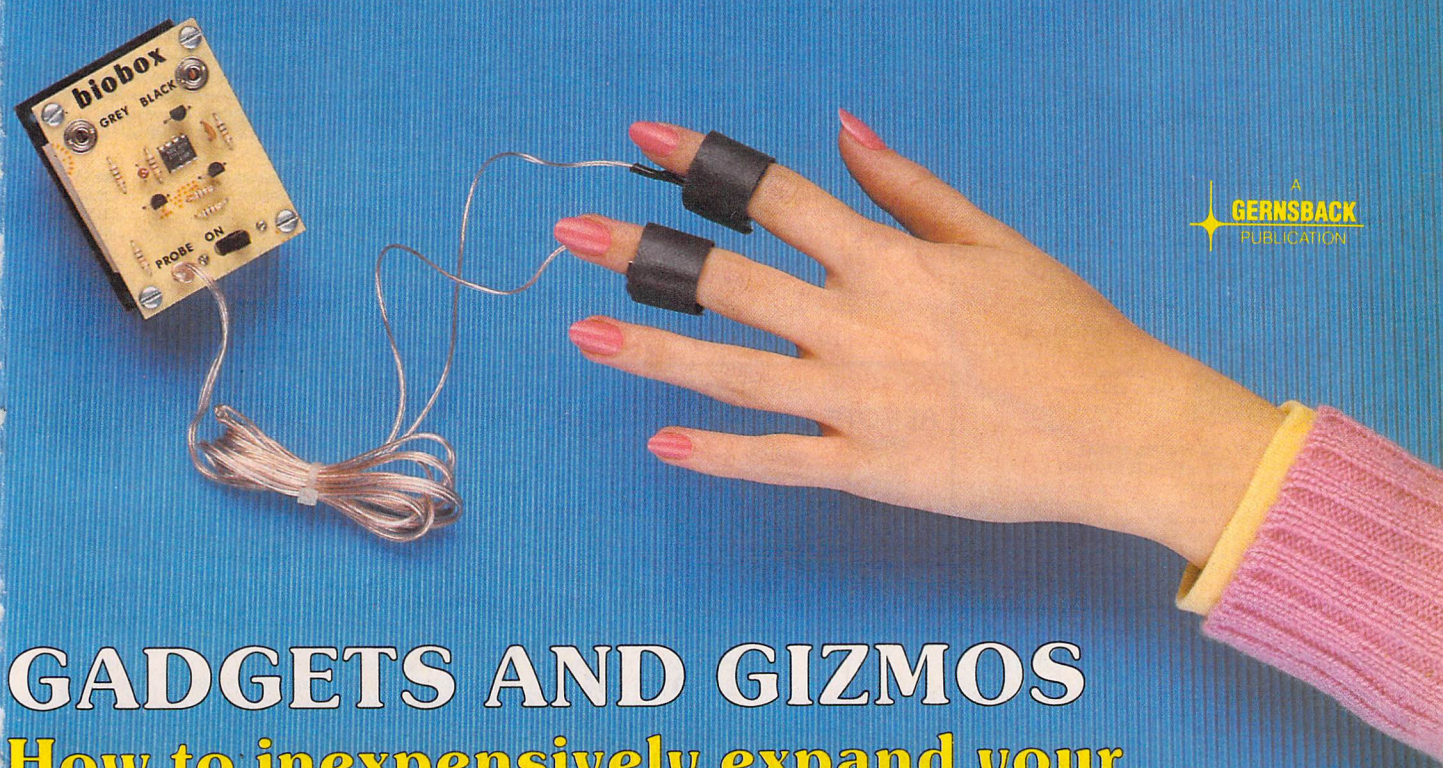
VOL. 1 No. 8 December 1984

COMPUTER DIGEST

NEW KIND OF MAGAZINE FOR ELECTRONICS PROFESSIONALS

BIOBOX

Build this Biodfeedback Monitor and use your computer to keep calm.



A GERNSBACK PUBLICATION

GADGETS AND GIZMOS

How to inexpensively expand your computer's capability.

