

COMPUTER BITS

By Carl Warren

Latest Micros Offer Power and Graphics

THE microcomputer race is running at even a faster pace than it was just a few months ago. Already, a number of manufacturers are responding to IBM by offering 16-bit power, while others are enhancing 8-bit designs with graphics functionality or lowering of costs. The most notable entry in the last few months is the Model 16 from Tandy/Radio Shack.

Introduced this past January, the Model 16 is a "downward-compatible" machine to the Model II. Employing both the 16/32-bit Motorola 68000 and a Zilog 8-bit Z80A microprocessor, the system supports up to 512K bytes of user memory and is software compatible to the Model II. Besides serving as the "engine" in the 8-bit mode, the Z80 assumes the additional task of handling I/O duties, screen refresh, and general system housekeeping.

The Model 16 has a starter price of \$4999 for 128K bytes of memory, a single 1.25M-byte Tandon 8-in. drive, and one parallel and two serial RS-232C ports, one of which is capable of bisynchronous operation with IBM and other mainframes. A hard-disk port can be added to permit up to four 8.4-mega-byte drives. Provisions have been made to use the ARCNET local network, which can support any combination of

255 Model II and Model 16 computers. Adding memory is done in 128K increments with the first add-on costing \$499 for the 128K RAM chip set. Adding the final 256K costs an additional \$1200, \$699 for the board with 128K and \$499 for the final 128K RAM set. An additional drive is priced at \$799 for a full system price of \$7495. Adding the 8.4M-byte hard-disk system brings the price to \$9993.

For those applications that require graphics display, Radio Shack has the high-resolution graphics board for \$499. The board which is designed to fit on the backplane of either the Model 16 or Model II contains 153,600 bits of refresh memory to maintain the display. Cables are connected to the video board so the graphics screen is synchronized with the character video screen.

Working in tandem with the video board is an enhanced BASIC either for the Z80A or 68000 that provides such graphics attributes as: LINE, CIRCLE, PAINT, and GET and PUT.

Since the operating system for the Model 16 supports both multiuser and multitasking operations, you can attach either two additional TRS-80s or the TRS-80 Model DT-1 Video Data Terminal for \$699 each.

This 8-bit microprocessor-controlled

terminal emulates a Televideo 910, Adds 25, Lear Siegler ADM-5, or Hazeltine 1410. Terminal characteristics are saved during setup in EPROMs, thus eliminating the necessity of having DIP switches.

Should you already have a Model II and want the additional power offered by the 68000 microprocessor you can purchase the \$1499 Model 16 enhancement option. This two-board option fits into the backplane of a Model II, and contains a Z80A and 68000, plus necessary serial I/O. The memory board comes with 128K of memory expandable to 256K, which is the maximum permissible on the Model II due to power supply considerations.

To take advantage of all the attributes available in the system, Radio Shack has developed a multiuser/multitasking operating system. Even though they present the machine as being able to use all current Model II software, they have or are developing a number of application packages to take advantage of the 68000. You should, for example, be able to purchase now a 16-bit version of the popular ScripSit wordprocessing package, Profile database handler, and powerful communication software, that gives you IBM bisync compatibility.

Even more is available, from the Texas giant to enhance your data-processing capability. Introduced at the same time as the Model 16, the TRS-80 Pocket Computer Model PC-2 is priced at \$279.95. The PC-2 comes with a 16K ROM BASIC that is equivalent to that available on the Model III and uses a proprietary 8-bit CMOS microprocessor operating at 1.25 MHz. Four AA alkaline batteries supply power.

In addition, the powerful hand-held has programmable function keys. The LCD display has 26 character positions with upper/lower case, and the 7 x 156 dot matrix is completely controllable by BASIC for the generation of special characters including Greek math symbols. Furthermore, the display has an 80-character buffer with automatic scrolling for lines over 26 characters.

The basic unit comes with 2K of user memory, expandable to over 18K with a unique cartridge system that plugs into the back of the unit. Currently, you can purchase a 4K RAM module for \$69.95 with larger modules as well as special ROM modules available soon.

