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Tested in this issue:

Hewlett-Packard HP-85 Computer
JBL L112 Speaker
Fluke D811 Multimeter



VOLUME 19 NUMBER 5

POPULAR ELECTRONICS

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the Y8008 connector inserted, the probe tip function is dependent on the setting of the various pushbuttons. The probe comes with a variety of tip attachments, and a pair of conventional test leads is provided. The 10-ampere input has its own banana-plug connector.

The *dc voltage* function provides five ranges from 200 mV to 1 kV with an accuracy of $\pm 0.1\%$ of reading plus one digit on all ranges. Overload protection to 1 kV dc or peak ac is provided on all ranges, the input resistance is 10 megohms on all ranges, normal-mode rejection is greater than 60 dB at power-line frequency, and common-mode rejection is greater than 90 dB at dc and power-line frequency.

The *ac voltage* function provides five ranges from 200 mV to 750 volts. Rated accuracy from 200 mV to 200 volts is 0.5% + 2 digits from 45 Hz to 10 kHz; 1% + 2 digits from 10 kHz to 20 kHz; and 5% + 3 digits between 20 kHz and 50 kHz. On the 750-volt ac range, accuracy is 0.5% + 2 digits from 45 Hz to 1 kHz. Overload protection extends to 750 volts rms, 1 kV peak, not to exceed 10⁷ volt-Hz, except for 10 seconds maximum on the 200-mV and 2-volt ranges. The input impedance is 10 megohms with less than 100 pF shunt capacitance. Common-mode rejection is greater than 60 dB at 60 Hz.

The *resistance* function provides six ranges from 200 ohms to 20 megohms. Accuracy is rated at $\pm 0.2\%$ reading + 1 digit on the four lower ranges and $\pm 0.5\%$ reading plus 1 digit on the upper two ranges. Overload on all ranges is 500 volts dc or rms, while the open-circuit voltage is less than 3.5 volts on all ranges. Three diode test ranges are provided to forward-bias diode junctions.

Three *conductance* ranges are provided. These are useful for measuring conductances too low (resistances too high) to be resolved by normal measurement techniques. The unit of conductance is the Siemen (S). The 2-mS (1/500 Ω) range measures down to 1 MS (1/1 MΩ), $\pm 0.4\%$ reading + 1 digit; the 20-μS (1/50 kΩ) range measures to 10 nS (1/100 MΩ) with the same accuracy as the 2-mS range, while the 200-nS (1/5 MΩ) range goes to 0.1 nS (1/10¹⁰ Ω) with an accuracy of $\pm 1\%$ reading + 10 digits. Overload protection to 500 volts dc or rms is provided on all ranges.

Dc currents are measured in six ranges from 200 μA to 10 amperes. Accuracy is $\pm 0.3\%$ reading + 1 digit except on the 10-ampere range where it is $\pm 0.5\%$ reading + 1 digit. Overload protection is by fuses except for the 10-ampere range. The voltage burden is 0.3 volt maximum on all ranges except 2 amperes which is 0.9 volt, and 10 amperes where it is 0.5 volt.

Ac currents can be measured via six ranges from 200 μA to 10 amperes. Accuracy on the 200-μA through 200-mA ranges, between 45 Hz and 10 kHz, is 1% + 2 digits; and between 10 kHz and 20 kHz, it is 2% + 2 digits. On the 2- and 10-ampere ranges, accuracy between 45 Hz and 2 kHz is 1% + 2

digits. The overload and voltage burden is the same as for dc current.

Operating temperature is between 0°C and 50°C, with the temperature coefficient less than 0.1/°C times the applicable accuracy specifications from 0°C to 18°C and 28°C to 50°C. Acceptable relative humidity for the instrument extends to 80% at 35°C or 70% at 50°C. Rechargeable NiCd batteries provide from 15 to 40 hours of operation, with a 14-hour recharge time. Low battery voltage is indicated by the sign BT on the LCD display.

Comments. The Fluke D811 was checked by Lockheed Electronics Instrumentation Measurements Lab., against standards traceable to the National Bureau of Standards. The IML found that the D811 met its advertised specifications in all respects.

In using the instrument, we had no problems. We really liked the Touch-Hold Probe and its method of connection to the DMM. Because of its connector, the probe can be left permanently attached to the meter, and there is no need to shuffle test leads to change function. The "hold" pushbutton on the probe—which "freezes" the LCD display—has been very helpful, as we can now store a voltage or resistance measurement and check the value given on a schematic.