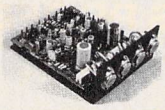
PATCHING WORDSTAR

How to modify WordStar to access the special functions of your MX-80

60W + 60W O.T.L. AMP

Stereo pre-amp + tone control + power amp. All in on unit, fully assembled! Compact in size: 7"x4¾"x2½". Can be fitted into most cabinets. Power transistors using 25C1667 X 4 to give a max output of 60W + 60W (8Ω)
• Frequency response: 20Hz~85KHz(−1dB) • Total harmonic distortion: 0.02% (1KHz) • Signal/Noise Ratio: 88 dB (open loop) • Tone control: 100 Hz±16 dB 10 KHz±14dB • Dynamic range: 60 dB • Power Supply: 48V~70V 5 Amp. • Filter Capacitor: 4700 μ 75V or better.

MODEL: SA-4520



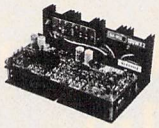
Assembled Model $39.95
Transformer (Optional)....$22.50
Filter Capacitor 4700μF 75V (Optional).....$6.50 ea.

★ REDUCED PRICE ★

LOW T.I.M. TRANSISTORS 100W + 100W

• Employs Hitachi low noise I.C. for pre-amp • Max. output 16 V P-P (non distortion) • With hi-low filter, and tone defeat circuit • Rear power amp with short circuit protection • Giant heat sink for maximum results • Tone controls±14dB • All components (except pots for volume, and tone controls) are pre-assembled, the quality is guaranteed. • Power supply DC±35V-50V

MODEL: SA802C

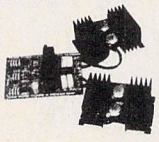


Fully Assembled $75.00
Transformer (Optional)....$22.50 ea.
Filter Capacitor 4700μF 75V (Optional).....$6.50 ea.

100 WATTS

CLASS A POWER AMP KIT

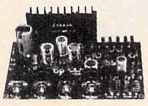
$49.50



Dynamic Bias Class "A" circuit design makes this unit unique in its class. Crystal clear, 100 watts power output will satisfy the most picky fans. A perfect combination with the TA-1020 low TIM stereo pre-amp.
Specifications • Output power 100W RMS into 8Ω. 125W RMS into 4Ω • Frequency response 10Hz-100KHz • THD less than 0.01% • S/N ratio better than 80dB • Input sensitivity 1V max. • Power supply ±40V at 5A.

Power Transformer (Optional).....$24.00

NOW WITH ON-BOARD LED LEVEL DISPLAY



★ SPECIAL ★
Excellent Price!
Model 001-0034
$29.50 per Kit
Transformer $10.50 ea.

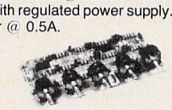
TA-322 30 WATTS TOTAL 15W + 15W STEREO AMP KIT

This is a solid state all transistor circuitry with on board stereo pre-amp for most microphone or phone input. Power output employs a heavy duty Power Hybrid IC. Four built on board controls for, volume, balance, treble and bass. Power supply requires 48VCT 2.5A transformer. THD of less than 0.1% between 100Hz-10KHz at full power (15 Watts + 15 Watts loaded into 8Ω).

LOW TIM DC STEREO PRE-AMP KIT TA-1020

Incorporates brand-new DC design that gives a frequency response from 0-100KHz ±0.5dB. Added features like tone defeat and loudness control let you tailor your own frequency supplies to eliminate power fluctuations!
Specifications: • THD/TIM less than .005% • Frequency response DC to 100KHz ±0.5dB • RIAA deviation ±0.2dB • S/N ratio better than 70dB • Sensitivity; Phone 2mV 47KΩ, Aux 100mV 100KΩ • Output level 1.3V • Max output 15V • Tone controls; Bass ±10dB @ 50Hz, Treble ±10dB @ 15Hz • Power supply ±24VDC @ 0.5A. Kit comes with regulated power supply. All you need is a 48VCT transformer @ 0.5A.

Only $44.50
Transformer $4.50 ea.