To further increase the functionality and expandability of the PC-2, there is a 60-pin I/O bus containing address, data, and control signals that enable connection to a wide range of peripheral modules. One of the first add-ons, is a printer that has 9 different character sizes with up to 36 characters per line in four colors on standard—cash register—2.25-in. paper. Any one of the four colors (red, blue, green, or black) can be selected under software control for creating graphics plots with resolution as fine as 200 x 500 points. When you add this \$239.95 option to the PC-2, you also get an additional 25 commands to enhance BASIC with special graphics.

computers

In addition to the above, Radio Shack is offering a low-cost networking scheme called Network III, priced at \$599. This clever device is a software-controlled RS-232 serial multiplexer that allows as many as 16 users to share resources at data rates up to 19.2K baud.

Interestingly, the Network III, doesn't necessarily require a TRS-80. Therefore, it may make an ideal solution for networking a number of different systems. Be aware, however, that software is required to handle the polling function, and currently it's only available for Radio Shack equipment.

More for the home than the office, is Commodore Business Machines Inc.'s Ultimax and Commodore-64.

The Ultimax, which has a planned selling price of \$149.95, is a programmable color computer, which will compete with sophisticated video game machines like those offered by Atari and Intellivision. The Ultimax connects to any TV set, features a flat membrane keyboard, is programmed in BASIC and uses both ROM cartridges and tape cassettes for games, programming and music synthesis. In addition, you can add joysticks, paddles and light pens to enhance the "entertainability" of the machine.

To match the low end of the small business world, there is the Commodore-64 that has a price of \$595. This system is to compete with the Apple II+ and similar machines. It has a CP/M option and comes with 64K of memory and a 66-key keyboard with upper and lower case capability.

Color appears to be the rising attraction as a user-oriented feature. And Astrovision with the Astroarcade is prepared to cash in on the capability it offers.

The Astroarcade is a Z80 based add-on system starting at \$299 for the basic game unit with a \$599 keyboard unit that houses a disk controller. It also has serial ports, cassette tape controller and voice synthesizer, and is totally oriented toward color.

The system, designed by Jeff Fredericksen, developer of the coin-operated circuitry used in Bally arcade games, says it's the only personal computer that approaches the realism and animation capability found on coin-operated arcade machines. This wizardry is achieved by employing three microprocessors, 4K of RAM, 8K of ROM (expandable to 32K), and an optional Astro BASIC in ROM cartridge.

The custom-designed video processor chip, operating at 7 MHz, handles all color manipulation and NTSC broadcast quality video. The result is a color display that rivals even expensive commercial graphics processors.

In operation, you can select from a palette of 256 colors (four at a time in video games or two at a time with Astro BASIC). The screen is continually mapped in 4K RAM allowing for com-

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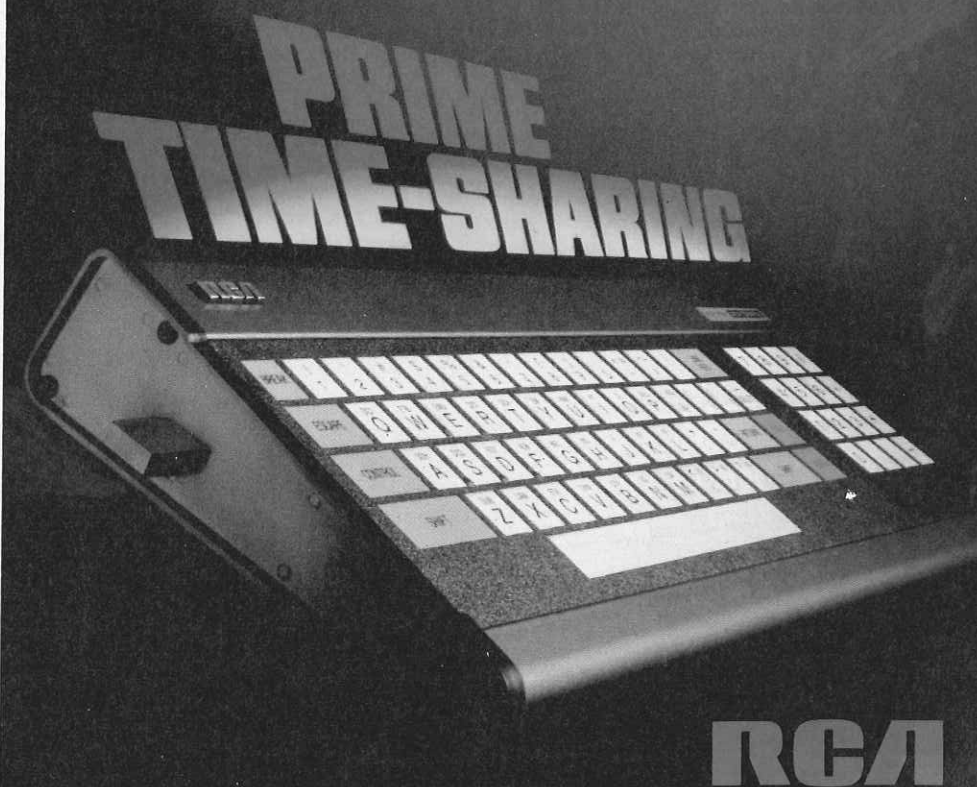
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*Suggested User Price.



