

# Popular Electronics®

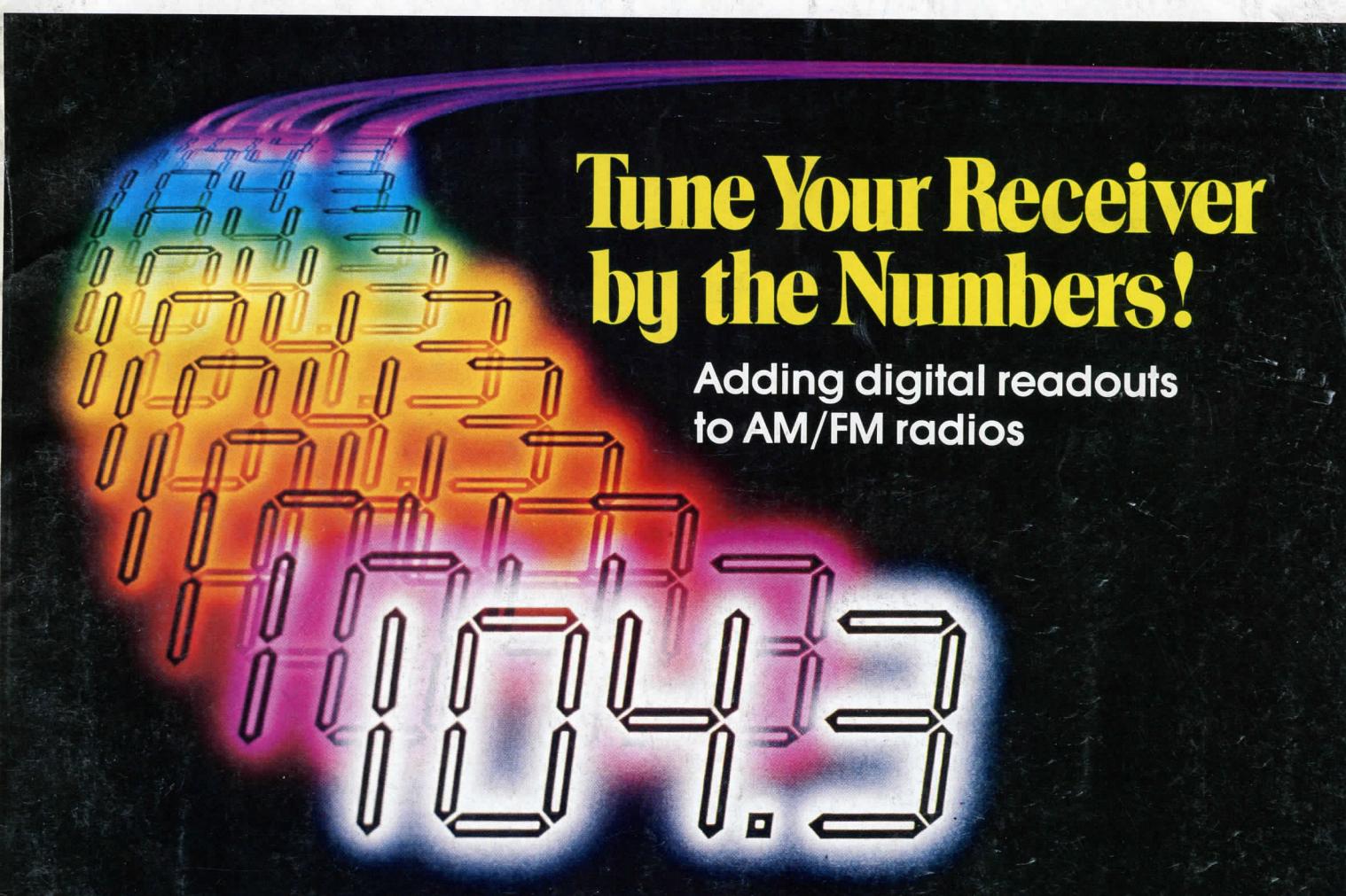
WORLD'S LARGEST SELLING ELECTRONICS MAGAZINE