MAGNETIC HEAD EQUALIZER

• Standard RIAA curve for all kinds of magnetic heads • 3 stages crossover circuit for best results • Output voltage guaranteed to be stable without any oscillation • Power Supply: 24 V.D.C.

MODEL: MA-142
Part #370-370.....$6.95 ea.

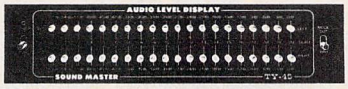
STEREO MICRPHONE AND ECHO MIXER FOR STEREO AMPLIFIER SYSTEM

The circuitry employs all integrated circuits, BBD type echo circuit, echo time can be adjusted (max. .30 Msec.) Also with a microphone preamp on the board. Fully assembled.

MODEL: MX205
Part #370-0360..... $29.95 ea.

20 STEPS LED TRI COLOR LEVEL INDICATOR KIT

This new stereo level indicator kit consists of 40 3-color LED's to indicate sound level output of your amplifier from −57dB to 0dB. Comes with an attractive silk screen printed panel. Has selector switch to allow floating or gradual output indicating. Kit includes all parts. Front panel and power supply.



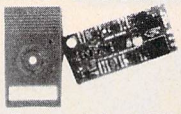
MODEL: TY-45 .....$29.50 per Kit

0—15V 2 AMP VARIBLE DC POWER SUPPLY KIT

All solid state circuitry with high efficiency power transitor 2SD388 and IC voltage regulator MC1733. Output voltage can be adjusted from 0-15V at 2A current limited. Internal resistance is less than 0.005Ω, ripple and noise less than 1mV, dual on panel meters for voltage and current reading, also with on board LED and audible over load indicator. Kit comes with pre-drilled PC Board, instructions, all necessary electronic components, transformer and a professional looking metal cabinet. The best project for school and the most useful instrument for repairmen. Build one today!

MODEL: TR 100
$59.50 ea.

INFRA-RED BEAM REMOTE CONTROL SWITCH KIT



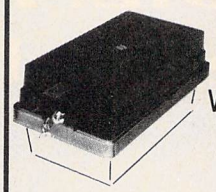
This Infra-red Control switch can be used to control appliances on/off up to 500 watts.

Has effective control up to 30 feet. No antenna needed. Kit comes with transmitter and receiver unit, case and all components.

Easy to build!

MODEL TK-41 KIT ..... $19.95 ea.

DISK BOX



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DISK BOX with Lock Holds 100 Disks.....14.95
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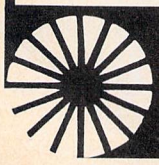

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CIRCLE 112 ON FREE INFORMATION CARD

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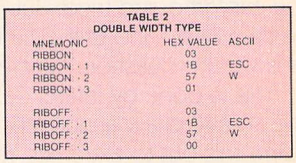

TABLE 2
DOUBLE WIDTH TYPE

MNEMONIC	HEX VALUE	ASCII
RIBBON	03	
RIBBON · 1	1B	ESC
RIBBON · 2	57	W
RIBBON · 3	01	
RIBOFF	03	
RIBOFF · 1	1B	ESC
RIBOFF · 2	57	W
RIBOFF · 3	00	

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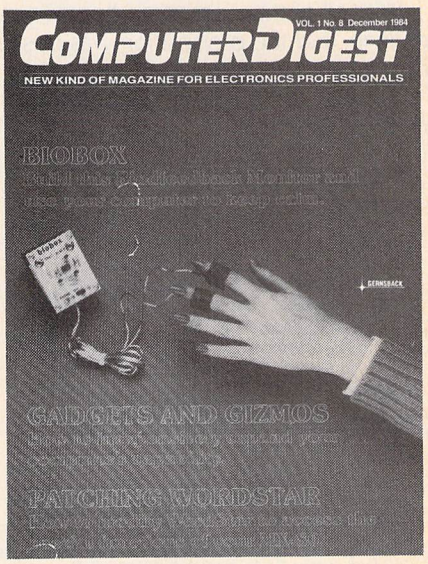
ON THE COVER

While we're not making any medical claims, biofeedback monitoring seems to help lots of people attain calm. By computerizing the results, you can keep a constant check on how well you're doing. **See page 11.**



EDITORIAL

Platonic dialectic and the computer

■The next generation of computers will have the ability to reason.