The instruction manual (which is as important as any peripheral) is very well written, profusely illustrated, and covers the D811 completely. It even provides the names, addresses and telephone numbers of worldwide Fluke technical service centers.

The D811 is hardly a pocket-size instrument, but it is not large and bulky. Its convenient carrying handle also acts as a variable tilt stand for bench operation. And, a detailed summary of device specifications is printed on the underside of the case.

Other optional accessories include the 801-600 High Current Probe that allows current measurement from 2 to 600 amperes, the 80K-40 High Voltage Probe that allows voltage measurement from 1 to 40 kV dc or peak ac, and 28 kV rms ac, the 81RF High Frequency Probe that allows measurement of signals from 0.25 to 30 volts rms between 100 kHz to 100 MHz, the 80T-150 Temperature Probe for measurements between -50°C to +150°C, or -58°F to +302°F, and the Y8205 Carrying Case made of soft vinyl plastic. The last also has provisions for test leads, the power cord, and compact accessories.

In our view, the D811 RMS Multimeter is an excellent instrument, whose specifications are somewhat better than one would expect of such a reasonably priced instrument. Furthermore, it incorporates several unique features that in practice prove very much worthwhile. We can recommend it, without reservation, to anyone in need of a first-class bench/portable digital multimeter. — Les Solomon.

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POPULAR ELECTRONICS

COMPUTER BITS

By Carl Warren

New Systems for 1981

JANUARY is when manufacturers attend the annual Winter Consumer Electronics Show in Las Vegas to display their new products for the consumer market. This year, there were few really "new" product introductions. Most of the products turned out to be already familiar items in new packages, but there were a number of items worthy of note.

What many of us thought would be a significant entry to the personal-computer market by Commodore Consumer Products Group turned out to be little more than a repackaging concept, with color- and sound-generation capabilities thrown in. The product, the Video Interface Computer (VIC) 20, is a less-than-




Mattel Electronics Computer Backgammon

\$300, keyboard-sized unit with 5K bytes of RAM; circuitry that supports eight character colors, eight border colors, and 16 screen colors; and sound generators for development of computer music. It's designed to use the same PETBAS-IC and graphics functions used in the company's Pet microcomputer. Memory can be expanded to 32K of RAM, and the system can handle disk drives, printer, cassette deck, and game controls.

Mattel Electronics again showed up with its "Intellivision" video-games player/computer system and numerous games. The system consists of a master unit whose primary function is to provide video-game playing capability and a keyboard unit into which the master component plugs. The master unit offers, a reasonable display, and the games are better than most. The keyboard component, which has been announced several times before and never reached market, includes a cassette deck and a very weak

keyboard. On the plus side, Mattel deserves high marks for its hand-held computer games, particularly computer

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A complete guide to super low cost alphanumeric and graphic microprocessor-based video displays. Includes do-it-yourself construction details and documented and debugged support software. \$5.95

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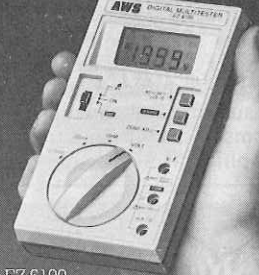
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computers

witnessed at CES. I'll pass on pricing and technical details when I get them.

Speak Up. Since 1978, there has been a growing interest in computer-generated speech and speech recognition. Texas Instruments leads in this field with its "Speak and Spell" unit. This year, TI has added the "Speak and Read" learning aids, designed to assist teachers. Speak and Read cartridges available now include "Who's Who at the Zoo," "Sea Sights," and "Dog on a Log." The solid-state plug-in modules retail for \$25 each.

TI has also put forth major efforts in communication-mode modules and is aiding outside sources in developing software for its 99/4 microcomputer. Now software developers can use Pascal and a special development system. If you're in the software business and want to develop software for the 99/4, contact TI for details.

Anyone who wants to develop his own speech laboratory would do well to contact Telesensory Speech Systems, which has an advanced speech synthesizer for small computers. The company's Series III speech module can accommodate standard and custom vocabularies of up to 256 words. The module contains the company's own speech synthesizer, vocabulary data memory, on-board speech filter, and audio amplifier. The TTL-compatible board requires a +5-volt supply. Consult Telesensory directly for pricing and technical details and ask for a catalog of all its speech products.