OCTOBER 1981/\$1

## DXing TV Satellites for Entertainment & News

## Aftermarket Add-ons for Apple Computers

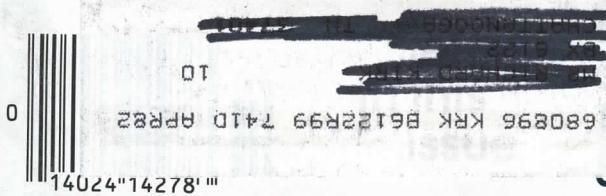
## THE ELECTRONIC WORLD Guide to Home Video Movie Making



## Tune Your Receiver by the Numbers!

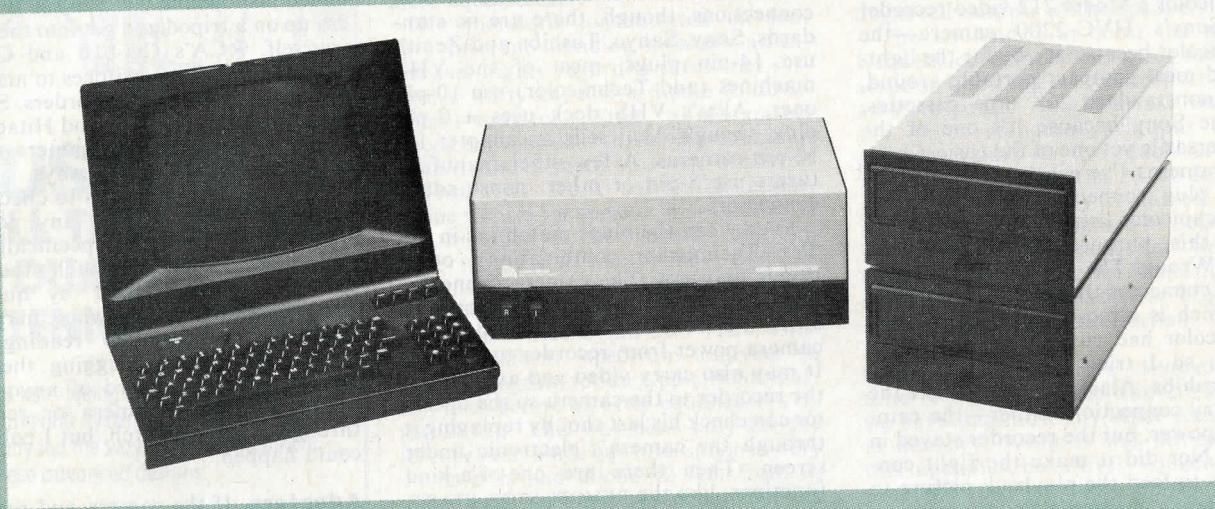
Adding digital readouts  
to AM/FM radios

Electronics "Explorer" Microcomputer  
Tbx 20/20 Computerized Equalizer/Analyzer  
Toshiba CB965 19" Tabletop Color TV  
Simpson 260 Model 7 Analog Multimeter



# Popular Electronics Tests

## *The Netronics Explorer 85 Computer*



The Explorer/85 computer from Netronics Research and Development is one of a rare breed—a simple, low-cost, yet exceedingly well-designed computer that starts as a basic kit, and can easily be expanded as the builder/user requires. Through the addition of other low-cost kits, the Explorer/85 can be expanded into an excellent and useful general-purpose computing system whose final price undercuts comparable systems.

The basic one-board system called Level-A (\$129.95) contains an 8085 CPU (a "grandson" of the famous 8080) that is 100% compatible with 8080 software. It includes eight RST vector interrupts and four hardware interrupts that are automatically channeled to the monitor with a register save routine, and RAM area addresses that redirect the processor to the desired interrupt routine. The 13 $\frac{1}{4}$ " x 10 $\frac{3}{4}$ " glass epoxy board features plated-through holes with solder mask, and has provisions for serial I/O and another 25-pin socket for a hex keypad, a cassette recorder circuit with motor control, a speaker output, a LED indicator on the 8085 serial output line, a printer interface (less drivers), and four 8-bit plus one 6-bit I/O ports. The 8085 operates at 6.144 MHz. Other hardware includes a programmable 14-bit binary counter/

timer, 256 bytes of RAM at F800 that can be expanded to 4K on the mother board or to 64K via the S-100 bus.