Radio Shack TRS-80 Model 16 Microcomputer



plex imagery that approaches that found on expensive CAD graphics systems.

The second processor, also a custom I/O chip, handles the interfacing to hand-held controls, and is responsible for producing music equal to that available on expensive music synthesizers.

Attaching the Arcade to the ZGrass-32 (keyboard element) computer gives you Z80 power and the use of other peripherals including disks, printers, and modems. (See the color photo in "The Electronic World," made by Real Time Design, Inc., with this system.)

For business applications, there is the Toshiba Model T100. This powerful system built around a 4-MHz Z80A, sells for about \$800 with keyboard, 64K RAM, 32K ROM, and audio cassette interface. For \$1450 you can add disk storage and \$900 attaches the C. Itoh Model 8510 dot-matrix printer.

The display system can either be your home TV or a \$900 color monitor. The display is an 80-character x 24-line display and 25th status line, as well as the choice of 8 colors and graphics with resolutions as high as 640 x 200 dots.

By employing the yet unpriced expansion unit, you can add communication interfaces, and special controller cards such as an IEEE-488 board.

To ensure compatibility to a wide range of user software, Toshiba has elected to employ Digital Research's CP/M operating system, with a special BIOS to enhance the user interface via menu selection.

Although the T-100 was shown at the January CES, it isn't planned for full scale availability until sometime after NCC this June.

Even the Chinese are joining the race with a system from Tatung Company of America Inc. Their Model MCS-32xx series, built in Taipei Republic of China, is based on a Z80A 4-MHz single-board computer that supports up to 208K bytes of user memory, 6 serial ports, 1 parallel port and a hard-disk interface. A typical configuration is the Mode MCS-3240-4 with two quad-density, 8-in floppies for 2M bytes storage, 64K RAM, and a parallel port. It can support two users under Digital Research's MP/M II O/S, for under \$10,000 including the Model VT-8210

FOR MORE INFORMATION

To get more information on items mentioned in this column, contact the following manufacturers directly.

Astrovision Inc.

6460 Busch Blvd., Suite 215
Columbus, OH 43229
800-848-6989

Commodore Business Machines Inc.

681 Moore Rd.
King of Prussia, PA 19406
215-337-7100

General Consumer Electronics Corp.

233 Wilshire Blvd.
Santa Monica, CA 90401
213-394-9667

Panasonic

1 Panasonic Way
Secaucus, NJ 07094
201-348-7000

Tandy Corp./Radio Shack

1800 One Tandy Center
Fort Worth, TX 76102
817-390-3300

Tatung Co. of America Inc.

2131 Gladwick St.
Compton, CA 90220
213-637-2105

Toshiba America Inc.

Information Processing Systems
2441 Michelle Dr.
Tustin, CA 92680
714-730-5000

8085 microprocessor based intelligent terminal, which has a price of under \$1000 for a version with 8K RAM (expandable to 32K).

Using a memory management scheme, for the 4116, 16K, 200-ns RAM, the unit is able to effectively handle the necessary switching of memory banks to accommodate the needs of MP/M II.