Don't expect anything particularly massive at first, for principals have to be explored and tried. But if you tell tomorrow's computer that "All fish live in the water," and that "The trout is a fish," the computer will be able to answer the question "Where do trout live?" by saying "in the water."

This is done by inference. The new generation of computers will indeed be able to draw an inference from information it is supplied, and if you carry this out to extremes, massive changes can be expected.

For one thing, today's modern, up-to-the-minute computer will be archaic by comparison. Just as we now compare masses of memory from one computer to another, we will, in the future, be comparing levels of inference. There isn't the least doubt that tomorrow's computers will have the ability to solve, by inference, more and more complex equations. And the more-complex the equation, the better the computer. Another parameter—inference level—will be added to the vast store of requirements that we compare when purchasing a new computer system.

If you stop and think about it for a moment, the applications for inference are legion. In business, in science, why there's hardly an area where sound, logical reasoning can't make a viable, important contribution. Give such a computer the basic elements of a story plot and let it go to work, and it can spit out a 50,000 word novel in the twinkling of an eye! A physician can feed in a series of symptoms, and the computer can make one or more possible diagnoses. "What if" considerations take on a whole new meaning.

According to a recent news story in the New York Times, the reality of this is almost upon us, and is the goal of the 1990's.

With all of this, I am reminded of a class in Basic Philosophy that I took in college, and the proposition was posed as follows: "All fish swim. Some men swim."

What was the logical conclusion? Of course (incorrectly) it's... "Some men are fish."

Byron G. Wels

Byron G. Wels
Editor

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LETTERS

More and better

I wanted to cast a positive vote for your magazine, which I enjoy very much. I'd like to see more space devoted to it each month. How soon will ComputerDigest become a "stand-alone" magazine?—Mark Matson, San Bernardino, CA.

We're really trying Mark, but unless we get sufficient advertising support to warrant standing alone, it might be some time! The reader response has been absolutely wonderful however.

Same authors?

I've noticed that—for the most part—you use the same authors much of the time. I don't quibble about it, for the articles are superlative. I was just wondering.—Frank Sutton, Wilmington, Del.

If you start recognising some of the names, rest assured that it's only because they're good—and prolific.

Reads editorials

I don't know how other people read your magazine, I suppose that they always begin with articles that catch their fancy first, then go on to others. Me? I read editorials. Your last one, about the future being here today, really struck home. I'm now hard at work on that project, and will have a submission for you shortly. I'm anxious to see what others come up with, too.—Martin Friedkin, Kalamazoo, MI.

Thanks Martin, we're anxious to see what you come up with!

More info

I'm relatively new to computing and saw your magazine at a friend's home. I don't actually own a computer myself as yet, and was wondering if you could provide me with some information on what to buy?—Charles Horst, Bloomfield, NJ

Charley, that's a tough one. But you're doing the right thing. Read ComputerDigest and ask around. You can't fill yourself with too much information!

Loaded question

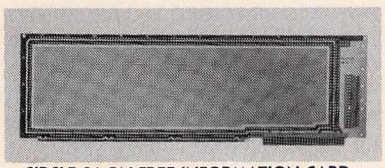
Here's a loaded question for you. My young son is getting deeply involved with computers at school, and I assume that this is good. But how do I keep up with him? He asks questions now that I just can't answer!—Fred Steen, Detroit, MI.

Fred, try an adult education course in computers. You'll catch up, and who knows? Might even develop a brand-new interest for yourself!

COMPUTER PRODUCTS

For more details use the free information card inside the back cover

PROTOTYPING CIRCUIT BOARD, model *4613-3,* allows use of both wire-wrap and solder interconnections to speed interface design for IBM *PC* or *XT* microcomputers. The model *4613-3* has power and ground buses surrounding the component area on both sides of the board. Plated-through holes, on 0.1-inch centers, mount up to 91 16-pin DIP'S.