A very useful monitor contained in a 8355 2K ROM (located at F000) includes tape LOAD/DUMP with label, EXAMINE/CHANGE MEMORY contents, INSERT data, provisions for a warm start (register save input) that is useful for breakpoint debugging, EXAMINE/CHANGE registers, single-step with register display at each break point, and GOTO execution address. Monitor routines in the terminal version (not available in the hex keypad version) can move data blocks from one location to another, fill memory blocks with a selected value, display memory blocks, select baud-rate automatically, and control variable line length (1 to 255 characters/line). Also included is a channelized I/O routine with 8-bit parallel output for a high-speed printer, and a serial console I/O so that the monitor can communicate with serial I/O ports. The monitor source listing is available. The system can be used with a conventional terminal or hex keypad. Level-A detects the baud rate of a terminal and readjusts itself accordingly.

The Level-B Expansion Kit (\$49.95) provides the signals plus buffer drivers to support up to six S-100 boards. Included in this portion are the 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, a jumper-selectable wait-state generator to allow use of slow memory, and two separate 5-volt regulators to provide stability and reduce bus noise. Besides installation information, the manual for this kit also contains a description of the S-100 bus used in this computer.

The Level-C Expansion Kit (\$39.95) is mainly metalwork (card cage) that increases the number of S-100 board connectors (not supplied) to five, and also provides a trouble-shooting socket for vertically mounting an S-100 board. The metal structure mounts directly on the motherboard.

Level-D (\$49.95) provides an additional 4K of on-board static RAM to the original 256 bytes in the basic system. It also has a power-supply regulator and decoupling, and requires the installation of Level-B. The additional memory can be located at any 4K block from 0000 to EFFF.

Level-E (\$5.95) provides the sockets, power-supply regulation, filtering and decoupling components, and allows the use of up to 8K of 2716 or 2516 EPROMs. Jumpers are provided to allow these sockets to be used with RAM.

(MEMR and MEMW signals are available for this purpose.) This add-on requires the installation of Level-B, as well as an external +8 volts at 700 mA, unregulated.

Power for the system is provided by the AP-1 Power Supply (\$39.95) that provides +8 and -8 volts dc, and 20 volts peak-to-peak ac. The output current is 5 amperes and switches accommodate both line and load conditions.

Memory expansion is via the "Jaws" S-100 dynamic RAM board with the 16K version at \$149.95, expandable in 16K increments (at \$50 per 16K), to a full 64K. This board takes so little power, even with 64K installed, that heat sinks are not required for the regulators. It uses the Intel D8202 arbitrator IC to keep the chip count to a minimum.

The 8" CDC (Control Data Corp.) disk drive has a single-density capacity of 401,016 bytes or double-density capacity of 802,032 bytes unformatted, LSI controller, write protection, and an access time of 25 ms (one track).

The Disk Controller-I/O Board can handle up to four 8" drives, uses a 1771A controller, and has an IBM-compatible data separator, two serial I/O ports with independent rates to 19,200 baud, autoboot-to-disk on system reset (allowing a full 64K byte RAM for actual program use), and operating software in a 2716 EPROM.

Software is Microsoft BASIC (\$64.95) which requires Level-B and 12K of RAM, or the BASIC comes in ROM (\$99.95) which requires Levels B and E and at least 4K of RAM. There is a disk version at \$325 that requires Level-B, 32K of RAM, a floppy disk controller (\$199.95), and an 8" disk drive (\$499.95). The disk can be housed in a metal cabinet with the disk power supply (\$69.95) with the required cables at \$25. CP/M 2.2 is available for \$150.

The system we built consisted of Levels A and B, the disk controller, two double-density, single-sided CDC 8" drives, the necessary cables, power supplies, and metal enclosures.

