

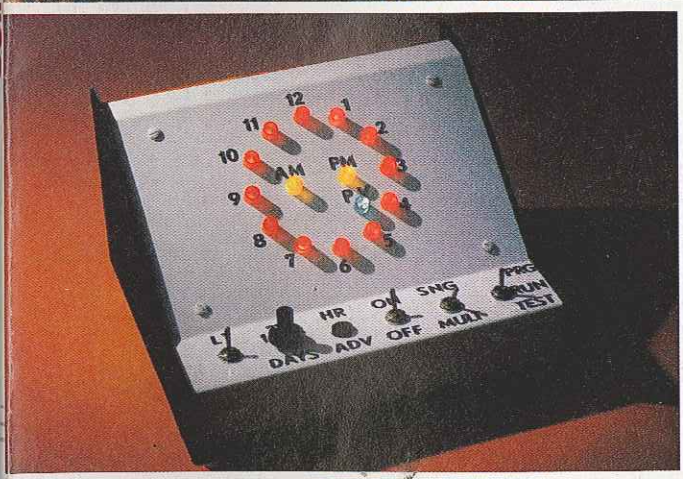
# Popular Electronics®

WORLD'S LARGEST-SELLING ELECTRONICS MAGAZINE

JULY 1981/95¢

## Video Disc Players Compared Car Electronic Ignition Systems TRS-80 Color Computer Review

### Protect Your Home with the Burglar Baffler



VIDEO 81  
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VIDEO 81



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**SPECIAL  
UPDATE:**

## LETTERS

### From the VOA

In the "DX Listening" column for March 1981, there are two references to the *Voice of America* that require some clarification.

The first is the implication that *VOA* broadcasts only official policy. In fact, the *Voice*—as America's largest international broadcaster, with an estimated regular weekly audience of 80-million people—is a respected source of world news and information. Its newscasts are prepared by professional journalists and are separate from the clearly labelled commentaries explaining U.S. foreign policy.

Second, the *VOA* relay station on the Caribbean island of Antigua is hardly redundant. It is, in fact, essential if *VOA* is to provide the type of mediumwave service the majority of Caribbean listeners want and deserve.

Finally, the implication, from whatever source, that *VOA* mediumwave

broadcasts would ever "be part of a CIA plot against the eastern Caribbean" is simply absurd. Such a connection does not exist, whatever critics of a more audible *VOA* in the region might wish to believe.—*M. William Haratunian, Acting Director, Voice of America.*

### No Soft Errors

Mr. Mims' "Solid-State Detective Story" (Sept. 80) was rather interesting. However, if he hoped to find soft errors in his RAMs with alpha radiation, he would be disappointed if the chips were sealed, as alpha particles simply cannot penetrate more than a sheet of paper.

My chemistry teacher and I repeated Mr. Mims' experiment with a few variations. We used a video game that has 4K of RAM for our RAM scanning circuit. Then we used a beta-emitting device, because beta particles penetrate considerably deeper than alpha particles. Finally, placing the beta source directly over the powered RAMs, we bombarded the latter at several thousand counts per second (instead of the few counts per second used by Mr. Mims). We detected no soft errors during 10 hours of continuous beta bombardment.—*Edward Ramsden, Quincy, MA.*

### New Computer Is Important

In the "Computer Bits" column of May 1981, Carl Warren states that Commodore's new Video Interface Computer 20 is little more than a re-packaging concept, with color- and

sound-generation capabilities thrown in. In my view, the point is not that the VIC-20 represents anything remarkably new in technology (although many would argue that the new video interface chip is quite remarkable), but that it is being introduced for under \$300. If that isn't remarkable, I don't know what is!—*Dennis Globus, Panorama City, CA.*

### Variable Speed for Film Editors

I have read the article "Vary the Speed of Synchronous Motors with this Programmable Control" (April 1981), and it occurs to me that this control might be very useful for film editors who require accurate variable speed. Perhaps it could be used in projectors and professional cameras where speed is important to give fidelity in sound.—*J.V. John, Chicago.*

### Oscilloscope Specifications

In your article "Oscilloscope: 1981" (April 1981), you covered the subject of bandwidth very well, but the reader who may not have a strong electronics background or is unfamiliar with scope specifications may be misled by the numbers given by manufacturers. In a strict engineering sense, bandwidth for voltage amplifiers is defined as  $f(\text{upper}) - f(\text{lower})$ , where  $f(\text{upper})$  is the high-frequency point at which the gain has dropped by approximately 30%. The point  $f(\text{lower})$  is defined similarly except it refers to the low-frequency point. Since most oscilloscopes have an  $f(\text{upper})$  that is much larger than  $f(\text{lower})$ , which is usually dc, the bandwidth is normally listed as  $f(\text{upper})$  only. Some manufacturers prefer to use some other (incorrect) definition of bandwidth. A prospective oscilloscope purchaser should be aware of this "specmanship" played by the manufacturers, and consult with someone who is familiar with the game before purchasing.—*S.D. Swift, Albany, GA.*