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Form and plug-compatible with IBM cards, the board may be installed in any expansion slot in the IBM *PC* or *XT.* A 31/62-contact card-edge connector with nickel-gold-plated fingers mates with the IBM system bus. The contacts are chamfered at 45 degrees for easy insertion. The board also has a dedicated area, predrilled to mount 9-, 15-, 25-, or 37-pin miniature connectors for external input/output. A connector-mounting bracket, with cutouts for all four connector sizes, relieves strain on the connector pins.

The model *4613-3* is priced at $40.28. It comes with complete instructions, including IBM bus signal conventions.—**Vector Electronic Company,** 12460 Gladstone Avenue, Sylmar, CA 91342.

MICROCOMPUTERS, Morrow Inc.'s model *MD1E* and model *MD3E* are economy-model business/personal computers aimed at users whose primary application needs are for word-processing software.

The model *MD1E* features one double-sided, double density 5.25-inch disk drive and *NewWord* word-processing software. The model *MD3E* features two double-sided, double-

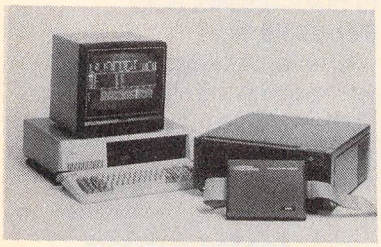
CIRCLE 22 ON FREE INFORMATION CARD

density 5.25-inch disk drives, *NewWord* word-processing software, and the *Correct-It* spelling checker. Both systems come with a full-featured terminal and detachable keyboard.

The model *MD1E* is priced at $999.00; the model *MD3E* costs

$1499.00.—**Morrow, Inc.,** 600 McCormick Street, San Leandro, CA 94577.

EMULATOR PORT, the Kontron PC Interface *KPCI,* turns the IBM *PC/XT* into a universal development system for the design, test, debugging, and implementation of hardware and software for most microprocessor devices. The *KPCI* package consists of hardware and a set of software tools, including a cross-assembler, linker, emulator software, and additional CP/M utilities. For operation, the *KPCI* requires an IBM PC/XT with monitor and DOS. A Kontron emulator subsystem and Pascal compiler are optional.



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The *KPCI* is priced at $1500.00.—**Kontron Electronics,** 630 Price Avenue, Redwood City, CA 94063.

COLOR-DISPLAY MONITOR, model *SC-100,* is a 13-inch CRT monitor with 90° inline, 0.65-mm dot pitch, and an audio speaker with earphone jack. The model *SC-100* is compatible with Apple *II,* Apple *IIe,* Atari *800,* Commodore *64,* VIC*20,* IBM, PCjr., TI*99,* and many others.

The model *SC-100* has a resolution of 280 lines horizontal and 300 lines vertical; display format of 1000 characters (5 × 7 dots, 40 × 25), and many other features. It generates 16 different colors. The sound is from a one-watt amplifier coupled to an internal mini speaker.

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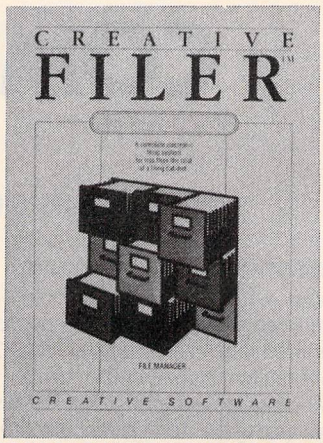
The model *SC-100* is $329.00.—**Sakata USA Corporation,** 651 Bonnie Lane, Elk Grove Village, IL 60007.

SOFTWARE SERIES, *Creative Writer, Creative Filer,* and *Creative Calc* are designed for use with IBM, Apple, and Commodore *64* home computers.