The system was constructed in accordance with the information in the manuals—which was just about equal to the task. A couple of phone calls to the plant were necessary to clarify a couple of points.

Since the disk controller contains the start-up (from RESET) utility in ROM (and also contains the ports for the printer and terminal), we elected to use the full 64K Jaws board (\$299.95). Although Netronics has a terminal kit, we used a Heath H-19 terminal and a Teletype Model 43 printer.

Once the system was interconnected, power was turned on. We installed the CP/M diskette, hit the RESET pushbutton on the front panel of the Explorer,

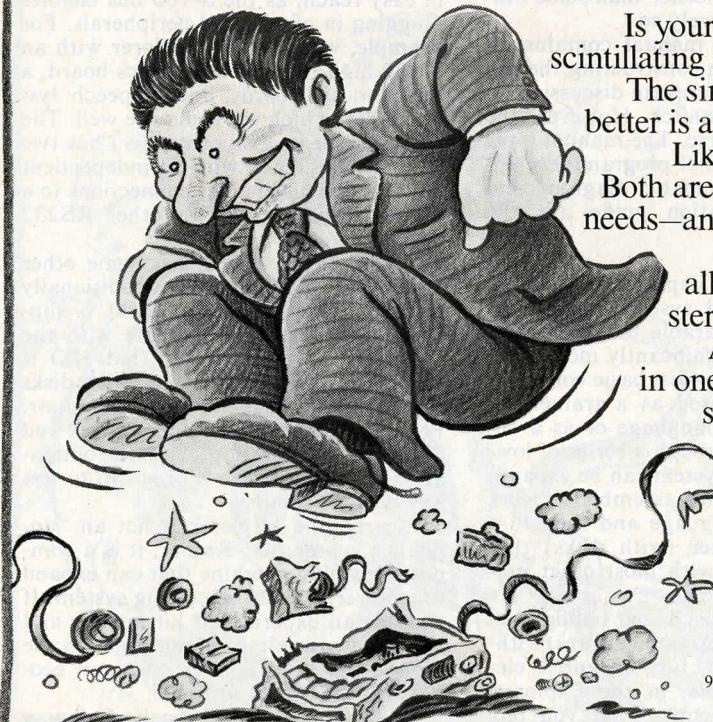
and the CP/M signed on immediately.

The computer enclosure houses the mother board, the S-100 bus expander, the small power supply, and a ventilating fan. Since, after many hours of use, the computer barely got warm, we disconnected the fan to quiet the tiny noise it made.

**Evaluation.** Since, in this configuration, the Explorer is a dedicated CP/M machine, we elected to challenge it with WordStar/MailMerge that contained a large number of files that we use at our computer club. As users of this word-processing software know, it really exercises the disk drives. The Explorer performed well, with typical Z-80 execution speed, and the CP/M, a disk operating system, behaved as it should.

Since, in our experience, the limiting factor in using a computer of this type in extreme environments is operator comfort, we decided to limit temperature stresses to those that would make a typical human surrender. To check high-temperature operation, we used hair dryers, one aimed into the computer housing and the other at the disk-drive housings. With the internal temperature of the housings at 105-110°F, the system went about its business free from problems, churning out form letters and spinning both disk drives merrily. Then we positioned the Explorer and its disk

