAM, but, depending on how you are using the system, you may or may not be able to use all that memory. You see, the Commodore-64 still uses a 6510 eight-bit microprocessor, closely related to the 6502 used in the PET, CBM and VIC machines.

With an eight-bit microprocessor, you can address only 64K memory locations. Besides the RAM used for your programs, the microprocessor also has to address the ROM operating system that lets the system execute Basic programs. It also has to be able to address interfaces for communicating with external devices like the cas-

sette tape or disk drives and printers. In addition, it has to manage the video screen display and keyboard.

The Commodore-64 uses some unique addressing techniques that let various memory or interfaces occupy the same address space. With a little fancy circuitry, the Commodore-64 makes maximum use of its limited 64K address space. What this means to you, the Basic programmer, is that you have only a little over 38,900 bytes for Basic programs when the system is used in its normal mode.

Several sections in the *Commodore-64 Programmer's Reference Guide* deal with internal addressing and how you can control many of the various options available. If you really want to, you can disable the Basic ROMs and various other items within the machine and gain more of the available RAM memory as needed. It probably will take some time before you understand the ideas and techniques involved and before you can make maximum use of the available features.

If you're not programming in assembly language, however, you'll probably never have to worry about things like this (at least not right away). There are enough other features to explore right now that should keep you busy for quite some time.

More Graphics . . .

One of the most impressive features of the Commodore-64 is its expanded graphics capabilities. There are a number of different character modes,

Address correspondence to Robert Baker, 15 Windsor Drive, Atco, NJ 08004.

as well as bit-mapped graphics and something new called "sprites." The new 6567 VIC-II chip is really something to marvel at.

The Commodore-64 has three modes for displaying text: standard, multicolor and extended-color. Characters are normally defined from ROM, but in each mode they can be taken from ROM or RAM. When you want special graphics characters for a program, all you have to do is define the new character shapes in RAM and tell the VIC-II chip to get its character information from there instead of from the character ROM.

In standard text mode, each charac-

The only sacrifice is in horizontal resolution, since each multicolor character cell is treated as a 4×8 grid, with each dot being twice as wide as in standard text mode. However, standard and multicolor mode text can be mixed on the screen at the same time!

Color Your World

Extended-color text mode gives you control not only over character color, but over the background color of each individual character. In this mode, each character is treated as an 8×8 grid, just like in standard text mode. The difference is that you can now have one of four different background

horizontal by 200 vertical dots for the whole screen. In the multicolor bit-map mode, two bits are used to define a single dot, giving a resolution of 160 by 200 dots. In either mode you'll have to set aside 8000 bytes of memory for the bit-map to control the screen graphics. Unfortunately, high-resolution graphics routines are generally too slow when written in Basic, so they're normally written in assembly language.

A Spritely Feature

The most exciting feature of the VIC-II chip is its "sprite" graphics capability. Sprites give you a way of ani-



The Commodore-64 features expanded graphics capabilities, including three modes for displaying text (standard, multicolor and extended-color). The C-64 also features music-making capabilities, made possible by the MOS 6581 Sound Interface Device chip.

ter is formed in an 8×8 grid of dots. As each character is displayed, any "off" dot assumes the background color that is the same for the entire screen. Any "on" dot is displayed in the color (defined in the Color Control Memory) that corresponds to the screen location of that character.

Each character can be displayed in any of the 16 available character colors. There are several ways of selecting character colors; the most common way is to include color controls within your Print commands.

When you're using standard text graphics, all the dots within each 8×8 character can have either the background or foreground (character) color. In some ways, this limits the color resolution within each character position. In multicolor text mode, each dot can be one of four colors.

colors for each character. However, you're now limited to the first 64 characters in the available character set, since two bits in the character code are used to select the background color.

When writing games or plotting charts, you eventually get to the point where you want high-resolution display. The Commodore-64 provides just that through bit-mapping of the screen. Bit-mapping is a method in which each possible dot on the screen, sometimes called a pixel, is assigned its own bit within a specific location in memory. If that memory bit is a 1, the dot it represents is on; if the bit is cleared to 0, the corresponding dot is off.