Creative Writer has all the standard word-processing functions. Documents can be composed, edited, saved, retrieved, and printed. The program is especially slanted for composing memos, letters, and reports that can be detailed by using data obtained from *Creative Filer* and *Creative Calc.*

Creative Filer is an electronic filing system that simplifies data management. Consumers can create computerized index cards on the screen in any format and then add, modify, delete, or browse through alpha-numerically stored data. An added feature allows report formats to be created, to which any stored data can be applied.



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Creative Calc is a spreadsheet that simplifies any mathematical process. Numbers are entered and results automatically calculated and displayed on the screen. If a number is changed, *Creative Calc* changes all other related figures to fit the new format. It can be used to summarize and analyze household expenses, plan investments, and play "what-if" with various tax options.

The three programs are priced at $49.95 each.—**Creative Software,** 230 East Caribbean Drive, Sunnyvale, CA 94089.

Don't Miss This Surplus Buy Of The Year!!

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- Full ASCII Char. Set
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GIZMOS

Here's a look at cheap gizmos and expensive gadgets for extra computer power.

HERB FRIEDMAN

■With few exceptions, most of the low-cost personal computers are designed to marry the user to the manufacturer through unusual interfacing, or by providing odd-ball features that can be secured only by using the manufacturer's own peripherals and accessories. While the computer might be jam-packed with programming features such as extended BASIC, graphics, color and sound, getting the end product out of the computer is often difficult if you don't use the manufacturers own peripherals—which are usually overpriced for what you get.

An IBM PC, on the other hand, is possibly the most expensive personal computer system. The basic package consists of the keyboard, 64K of RAM and a cassette I/O—you must add expensive plug-in interfaces and a monitor just to get a visual display. The price of an IBM soars from about $1350 (for the basic package) to well over $3000 if you include disk drives.

But regardless what kind of computer you have, if it's a popular brand such as the Atari, Commodore, Radio Shack or IBM, or almost any IBM-compatible, you can usually do things at much less expense by using the gizmos and gadgets available from what are called *aftermarket* or *third party* vendors. Keep in mind, however, that accessories from aftermarket vendors might not provide all or similar features to those of the manufacturer's own hardware.

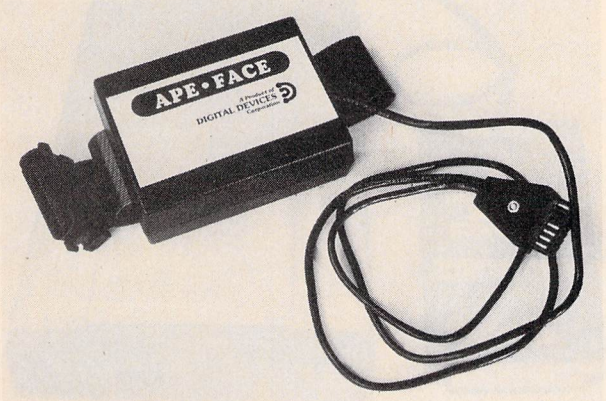
Adapters

One of the best-known Commodore serial-to-parallel adapters is the *The Connection* (Micro Ware, 1342 Rt. 23, Butler, NJ 07405). It is priced well under $100. Connected between the computer and the printer, it converts the non-RS-232 serial output of the Commodore 64 and VIC-20 computers to standard Centronics parallel, which permits you to print the ASCII character set on any daisy, matrix, or ink-jet printer that has a Centronics-type input. If the special graphics are important to you, check with the manufacturer of the adapter because they often have specific models for emulating the Commodore graphics.

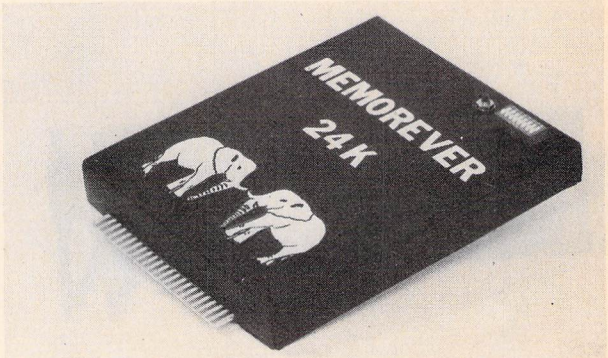
A similar adapter called the *Ape Face*, (Digital Devices Corp., Suite 127, 151 Sixth St., Atlanta, GA 30313) is available for Atari computers. Again, it converts the non-standard Atari printer output to standard Centronics.