I'd strongly suggest that a scope buyer see the instrument he is going to buy before doing so. Take the covers off and visualize trying to change a panel light. He may be surprised at what is necessary in some models. To save money, he should be able to service his own instrument and if changing a panel light looks impossible, consider another purchase. Also, he should read the owner's manual before he buys, studying especially the calibration and maintenance sections. You get what you pay for and a less expensive scope might not be as well documented as it should.—*David Whitfield, Santa Fe, NM.*

I was particularly pleased with "Oscilloscope 1981" in the April issue. However, I must point out the table is in error in stating that the Heath Model IO-4555 does not have a sweep magnifier. I am the satisfied builder-owner of a Heath IO-4555, and I can assure you that in the center of the TIME/CM switch is a dual-function switch/potentiometer labeled VARIABLE-PULL FOR XS. It performs both functions reliably.—*Robert Hornberg, Lombard, IL.*

# Popular Electronics Tests

## The Radio Shack TRS-80 Color Computer

DESIGNED around a 6809E microprocessor, the Radio Shack TRS-80 Color Computer is meant for the home enthusiast. It offers sound generation and color graphics, of which the maximum resolution (256 x 192 pixels) permits excellent displays. Like many units in its class, the color computer comes equipped with a TV/Game 60-dB isolation switch that permits its use with any TV receiver through the set's antenna terminals.

The computer is housed in a gun-metal silver plastic case that covers the single-board computer and provides RFI shielding. The 53-key, short-stroke keyboard is laid out in a typewriter-like format. Although the keys have flat tops and are not really geared for fast typing they have an excellent "touch," and positive closure. Two joystick interfaces, a high-speed cassette interface, and an RS232 serial interface, a channel select switch for channels 3 or 4, and a 15-ft video connector cable for attaching to the isolation switch are available on the rear apron along with the RESET and POWER ON/OFF switches. All interface connections are made via a DIN connector. A small spring-loaded door in the right side allows plugging in the ROM-based Program Paks.

In its basic configuration, the TRS-80C is supplied with 4K bytes of RAM (expandable to 16K) and 8K of ROM that contains BASIC and other system firmware (expandable to 16K). The basic price of the TRS-80C is \$399. Options include: 16K memory conversion (26-3015), \$119, extended BASIC add-on (26-3018), \$99, Model CTR-80A Cassette Recorder with cable, \$59.95, and Dual Gyating Joysticks (26-3008), \$24.95. A fully configured Color Computer, including extended BASIC and 16K RAM (26-3002), is priced at \$599.

The currently available software comes in what Radio Shack terms Program Paks and include: Chess \$39.95, Quasar \$39.95, Pinball \$29.95, Football \$39.95, Checkers \$29.95, Personal Finance \$39.95, Math Bingo \$29.95, and Music \$29.95. The only cassette-based

package available is Videotex for \$29.95, which includes a free hour on Compuserve's information system network. A number of other packages are reportedly under development either by Radio Shack or outside vendors and will supposedly include an editor/assembler, Pascal, and Pilot. Micro Works of Delmar, CA has developed a Monitor available in cassette for \$29.95 or ROM for \$39.95 that permits the changing of

memory, communicating with a host, and development of high-level graphics.

**General Description.** The Motorola 6809E microprocessor works in tandem with a Motorola 6847Y Video Display Generator that reads data from memory and produces a composite video signal, and a 6883 synchronous address multiplexer. Interface to the television is accomplished via the 1372 modulator, as



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shown in the block diagram. In operation, the computer is tied into the television receiver via the isolation switch and a 15-ft cable. The fully interfaced composite video signal permits the creation of a 31 character by 16 line display. Line wrap is automatic.

On power up, the computer defaults either into color BASIC, or, if a Program Pak is installed, to the program contained in the Pak.

Initial familiarization with the unit is facilitated by a 31-page Operation Manual. This covers every aspect of getting the computer into operation. It also provides helpful short programs to check the video-monitor color purity, horizontal and vertical positioning, and the sound on the TV set's speaker.

Compensating somewhat for the lack of software available for the TRS-80C is an extremely powerful BASIC interpreter. The version for the 4K machine is designed for the beginner and offers the functions that allow color selection, creation of a variety of sounds, and text string manipulation. The BASIC provides full string operators, LEFT, RIGHT, MID, PEEK, POKE, EDIT, and RENUMBER. Operators are provided to allow access to joysticks and the other peripheral ports. Use of the language is explained in a well-written, highly illustrated 152-page manual, "Getting Started with Color BASIC."