The VIC-II chip supports two bit-mapped graphics modes. In the standard bit-map mode, resolution is 320

horizontal by 200 vertical dots for the whole screen. In the multicolor bit-map mode, two bits are used to define a single dot, giving a resolution of 160 by 200 dots. In either mode you'll have to set aside 8000 bytes of memory for the bit-map to control the screen graphics. Unfortunately, high-resolution graphics routines are generally too slow when written in Basic, so they're normally written in assembly language.

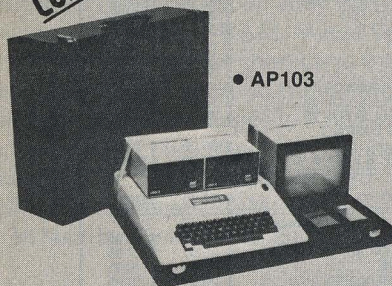
Sprites are essentially a special type of programmable character. All you have to do is tell a sprite "what to look like," "what colors to be" and "where to appear." The VIC-II chip will do all the rest! You can use sprites with any of the other graphics modes—bit-mapped or character, multicolored or standard. Each sprite carries its own shape, color and position definition.

Each sprite can be either standard (two colors) or multicolor (four colors) and can use any of the 16 colors. Each sprite is 24 horizontal dots (12 in multicolor) by 21 vertical dots and can be magnified two times horizontally or vertically or in both directions.

Each sprite can be turned on or off

Circle 320 on Reader Service card.

computer case company



Attache-style cases for carrying and protecting your complete computer set-up. Accommodates equipment in a fully operational configuration. Never a need to remove equipment from case. Simply remove lid, connect power, and operate.

| | | |
|-------|--|-------|
| AP101 | Apple II with Single Drive | \$109 |
| AP102 | Apple II with Two Disk Drives | 119 |
| AP103 | Apple II, 9 Inch Monitor & Two Drives | 129 |
| AP104 | Apple III, Two Drives & Silentye Printer | 139 |
| AP105 | 13" Monitor with Accessories | 99 |
| AP106 | AMDEK Color Monitor | 119 |
| RS201 | TRS-80 Model I, Expansion Unit & Drives | 109 |
| RS204 | TRS-80 Model III | 129 |
| AT301 | ATARI Computers with Peripherals | 109 |
| P402 | Centronics 730/737 & Radio Shack Printer | 89 |
| P403 | Epson MX70/80 or Microline 82A | 89 |
| P404 | Epson MX100 Printer | 99 |
| P405 | IDS 560 or Prism 132 Printer | 109 |
| P406 | Starwriter/Printmaster F-10 Printer | 119 |
| P407 | Okidata Microline 83A or 84 Printer | 99 |
| P408 | Prowriter 2 Printer | 99 |
| P409 | Prowriter (Apple Dot Matrix) Printer | 89 |
| IB501 | IBM Personal Computer | 129 |
| IB502 | IBM Monitor | 99 |
| HP601 | HP41 with Accessories | 99 |
| CM703 | Commodore Model 64 with Drives | 119 |
| CM704 | Commodore Model 64 with Dataset | 109 |
| NS010 | North Star Advantage | 139 |
| CC80 | Matching Attache Case (5") | 85 |
| CC90 | Matching Attache Case (3") | 75 |
| CC91 | Matching Accessory Case | 95 |
| CC92 | 5.25" Diskette Case | 49 |

computer case company

5650 Indian Mound Court
Columbus, Ohio 43213
(614) 868-9464

CALL TOLL FREE
800-848-7548



individually. Sprite priorities control what gets displayed when two or more sprites overlap. The VIC-II chip also provides sprite-to-sprite, sprite-to-text/bit-map images and sprite-to-background collision detection.

Normally up to eight sprites at a time can be maintained automatically by the VIC-II chip. You can display more sprites by using machine language and a Raster Interrupt feature; this allows you to create split-screen displays mixing text and bit-mapped data, or you can update displays outside the visible area to avoid screen flicker.