It's a different story if you plan on using one of the

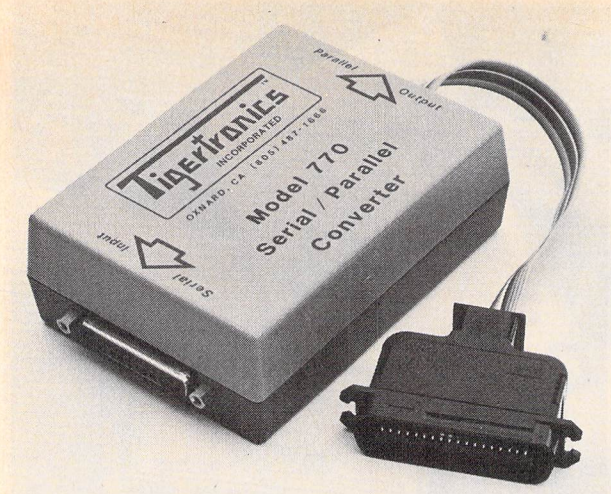
THE CONNECTION, FROM MICROWORLD, connects the RS-232 serial output of the Commodore 64 or the VIC-20 to standard Centronics parallel so you can print standard ASCII on any Centronics-input printer.



APE FACE from Digital Devices Corp., converts a non-standard Atari printer output to standard Centronics.



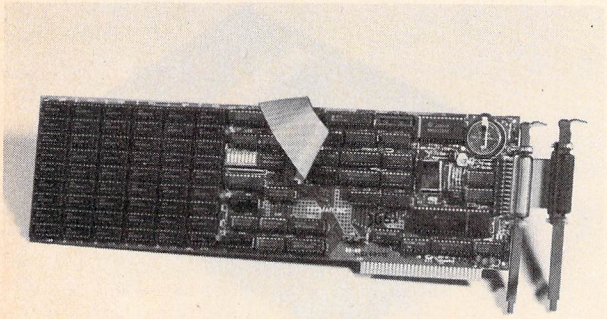
24K MEMORY EXPANSION for the VIC-20 with a built-in lithium battery to keep the memory non-volatile is available from Memotron.



TIGERTRONICS MODEL 770 plugs into the Color Computer's serial input/output and converts serial data to a Centronics-type output.

low-cost parallel printers with a CoCo: They won't work together without some form of accessory RS-232-to-parallel conversion interface. Again, several well-under-$100 RS-232 serial-to-parallel adapters such as the *Tigertronics Model 770* (Tigertronics, Inc., 1501 Pine St., Oxnard, CA 93030) are available. They plug into the CoCo's serial I/O—which is also the printer port—and convert the serial data to a Centronics-type output for parallel printers. None of the Color Computer printing adapters we know of will make the necessary conversions for emulating the Radio Shack printer graphics. If you need Color-Computer graphics you must use the appropriate Radio Shack printer. Connecting a printer to an IBM-compatible computer is normally expensive because a plug-in board with a serial or parallel printer output is required: A printer output port is not part of the basic computer configuration. However, several multi-function plug-in boards are available which include both parallel and serial I/O.

For example, if you're upgrading the memory in an IBM-compatible you might want to consider using a board such as the Tecmar *CAPTAIN* (Tecmar, Inc., 6225 Cochran Rd., Solon, OH 44139-3377), which provides both a memory upgrade and both serial and parallel ports. If you start adding up the cost of the memory expansion and I/O of an aftermarket board you'll probably find the total is several hundred dollars less than if you purchased the individual IBM modules, even though the cost of the multi-function board is somewhere in the range of $225-$350.



THE CAPTAIN from Tecmar provides a memory upgrade and both serial and parallel ports.