On the subject of speech synthesis, *Giving a Voice to Computers*, by Ed Teja, an expert in voice technology, should be available from Tab Books or through your local computer or electronics retailer for about \$10. It will acquaint you with the fundamentals of speech-synthesis and provide basic experiments you can perform. Perhaps the



Tiger Electronics Talking Computer

book's most important feature is its list of speech-module manufacturers.

Tiger Electronic Toys Inc. had an interesting item at the CES—a 1500-word vocabulary computer dubbed the K-2-8. The manufacturer characterizes this system as a gap jumper, since it's not limited to 250 words. The system has 15 different learning modes with specific goals for the student to reach.

Other Systems to Consider. If you're in the bulk-mailing business and maintain large mailing lists, you should keep an eye out for the WHIZ from AM

International. This specialized mailing-list system consists of an 80 × 24 character video display, Z80-based computer with 64K bytes of RAM, dual 5.25" single-sided double-density floppy-disk drives, and a Dataproducts dot-matrix bidirectional printer.

Mailing-list software for the WHIZ is written in Microfocus CIS COBOL and offers the same facilities found on large minicomputer systems. Price of the basic system is only \$8990. Adding an automatic labeler boosts system price to \$14,990, which is still \$6000 less than what you'd pay for a similar system from another manufacturer.

A new system that hasn't received much attention is the IF800 Model from OKI. It resembles Hewlett-Packard's high-end color-graphics systems and even emulates H-P's clear graphics. Resolution is 640 × 200 dots, each individually addressable. The Model 20 system is currently supported by an extremely powerful version of Microsoft BASIC, COBOL, FORTRAN, and a BASIC compiler. A color display, light pen, and time-of-day clock are all part of the package. I couldn't find out what the system costs or where to buy it, but you can expect it to compete with Apple in price. Look for it in the second half of this year. Additional information is obtainable from BMC International. ♦

MORE INFORMATION

For additional information about the products or services discussed in this column, contact the companies directly.

AM International
1900 Ave of the Stars
Los Angeles, CA 90067
213-556-9639

Astrovision
6460 Bosch Blvd, Suite 215
Columbus, OH 43229
614-885-0130

BMC International (USA) Inc
Union Bank Building, Suite 600
11222 LA Cienega Blvd
Inglewood, CA 90304
213-641-4588

Commodore Consumer Products Group
761 Fifth Ave.
King of Prussia, PA 19406
215-666-6800

Telesensory Speech Systems
3408 Hillview Ave, Box 10099
Palo Alto, CA 94304
415-493-2626

Texas Instruments Inc.
Inquiry Answering Service
Box 225012 M/S 308
Dallas, TX 75265

Tiger Electronic Toys Inc.
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Chicago, IL 60611
312-836-7100

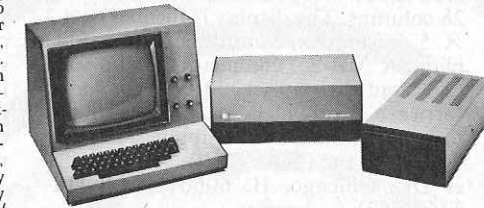
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Start learning and computing for only \$129.95 with a Netronics 8085-based computer kit. Then expand it in low-cost steps to a business/development system with 64k or more RAM, 8" floppy disk drives, hard disks and multi-terminal I/O.

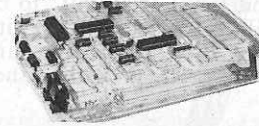
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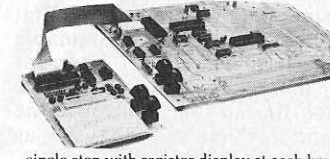
(Also available wired & tested, \$1799.95)



Full 8" disk system for less than the price of a mini (shown with Netronics Explorer/85 computer and new terminal). System features floppy drive from Control Data Corp., world's largest maker of memory storage systems (not a hobby brand!)



Level "A" is a complete operating system, perfect for beginners, hobbyists, industrial controller use. \$129.95



Level "A" With Hex Keypad/Display.

LEVEL "A" SPECIFICATIONS

Explorer/85's Level "A" system features the advanced Intel 8085 cpu, an 8355 ROM with 2k deluxe monitor/operating system, and an advanced 8155 RAM I/O... all on a single motherboard with room for RAM/ROM/PROM/EPROM and S-100 expansion, plus generous prototyping space.