Another interesting feature of the VIC-II chip is its ability to smooth-scroll the entire screen, one pixel at a time. When in this mode, the screen

size is reduced by one character space on each side and a half-character space at the top and bottom. The smaller screen size, 38 characters by 24 rows, is used to provide a place for your new data to scroll on from.

While the VIC-II chip does most of the task for you, the actual scrolling must be done by a machine-language program.

Making Music

The Commodore-64 is equipped with one of the most sophisticated electronic music synthesizers available on any computer: the MOS 6581 Sound Interface Device (SID) chip.

The SID provides three separate sound-generating sections, or "voices." Each voice is fully programmable for

Printer Power

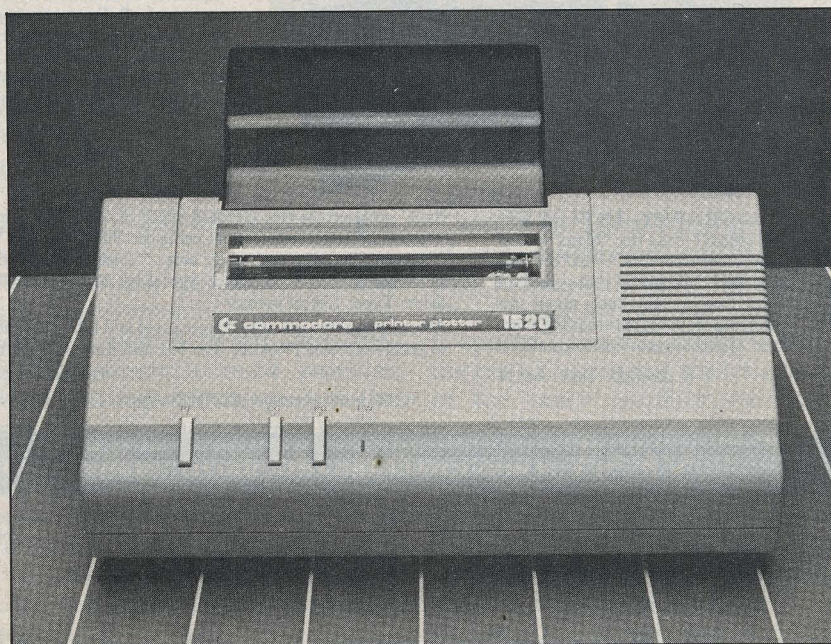
Commodore started the new year by releasing a new printer/plotter that retails for \$199.95.

The CBM 1520 Printer/Plotter uses 4½-inch roll paper and prints in four colors (or combinations of colors) to achieve multicolored graphs, charts and other types of illustrations. High-resolution graphics are achieved by the printer/plotter's ability to "step" 480 dots horizontally and up to 999 vertically. Four separate ball-point ink pens provide a clean color image,

and the five-inch-wide carriage accommodates standard roll paper.

The device, designed for use with the VIC-20 or Commodore-64, is easily programmed from Basic and requires no special modification to use.

Commodore also released a new handheld computer. The Commodore HHC-4 can be used as a portable computer and full-function calculator, or it can be connected to a television for full-screen computing. ■



Commodore's new CBM 1520 Printer/Plotter retails for \$199.95.

tone, waveform, Attack/Decay/Sustain/Release (ADSR), filtering and modulation.

The SID is capable of providing a wide range of control over pitch (frequency), tone color (harmonic content) and dynamics (volume). The three synthesizer voices can be used independently or together to create more complex sounds. Each voice consists of a tone oscillator, waveform generator, envelope generator and amplitude modulator.

To create complex sounds using the SID chip, you'll need to take several factors into account.

First, you have to select a note frequency for the oscillator, and then a waveform type. You then select durations for the ADSR cycles and options for filter mode and frequency cutoff. Next, you set the level of volume for the composite audio output. Finally, you tell the SID to start making the sound you defined.

It sounds complicated, but it's actually easy once you've played with it a while. The *Programmer's Reference Guide* should be a big help in this area, and it includes plenty of examples.