Once you have mastered this entry-level BASIC, you will more than likely

want to migrate up to "extended color" BASIC, described in a very complete 215-page manual, "Going Ahead with Extended Color BASIC." We recommend that, even if you purchase the full-

GRAPHICS SCREEN RESOLUTION				
PMode #	Grid Size	Color Mode	Pages Used	Point Size
4	256x192	2	4	□
3	128x192	4	4	▣
2	128x192	2	2	▢
1	128x96	4	2	▣
0	128x96	2	1	▢

ly configured system, you start with the first manual and work up to the second.

The extended BASIC is one of the most powerful we have seen and provides a full spectrum of graphics primitives including DRAW, CIRCLE, PAINT, and COLOR. In extended BASIC, up to 9 pages of memory (one page equaling 1536 memory locations) are available. One page is the normal mode and can be thought of as the entire available working video. The other 8 pages are for graphics. In other systems, these pages are called planes and are used to create depth or three-dimensional effects on the CRT screen.

In the graphics mode, two operators are required: PCLEAR defines the number of pages desired (4 pages is the default if PCLEAR is not used), and PMODE. The latter tells the TRS-80C the resolution (see table), and which graphics page to start on. Both can be variables in a program. Because more memory is required to generate the viewed screen, at highest resolution, only two colors are provided.

Working in concert with the basic graphic operators are functions such as PCLS, which clears the screen and sets the background to the specified color. The SCREEN function tells the computer what you will be using the screen display for—graphics or characters. As a consequence, this permits the creation of programs that combine characters and graphics. To further enhance the graphics capability of the machine, the BASIC has a PCOPY function that allows copying one page of graphics to another. Furthermore, you can draw a circle by using CIRCLE and specifying where its center is and its radius. The circle can be shrunk or stretched and even rotated by entering height and width parameters. If you desire, the PAINT operator allows a specified color to be used as a "fill in".

Boxes of all sizes and shapes are easily created using the DRAW functions and setting the parameters. A neat trick is to create a box on the screen and then fold and unfold it. Then if you're really inventive, create a ball that you drop into the box. All of this is possible by mixing the various BASIC functions and without running out of memory!

Powerful as they are, graphics functions represent only a portion of the interactive functions available in extended BASIC. Using the PLAY function, the tones of a chromatic scale (A-G#) can be generated and made to sound in any of five octaves; duration, tone-color, and loudness can be specified as well. One interesting program that can be created involves using the graphics functions to create various musical instruments on the screen and using PLAY to make the associated sounds.

And there is still more to the BASIC. Operators that query the joysticks are provided to enable moving things around the screen. Two really interesting functions are GET and PUT. GET allows reading the graphic contents of a rectangle into an array, while PUT allows reading the array back on the screen. And, of course, should you want to create some interesting designs, or develop a mechanical design, extended BASIC includes all the trigonometry functions.

**Evaluation.** The TRS-80 color computer that we evaluated was a 16K version with extended BASIC and without any of the Program Paks or cassette software mentioned earlier. Setting up the system is extremely simple, involving only connecting the computer to the isolation switch and the switch to the color-TV vhf antenna terminals, then tuning the TV receiver. Before using the computer, we spent some time reading the operation manual and both BASIC manuals, a move we strongly recommend for all users.

Before connecting the color computer to the TV receiver, we heard a rattle inside the case. Upon opening the case (we suggest you don't do this—it voids the warranty), we found that one of the two bolts holding down a transformer had worked its way loose and the other was about to follow suit. While we had the cover off we checked the clock and found it well within spec. We were unable to measure any significant RFI.

On power up, the TV receiver screen immediately turns green and the color BASIC sign-on message is displayed in the upper left-hand corner. There was no screen interference to disturb the display.

We did notice a slight pincushioning that we determined to be the fault of the receiver rather than the computer. By adjusting our TV receiver to create a slight ballooning, we created a more desirable display.

Although in general everything worked well, we found many discrepancies in the BASIC manuals. For example, when entering a SETCOLOR command to achieve a certain color, we got a different one. When we tried to emulate the suggested trig function formulas, we discovered that the math functions, as created in BASIC, were incorrect. Additionally, several of the sample programs contain errors that either caused incorrect operation or a syntax error.

We checked with Dave Lunsford of CompuSoft Publishing, who has been working with the TRS-80C for several months. He identified the same problems and provided Radio Shack with corrections. Radio Shack's Jonathan Erickson, the author of the manuals, verified the problems and indicated that corrections had been made for these and others that neither Lunsford nor we had found. Current owners will receive an updated manual in short order. Meanwhile, an errata sheet is provided with each set of manuals. Otherwise, the manuals are for the most part well-written and illustrated.