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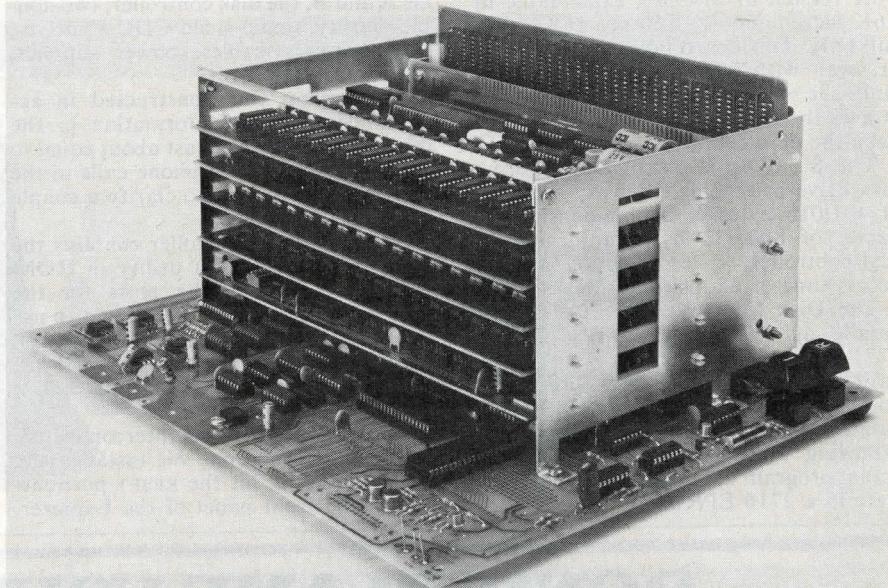
## computers

drives in the direct blast of an air conditioner, where the temperature was 55° F. Once again, the system ran without a hitch. Using a variable transformer, we varied the power-line voltage between 105 and 123 volts, still causing no problems.

Like many other disk-drive manufacturers, CDC feels that too many programs have been "bombed" by the operator's pounding on keys before the drive had finished its job, so these disk drives do not have a LED indicator to show

buy what you need. While construction of the Explorer/85 is not particularly arduous, it does require some previous kit-building experience.

Looking into the computer enclosure can be quite a shock, as there seems to be almost nothing there. The large mother board contains a small handful of chips, and there are only two plug-in boards on the S-100 bus—the 64K Jaws board and the disk controller board, as compared to a typical computer's seven boards. Such sparseness of components



Fully expanded Explorer with levels A, B, C, D, and E.

disk activity. The user is expected to wait until the cursor (or other screen action) shows up as a positive indication that disk activity has ceased. The CDC drives are a little noisier than some others but not excessively so.

The instruction manual contains all the information on constructing the basic system and a complete discussion on the use of the monitor. However, the information is sparse. The manual gives but one illustration of program development, and a schematic diagram and component-installation guide are the only illustrations.

**Comments.** The Explorer is an excellent, well-designed system whose performance is comparable to that of machines that cost significantly more. You can start with a low-cost basic computer kit that can be used as a trainer for learning machine language or as a device controller. Through a series of low-cost add-ons, the system can be expanded to a resident editor-assembler to work with assembly language and then to a full-blown computer (with disks) that can hold its own with most other machines on the market.

Using this approach, the builder can configure the system as he desires, without having to pay for unwanted elements. For example, in the Explorer, there is no requirement that you buy BASIC (or any other language). You

should contribute to reliability. An old engineering maxim has it: "that which you ain't got, ain't going to hurt you."

A wide variety of applications is within easy reach, as the S-100 bus enables plugging in of optional peripherals. For example, we used the Explorer with an S-100 high-resolution graphics board, a set of music boards, and a speech system, all of which worked quite well. The Explorer (or its disk controller) has two RS232 ports, each with an independent baud rate. This enables connections to a terminal and printer (or other RS232 device).

The Explorer system has some other appealing niceties not traditionally available. For example, CP/M is supplied with patches to operate with the CDC drive's controller so that I/O is automatic. This means that the disks can be simply plugged into an old Altair, Processor Tech, or similar computer and give turnkey operation. Also, the optional CP/M comes with a program to test any disk for quality.

Clearly, the Explorer is not an "appliance" computer. Rather, it is a computer learning machine that can expand to a powerful data-processing system. If you are an experienced kit builder and want to learn microcomputing from the ground up, the Explorer offers an economical way to do just that.

—Leslie Solomon

CIRCLE NO. 102 ON FREE INFORMATION CARD

**OSI BASIC.** FBASIC runs under the OSI OS-65D3 operating system and is a subset of OSI/Microsoft BASIC specially suited to systems-level programming. It produces stand-alone 6502 machine code modules. Special features include user-definable array locations, WHILE loops, GOTOS and GOSUBS to absolute addresses, direct access to registers, and more. It can also link compiled modules to the OSI interpreter. Requires 48K memory. \$155. Address: Pegasus Software, Box 10014, Honolulu, HI 96816.