The tonal quality of a sound is called timbre. The timbre of a sound is determined primarily by its waveform. When a note is played, it consists of a wave oscillating at fundamental frequency, as well as the harmonics of that wave. An acoustic instrument, like a guitar or violin, has a complicated harmonic structure. In fact, the harmonic structure may vary as a single note is played.

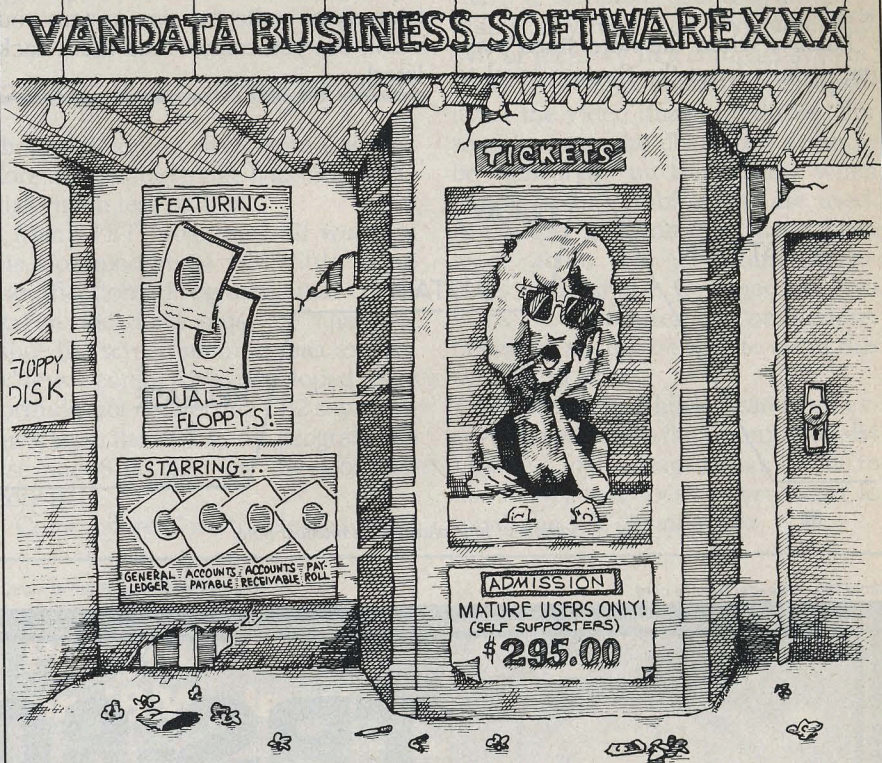
With the Commodore-64's SID chip, you can select a triangle, sawtooth or variable pulse waveform at the same time or in any combination, for each voice. By choosing carefully the waveforms used, you can create just about any harmonic structure you want. The waveform can be further refined by using the programmable filtering of the SID chip.

The programmable filter can be used to suppress or attenuate either the fundamental or the harmonic frequency outputs of each voice. You can select whether each voice is filtered, but only one set of filter parameters can be defined. They allow the selecting of cutoff or center frequency, resonance of the filter and one of four modes of operation (high-pass, low-pass, band-pass, and notch reject).

You can select one or more of the three SID voices to be filtered, or you can even filter an external audio input from the audio/video connector.

Circle 214 on Reader Service card.

FOR MATURE USERS ONLY.



If you're a dealer, OEM, or fairly knowledgeable end user, Vandata has an incredible deal for you — the Vandata Business Software Package. The package includes: General Ledger, Accounts Payable, Accounts Receivable and Payroll with Cost Accounting, plus our custom installation program. **All for only \$295.**

Why so low? Because a mature user doesn't need support. That drastically cuts our costs. And yours.

And if you're a software dealer, you can resell Vandata Business Software without paying royalties. The Vandata business package is the best-debugged, easiest-to-install enhanced Osborne-based system on the market. It's well worth up to \$995 with your support to end users.