PC Board: Glass epoxy, plated through holes with solder mask. • I/O: Provisions for 25-pin (DB25) connector for terminal serial I/O, which can also support a paper tape reader... cassette tape recorder input and output... cassette tape control output... LED output indicator on SOD (serial output) line... printer interface (less drivers)... total of four 8-bit plus one 6-bit I/O ports. • Crystal Frequency: 6.144 MHz. • Control Switches: Reset and user (RST 7.5) interrupt... additional provisions for RST 5.5, 6.5 and TRAP interrupts on-board. • Counter/Timer: Programmable, 14-bit binary. • System RAM: 256 bytes located at F800, ideal for smaller systems and for use as an isolated stack area in expanded systems... RAM expandable to 64K via S-100 bus or 4K on motherboard.

System Monitor (Terminal Version): 2k bytes of deluxe system monitor ROM located at F800, leaving 64K free for user RAM/ROM. Features include tape load with labeling... examine/change contents of memory... insert data... warm start... examine and change all registers... single step with register display at each break point, a debugging/training feature... go to execution address... move blocks of memory from one location to another... fill blocks of memory with a constant... display blocks of memory... automatic baud rate selection to 9600 baud... variable display line length control (1-255 characters/line)... channelized I/O monitor routine with 8-bit parallel output for high-speed printer... serial console in and console out channel so that monitor can communicate with I/O ports.

System Monitor (Hex Keypad/Display Version): Tape load with labeling... tape dump with labeling... examine/change contents of memory... insert data... warm start... examine and change all registers...

single step with register display at each break point... go to execution address. Level "A" in this version makes a perfect controller for industrial applications, and is programmed with the Netronics Hex Keypad/Display. It is low cost, perfect for beginners.

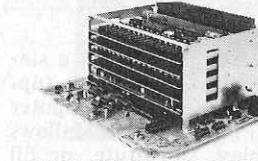
HEX KEYPAD/DISPLAY SPECIFICATIONS
Calculator type keypad with 24 system-defined and 16 user-defined keys. Six digit calculator-type display, that displays full address data as well as register and status information.

LEVEL "B" SPECIFICATIONS

Level "B" provides the S-100 signals plus buffers/drivers to support up to six S-100 bus boards, and includes: address decoding for on-board 4k RAM expansion selectable in 4k blocks... address decoding for on-board 8k EPROM expansion selectable in 8k blocks... address and data bus drivers for on-board expansion... wait state generator (jumper selectable), to allow the use of slower memories... two separate 5 volt regulators.

LEVEL "C" SPECIFICATIONS

Level "C" expands Explorer/85's motherboard with a card cage, allowing you to plug up to six S-100 cards directly into the motherboard. Both cage and card are neatly contained inside Explorer's deluxe steel cabinet. Level "C" includes a sheet metal superstructure, a 5-card, gold plated S-100 extension PC board that plugs into the motherboard. Just add required number of S-100 connectors.



Explorer/85 With Level "C" Card Cage.

LEVEL "D" SPECIFICATIONS

Level "D" provides 4k of RAM, power supply regulation, filtering decoupling components and sockets to expand your Explorer/85 memory to 4k (plus the origi-

Please send the items checked below:

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- Explorer/85 Level "A" kit (Hex Keypad/Display Version)... \$129.95 plus \$3 post. & insur.
- 8k Microsoft BASIC on cassette tape. \$64.95 postpaid.
- 8k Microsoft BASIC in ROM kit (requires Levels "B", "D" and "E")... \$99.95 plus \$2 post. & insur.
- Level "B" (S-100) kit... \$49.95 plus \$2 post. & insur.
- Level "C" (S-100 6-card expander) kit... \$39.95 plus \$2 post. & insur.
- Level "D" (4k RAM) kit... \$69.95 plus \$2 post. & insur.
- Level "E" (EPROM/ROM) kit... \$5.95 plus 50¢ p&h.
- Deluxe Steel Cabinet for Explorer/85... \$49.95 plus \$3 post. & insur.
- Fan For Cabinet... \$15.00 plus \$1.50 post. & insur.
- ASCII Keyboard/Computer Terminal kit: features a full 128 character set, u&l case; full cursor control; 75 ohm video output; convertible to baudot output; selectable baud rate, RS232-C or 20 ma. I/O. 32 or 64 character by 16 line formats, and can be used with either a CRT monitor or a TV set (if you have an RF modulator)... \$149.95 plus \$3.00 post. & insur.
- Deluxe Steel Cabinet for ASCII keyboard/terminal... \$19.95 plus \$2.50 post. & insur.
- New! Terminal/Monitor: (See photo) Same features as above, except 12" monitor with keyboard and terminal is in deluxe single cabinet: kit... \$399.95 plus \$7 post. & insur.
- Hazeltine terminals: Our prices too low to quote — CALL US
- Lear-Sigler terminals/printers: Our prices too low to quote: CALL US
- Hex Keypad/Display kit... \$69.95 plus \$2 post. & insur.