**Computational Utility.** T/MAKER II is a CP/M-based utility that produces charts and exhibits for reports, has screen editing controls, creates complete reports, integrates text and numerical data, and can produce reports in a letter format by merging preprogrammed mailing lists, without changing disks. The user defines relationships between rows and columns (similar to Visicalc), and the program will compute established equations and place answers in their appropriate positions. Changing a number automatically recalculates corresponding rows and columns. Automatic functions include percentages, averages, logarithms, and transcendentals. \$275. Address: Lifeboat Associates, 1651 Third Ave., New York, NY 10028 (Tel: 212-860-0300).

**Apple Monitor Extender.** The Monitor Extender for the Apple II is a cassette-based utility that allows different display formats and ASCII text entry. It includes search, fill and move commands and a disassembler that creates a labelled ASCII file in disk or cassette memory. In addition to normal hex, memory can be displayed in ASCII or binary. The disk commands work with 3.2, 3.2.1, or 3.3 DOS. Memory usage is 1 1/4 K bytes, disk buffer is 256 bytes, and the text buffer is variable. It will run on any page boundary. Address: Image Computer Products, 615 Academy Drive, Northbrook, IL 60062 (Tel: 312-564-5060).

**TRS-80 Assembly Language.** PDS is an assembly language development system running under TRSDOS for the Model III. It includes a relocating macro assembler, linkage editor/linking loader, string-oriented text editor, interactive editor/assembler, trace debug/monitor, disk disassembler, and several utilities that extend the power of TRSDOS. It is available on 5" double-density Model III diskettes. \$99. Address: Allen Ashley, 395 Sierra Madre Villa, Pasadena, CA 91107 (Tel: 213-793-5748).

**New BASIC.** "Energy BASIC" is an interpreter designed for energy management systems that contains many of the usual BASIC constructs plus a number of energy unique statements such as MODE, SET, ANSW, ELAP, ORIG, PSWD, TEMP, and TIME. It runs under CP/M 2.2 on 8" diskette, or resident in two 2716 PROMs. The Users Manual is \$20. EB010 AND EB080 are \$195. Address: International Data Systems, Inc., Box 17269, Dulles International Airport, Washington, DC 20041 (Tel: 703-661-8442).

**TRS-80 Word Processor.** "Word" is a complete text/file merge option that enhances the Word-M2 on the Model II, Word-IV on Model I, and Word-M3 on Model III. It can merge a text file with elements of a data file or mailing list, and the same document can be printed repeatedly. Word users return diskette and \$37. The Word program with this option is \$79. Address: Micro Architect Inc., 96 Dothan St., Arlington, MA 02174. (Tel: 617-643-4713).

**TRS80 Medical Office.** The Medical Office System (26-1568) is designed for the TRS-80 Model I and Model III with printer and disk. The software can store up to 3960 (Model I) or 4200 (Model III) patient records and can record and store up to 3685 (Model I) or 7700 (Model III) transactions per month. Insurance forms can be printed on demand. It also provides space for 200 different procedures, and 200 different diagnoses. Accounts receivable can be aged to 120 days. \$299. Address: Radio Shack stores and Computer Centers. ◇

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You get all this in the starting level (Level A) of the Explorer/85 for only \$129.95. Incredible! To use, just plug in your 8VDC power supply and terminal or keypad/display — if you don't have them, see our special offer below.

□ Level A computer kit (Terminal Version) ... \$129.95 plus \$3 P&H.

□ Level A kit (Hex Keypad/Display Version) ... \$129.95 plus \$3 P&H.

□ LEVEL B — This "building block" converts the motherboard into a two-slot \$100 bus (industry standard) computer. Now you can plug in any of the hundreds of \$100 cards available.