Minimum requirements are 48K RAM, CP/M™, or CDOS, CBASIC2™, a CRT and a 132-column printer. The package is available on most CP/M disk formats. Our installation manual is included and the Osborne/McGraw-Hill application manuals are available separately.

Why pay for support you don't need? Order the Vandata Business Software Package. **Call toll free: 1-800-426-5248.**

VANDATA

17544 Midvale Ave. N., Suite 106.
Seattle, WA 98133.
In Washington call (206) 542-7611.
VISA or MasterCard accepted.

The volume of a musical tone changes from the moment you first hear it—all the way through until it dies out, when you can't hear it anymore. When a note is first struck, it increases from zero volume to its peak volume. The rate at which this happens is called the Attack.

Then it falls from its peak to a middle-range volume. The rate at which the fall of the note occurs is called the Decay. The mid-range volume itself is called the Sustain level.

Finally, when the note stops playing, it falls from the Sustain level to

zero volume. The rate at which it falls is called the Release.

A sketch of the four phases of a musical note is shown in Fig. 1. Each of the items mentioned (A, D, S and R) gives certain qualities and restrictions to a musical note. The parameters Attack, Decay, Sustain and Release, collectively called ADSR, are all controllable via the SID chip.

The SID chip's parameters are controlled by 29 registers located in memory. The first 25 are "write only" registers (you write the parameters you want, but you cannot read them back later).

The last four registers are read only for returning information from the SID chip. Two of these registers allow the reading of digitized outputs from the oscillator and envelope generator of the third voice. The SID chip's parameters can be changed dynamically during a note or sound to create many interesting and fun effects. You can even synchronize voices or use one voice to modulate another. (Just wait and see how quickly you get hooked on having great sound effects!)

Potpourri of Features

The Basic operating system provided in the Commodore-64 is essentially the same as that in the VIC-20; it's also similar to CBM Basic 2.0, found in earlier PETs. There are a few minor bugs you should watch out for, but most can be easily programmed around.

There have been no enhancements to Basic for the new graphics and sound capabilities, but a special cartridge that will add new Basic commands for the expanded features is being promised. Books that instruct users on how to implement graphics and sound effects are being planned as supplements to the *Programmer's*

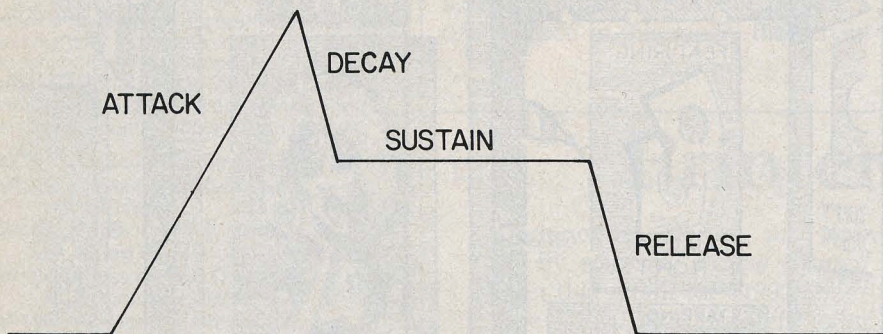


Fig. 1. Sample of four phases of a musical note.

Circle 189 on Reader Service card.

TRS-80*

100% Radio Shack Equipment

SAVE A BUNDLE

Order Toll Free 1-800-874-1551

FLA Residents 904-438-6507 collect

EPSON, OKIDATA, CITHO, TABCO Printer Switches



SALES CO.

704 W Michigan Ave; P.O. Box 8098
Pensacola, FLA 32505

*TRS-80 is a trademark of Tandy Corporation.

Reference Guide.

The normal processor in the Commodore-64 is the 6510, which is exactly like the 6502 used in the VIC, PET, CBM, Apple and Atari, except that the first two bytes of page 0 are used for an on-chip I/O port. The Commodore-64 uses this port to control its memory under software control or from external game cartridges. For example, when a Max Machine game cartridge is inserted, the Commodore-64 will automatically configure itself to look just like a Max Machine. This means you could use a Commodore-64 as a simple development system for Max Machine software.