- AP-1 Power Supply Kit ±8V @ 5 amps in deluxe steel cabinet... \$39.95 plus \$2 post. & insur.
- Gold Plated S-100 Bus Connectors... \$4.95 each, postpaid.
- RF Modulator kit (allows you to use your TV set as a monitor)... \$8.95 postpaid.
- 16k RAM kit (S-100 board expands to 64k)... \$199.95 plus \$2 post. & insur.
- 32k RAM kit... \$299.95 plus \$2 post. & insur.
- 48k RAM kit... \$399.95 plus \$2 post. & insur.
- 64k RAM kit... \$499.95 plus \$2 post. & insur.
- 16k RAM Expansion kit (to expand any of the above in 16k blocks up to 64k)... \$99.95 plus \$2 post. & insur. each.
- Intel 8085 cpu Users' Manual... \$7.50 postpaid.
- 12" Video Monitor (10MHz bandwidth)... \$139.95 plus \$5 post. & insur.
- Beginner's Pak (see above) \$169.95 plus \$4 post. & insur.
- Experimenter's Pak (see above)... \$219.95 plus \$6 post. & insur.
- Special Microsoft BASIC Pak Without Terminal (see above)... \$329.95 plus \$7 post. & insur.
- Same as above, plus ASCII Keyboard Terminal With Cabinet, Get Free RF Modulator (see above)... \$499.95 plus \$10 post. & insur.
- Special 8" Disk Edition Explorer/85 (see above)... \$1499.95 plus \$26 post. & insur.
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nal 256 bytes located in the 8155A). The static RAM can be located anywhere from 8000 to EFFF in 4k blocks.

LEVEL "E" SPECIFICATIONS
Level "E" adds sockets for 8k of EPROM to use the popular Intel 2716 or the TI 2516. It includes all sockets, power supply regulator, heat sink, filtering and decoupling components. Sockets may also be used for 2k x 8 RAM IC's (allowing for up to 12k of on-board RAM).

DISK DRIVE SPECIFICATIONS
• 8" CONTROL DATA CORP. professional drive. • Data capacity: 401,016 bytes (SD), 802,032 bytes (DD), unformatted.
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• Single or double density.

DISK CONTROLLER I/O BOARD SPECIFICATIONS

• Cont.rols up to four 8" drives. • 2716 PROM socket included for use in custom applications.
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Special Microsoft BASIC Pak (Save \$103.00!) — Includes Level "A" (Terminal Version), Level "B", Level "D" (4k RAM), Level "E", 8k Microsoft in ROM, Intel 8085 User Manual, Level "A" Monitor Source Listing, and AP-1 5-amp Power Supply; (regular price \$439.70), now yours at SPECIAL PRICE: \$329.95 plus post. & insur.

ADD A TERMINAL WITH CABINET, GET A FREE RF MODULATOR: Save over \$114 at this SPECIAL PRICE: \$499.95 plus post. & insur.

Special 8" Disk Edition Explorer/85 (Save over \$104!) — Includes disk-version Level "A", Level "B", two S-100 connectors and brackets, disk controller, 64k RAM, AP-1 5-amp power supply, Explorer/85 deluxe steel cabinet, cabinet fan, 8" SD/DD disk drive from famous CONTROL DATA CORP. (not a hobby brand!), drive cabinet with power supply, and drive cable set-up for two drives. This package includes everything but terminal and printers (see coupon for them). Regular price \$1630.30, all yours in kit at SPECIAL PRICE: \$1499.95 plus post. & insur. Wired and tested, only \$1799.95.

Special! Complete Business Software Pak (Save \$625.00!) — Includes CPM 2.0, Microsoft BASIC, General Ledger, Accounts Receivable, Accounts Payable, Payroll Package; (regular price \$1325), yours now at SPECIAL PRICE: \$699.95.

- Disk Controller Board With I/O Ports... \$199.95 plus \$2 post. & insur.
 - Special: Complete Business Software Pak (see above)... \$699.95 postpaid.
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 - Intel 8085 cpu User Manual... \$7.50 postpaid.
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