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LEVEL C — Add still more computing power; this "building block" mounts directly on the motherboard and expands the 8080 bus to six slots.

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LEVEL D — When you reach the point in learning that requires more memory, we offer two choices: either add 4K of memory directly on the motherboard, or add 16K to 64K of memory by means of a single \$100 card, our famous "JAWS".

Level D kit (CHECK ONE) ... □ 4K on-board ... \$49.95 plus \$3 P&H. □ 16K S100 "JAWS" ... \$149.95 plus \$2 P&H. □ 32K S100 "JAWS" ... \$249.95 plus \$2 P&H. □ 64K S100 "JAWS" ... \$299.95 plus \$2 P&H.

LEVEL E — An important "building block;" it activates the 8K ROM/B/PROM space on the motherboard. Now just plug in our 8K Microsoft BASIC or your own custom programs.

□ Level E kit ... \$5.95 plus \$2 P&H.

Microsoft BASIC — It's the language that allows you to talk English to your computer! It is available three ways:

□ 8K cassette version of Microsoft BASIC. (Requires Level B and 12K of RAM minimum; we suggest a 16K S100 card.) ... \$64.95 plus \$2 P&H.

□ 9K ROM version of Microsoft BASIC. (Requires Level B & Level E and 4K RAM just plug into your E socket.)

We suggest either the 4K Level D RAM expansion or a 16K S100 "JAWS". ... \$99.95 plus \$2 P&H.

□ Disk version of Microsoft BASIC. (Requires Level B, 32K of RAM, floppy disk controller, 8" floppy disk drive) ... \$325 postpaid.

TEXT EDITOR/ASSEMBLER — The editor/assembler is a software tool (a program) designed to simplify the task of writing programs. As your programs become longer and more complex, the assembler can save you many hours of programming time. This software includes an editor program that enters the programs you write, makes changes, and saves the programs on cassettes. The assembler performs the clerical task of translating symbolic code into the computer-readable object code. The editor/assembler program is available either in cassette or a ROM version.

□ Editor/Assembler (Cassette version; requires Level "B" & 8K (min.) of RAM — we suggest 16K "JAWS" — see above) ... \$59.95 plus \$2 P&H.

□ Editor/Assembler (ROM version, supplied on an S100 card; requires Level B & 16K "JAWS") ... \$99.95 plus \$2 P&H.

8" FLOPPY DISK — A remarkable "building block."

Add our 8" floppy disk when you need faster operation, more convenient program storage, perhaps a business application, and the ability to store thousands of programs and program language available today. You simply plug them into your Explorer/85 disk system — it accepts all IBM-formatted CP/M-based programs.

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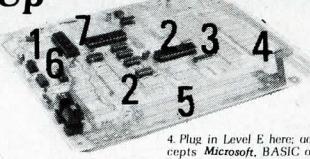
□ CP/M 2.2 Disk Operating System; includes Text Editor/Assembler, dynamic debugger, and other features that give your Explorer/85 access to thousands of existing CP/M-based programs ... \$150.00 postpaid.

NEED A POWER SUPPLY? Consider our AP-1. It can supply all the power you need for a fully expanded Explorer/85 (note disk drives have their own power supply).

Plus the AP-1 fits neatly into the attractive Explorer steel cabinet (see below).

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- 2. Add Level B to convert to S100
- 3. Add 4K RAM
- 4. Plug in Level A here; connect Jumper/BASIC or Keypad/Display
- 5. Add two S100 cards
- 6. Add your own custom circuit (prototyping area)
- 7. Connect terminal

1. CRT monitor or a TV set (if you have an RF modulator)

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□ Steel Cabinet for ASCII Keyboard/Terminal ... \$19.95 plus \$2 P&H.

□ RF Modulator kit (allows you to use your TV set as a monitor) ... \$8.95 postpaid.

□ 12" Video Monitor (10MHz bandwidth) ... \$139.95 plus \$5 P&H.

□ Deluxe Steel Cabinet for the Explorer/85 plus \$3 P&H.

□ Fan for cabinet ... \$15.00 plus \$1.50 P&H.

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