And don't forget—a Z-80 cartridge that will support the popular CP/M operating system will be released early this year. It'll be interesting to see how Commodore handles the use of disk files, since CP/M has its own methods of allocating disk space and processing disk files. Most CP/M systems use hard-sectored diskettes with a different disk formatting than that used by Commodore. Will it be possible to read CP/M diskettes from other systems?

The Commodore-64 will use all VIC-20 peripherals, including the VIC Modem, the VIC-1515/1525 printer and the VIC 1541 disk.

The older VIC-1540 disk normally will not work properly with the Commodore-64. There are two pokes you can use to get around this for most cases, but you should try to get the VIC-1541 disk. Data transfers to and from disk over the serial peripheral bus are rather slow at times (compared to the CBM 4040 and 8050 disks on the IEEE-488 bus).

The disk format used by the VIC-1541 is compatible with standard Commodore 4040 disk drives. This means that disks can be transferred among Commodore-64, PET, CBM and VIC-20 owners.

When using a VIC-1541 disk with the Commodore-64, keep in mind that the disk is a "smart peripheral"—the Disk Operating System (DOS) is actually in the disk drive and not in the computer. The version of Basic in the Commodore-64 does not include the newer CBM Basic 4.0 disk commands.

All disk commands must be sent to the disk over something called the command channel. This makes usual disk maintenance (for example, renaming, deleting or copying) a little more difficult than normal. However, a version of the familiar DOS Wedge

In my opinion,
the Commodore-64
is an excellent value,
and early sales figures
back this up

should be coming soon from Commodore; this should make handling of the disk much less painful.

Many PET programs will work on the Commodore-64 with little or no modification. Programs that poke screen locations must be changed, since the screen memory has moved. A few people have developed easy formulas for converting CB2 sound effects from the PET so the program can use the SID chip on the Commodore-64.

Commodore plans to release what it

calls a PET emulator for the Commodore-64, but you'll probably find it nicer just to convert the programs instead. VIC-20 programs may run on the Commodore-64 if they don't rely on the 22-column display and if they don't use the VIC graphics or sound.

In my opinion, the Commodore-64 is an excellent value, and early sales figures back this up. For only \$595, you get powerful graphics that approach those of the Apple and the Atari, a complete sound synthesizer unlike anything else available and 64K of memory in a compact system.

My only complaint so far is the quality of the video image produced. For some reason, the characters seem to be "smeared" on the display when certain color combinations are used. A number of comments have been made about this in various magazines and on the Commodore Network on Compuserve. Commodore, however, should be able to clean this up a bit in time.

For now, I just hope I can keep everyone away from the Commodore-64 I have on loan—long enough for me to use it. My son doesn't even want to touch the VIC-20 anymore... ■

Circle 67 on Reader Service card.

Put your Micro on IBM's level

Now you can communicate with the IBM world with Innovative Data Technology's 1/2" magnetic tape peripherals.

Popular configurations and optimum performance for most small systems that feature industry-standard interfaces, rapid data transfer rates, full operating and command subsets and a wide selection of models and configurations, IDT's magnetic tape subsystems provide economical and reliable data/program interchange, 40M bytes of storage and disc back-up. But most importantly, they help put your system in touch with the IBM universe.



Series TD 1012

9-track PE (1600 cpi), read-after-write, 10½" reels; 20KB/sec. data transfer \$6995.00*

Series TD 1050

9-track NRZI/PE, read-after-write, 10½" reels; 50KB/sec. data transfer \$8500.00*

*O.E.M., dealer/distributor discounts available.



4060 Morena Blvd. • San Diego, CA 92117
(619) 270-3990 • TWX: (910) 335-1610

Eastern Regional Office:
P.O. Box 1093 • McLean, VA 22101-1093
(703) 821-1101 • TWX: (710) 833-9888

IBM is a trademark of International Business Machines Corp.
Apple is a trademark of Apple Computer Inc.
TRS-80 is a trademark of the Tandy Corporation.