Should small size and small price be what you're looking for, then take a look at Panasonic's JR-100 priced at \$199. Employing a Motorola 6802 microprocessor, it has 16K RAM (expandable to 32K) an 8K ROM operating system with integer BASIC, and attaches to your home TV. All the system components are housed in a small typewriter style keyboard. An expansion chassis is

used to provide voice synthesis and recognition, and joystick I/O and serial I/O ports for hanging on printers and modems. Power to the system is supplied via an ac adaptor with a more hefty power supply apparently required for the optional high-speed cassette.

Although Panasonic officials were reluctant to discuss the attributes of the machine, they did say that formal introduction is planned for about July with production models being available shortly thereafter. Apparent hang-ups center around the lack of FCC registration and paucity of software. One package that you might expect though is a \$10 word-processing system.

Getting even smaller, there is a microcomputer that fits on your wrist. So if you want to wipe out a few hundred alien invaders while sitting on an airplane, or pit your athletic prowess against the onslaught of nerveless electronic sportsmen, then you're a candidate for a wristwatch microcomputer.

These marvels of electronics couple a quartz watch with a 12x24 cell LCD display and are available from General Consumer Electronics Corp. (GEC) in a game-playing series of watches aptly called: Game-Time, Arcade-Time, and Sports-Time.

Each of these unique watches is priced at under \$40 and plays multiple challenging games in the electronic field. The Arcade-Time watch, for example, comes with Hyperblast, Planet Raiders, Galaxy Gunner, and Cosmic Clash.

While playing the games, you can use the built-in micro-joystick and firing button to maneuver your missiles and guns to just the right position to wipe out the opposing side. And as you tire of one game, a touch of another button sends you off on a new adventure.

If you're more addicted to the excitement of sport and want to pit your abilities against electronic Abdul Jabars, then select Sports-Time. With this watch you can play football, basketball, or soccer. Using the joystick, you can move in for that all important goal, hat trick, or out-fox the computer.

The game characters are depicted in multiple cell graphics symbols on the LCD display and interact with your moves. To increase excitement, sound is added as you unleash your weaponry against the unyielding foe.

To keep you in touch with reality, the watch even tells the time and date.

Of course you may have more important things to do in between playing games, like adding up the total of your expense account. GEC has the answer for this also with their under \$40 Chase-N-Counter calculators.

As with the watches, you can tell the time, have a quick game of Star-Sweep (a Star Trek type of game), or add up your wins using the calculator keypad.

A game-playing microcomputer on your wrist may seem frivolous now; but so was the Altair microcomputer introduced in POPULAR ELECTRONICS just six years ago. ♦

POPULAR ELECTRONICS

DIGITAL AUTOMOTIVE TUNE-UP METER

Use it to measure and adjust dwell, rpm, voltage on your car, boat, cycle, or lawn mower

BY C. R. BALL

It's costly to have a mechanic tune up your automobile regularly so that it can run smoothly and use gasoline efficiently. You can do it yourself, however, with no great investment in tools or training. All that's generally needed is a single combination instrument that will measure dwell angle, engine rpm, and voltage.

Such an instrument is the DATUM (Digital Automotive Tune-Up Meter) described here. Featuring a digital read-out, it's easier to use and is capable of

better accuracy than analog-type meters since there are no scales to be interpolated and there's freedom from parallax error. Cost to build is only about \$70.

The DATUM uses a 3-digit, 7-segment LED display, and can measure 0 to 9999 rpm, dwell angles from 0 to 99.9°, and dc levels from -9.9 to 99.9 volts. The instrument is compatible with most factory and add-on electronic ignition systems, as well as conventional Kettering (points/breaker) ignition. Any engine (4-, 6-, or 8-cylinder, 2- or

4-stroke) can be tuned up using this instrument. Therefore it is useful for motorcycles, boats and lawn mowers, as well as cars.

Circuit Operation. The basic voltage-measuring circuit (Fig. 1) is designed around IC1, a dual-slope, A/D converter, and IC2, a BCD-to-seven-segment decoder/driver. The latter drives the parallel-connected segments of DIS1 through DIS3, while Q1 through Q3 provide the digit enable. This chipset,



Radio Shack's Model PC-2 provides pocket-size high-level data processing.