After several hours of using the machine, we found it difficult to use the

keyboard. This is primarily due to the use of very flat short-stroke keys. Radio Shack says that the expected use of the machine would not normally extend past a few hours. We would have preferred to see the keyboard used on the Model III, or at least a derivation of it. We also would have liked to have had dedicated keys for functions such as BREAK, ESCAPE, and CTRL, rather than trying to remember which combination to use. A possible alternative might be a labeling system on the keyboard or keys that quickly identifies these functions.

We also had difficulty holding the background color we had set when entering data. Each time we did, the computer defaulted to green. We were unable to find a satisfactory answer to this, but it was suggested that it might indicate the need to use the SCREEN function to set the parameters.

Truly a peccadillo is that the joystick ports don't match the manual in the way they are labeled. So when you think you are accessing the right joystick, you may be working with the left. Rather than relabel the computers, Radio Shack has altered the manuals to match the machine as it stands.

More disturbing is the use of reverse video and upper-case letters to indicate lower-case characters on the screen, in lieu of a full ASCII set. Similarly, we are disappointed to find that both versions of BASIC fail to understand common lower-case inputs.

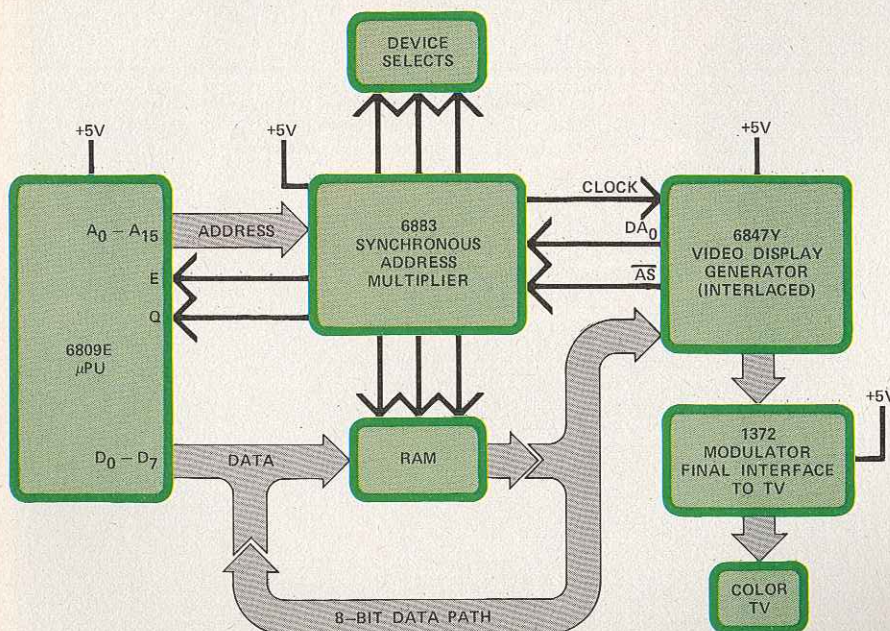
**Comments.** To evaluate microcomputer systems priced under \$500, one must take a number of variables into account. Chief among these is functional capabilities, which abound in this particular model.

Additionally, one must consider support. Like the other Radio Shack computers, this one should soon be backed up by a copious supply of software. Also, Radio Shack has some 7000 stores to provide service and supplies. Moreover, there is a rapidly expanding network of "cottage industry" companies providing software and peripherals for the new machine.

The color computer represents what we consider the top-of-the-line, low-cost system. Anyone seeking a machine that will serve well as a teacher and a base for a home communication and entertainment center will find the TRS-80 color computer a strong contender. Although we found some problems, Radio Shack has assured us that it is carefully monitoring the color computer and working to improve its weak points.

—Carl Warren.

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Block diagram of the TRS-80 Color Computer. The 6883 multiplexes available RAM and peripheral devices

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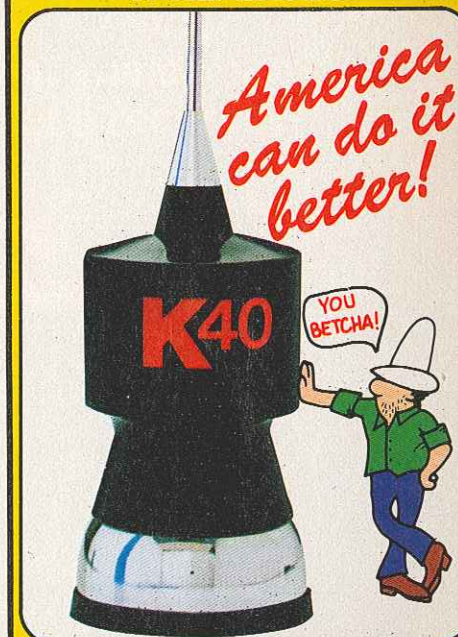
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