Modems

In order to access a database through the dial-up telephone system you need a modem between the computer and the telephone system. Unfortunately, most of the home/family/small-business computers don't have a standard RS-232 I/O, so it's extremely difficult to connect a standard modem. While most manufacturers sell a proprietary modem for their computer, if you want to enjoy the convenience features of the more common high-performance models—such as the auto-dialing and auto-answer of the Hayes Smartmodem—it can't usually be done unless you connect some kind of interface that provides an RS-232 I/O for the computer. It doesn't make any difference whether the interface matches the TTL logic of the user port (where the game cartridges are plugged in) or the special disk-drive serial port as long as the end product is a standard RS-232 I/O that supports all the "bells and whistles" of RS-232 accessories. Just such a device is the *VIC20/C64 RS-232 Interface* (Omnitronix, Box 12309, Seattle, WA 98111), which plugs into a VIC-20 or Commodore 64's TTL user port and provides an RS-232 I/O that supports pins 2 through 8, 20 and 22...all independent of the others.

If you're interested in writing your own applications programs on a Color Computer, consider using a *mouse* to control the screen functions. Formerly available only for the most expensive personal computers such as Apple's Lisa and the IBM-compatibles, a *mouse* can now be used with a CoCo by simply plugging it in and loading a control program.

While we normally tend to associate memory upgrades with the expensive IBM-compatible computers, they are also available for the least-expensive computers, in particular, the Commodore VIC-20 and the Commodore 64.

The basic VIC-20 comes with only 5K of RAM, which can't do very much unless you're experienced at

THE VIC20/C64 RS-232 interface from Omnitronix plugs into a TTL user port and provides true RS-232 I/O.

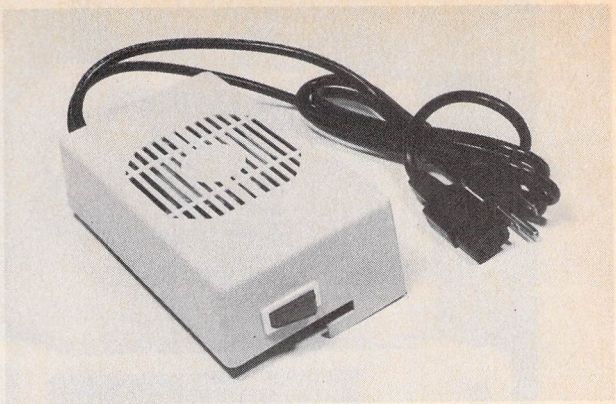
writing very tight code. Commodore's own memory upgrades are expensive; aftermarket memory enhancements are often a better value, or, sometimes, something special. For example, Memotron (Box 714, McPherson, KS 67460) sells a *non-volatile* 24K memory expansion for the VIC-20. A built-in lithium battery keeps your program or data "live" after the computer's power is turned off. If you have already partially upgraded your VIC-20's RAM, say with an additional 8K, you can utilize a RAMAX Jr. (Apropos Technology, 1071 Avenida Acaso, Camarillo, CA 93010) plug-in memory expansion board that brings the total memory up to 32K. One of the best accessories for low-cost computers is often nothing more than a cooling fan, usually mounted on the outside of the cabinet. Almost without exception, even on the hottest of summer days, the openings in a computer's cabinet provide a sufficient air flow to keep the internal ambient temperature within safe limits. But the internal temperature can increase sharply when the computer is upgraded with extra internal memory, printer drivers and other accessories not originally provided in the basic purchase, and the "extra" heat can be no end of problems: intermittent memory failures and disk errors, blown fuses, etc. Accessory cooling fans and blowers are available for just about all computers which lend themselves to user-installed upgrades. For example, there is no end to the number and kinds of cooling fans for the Apple II computers. Most are similar to the unit from Jameco Electronics (1355 Shoreway Rd., Belmont, Ca 94002), which fits on the outside of the Apple's cabinet.

Regardless of what kind of computer you have, if it didn't come with an integral fan, an add-on might prove to be the best investment you can make. If nothing else, on a muggy, soggy day it moves the air around inside the cabinet and keeps moisture from settling out on the components and on the sockets.

Higher prices

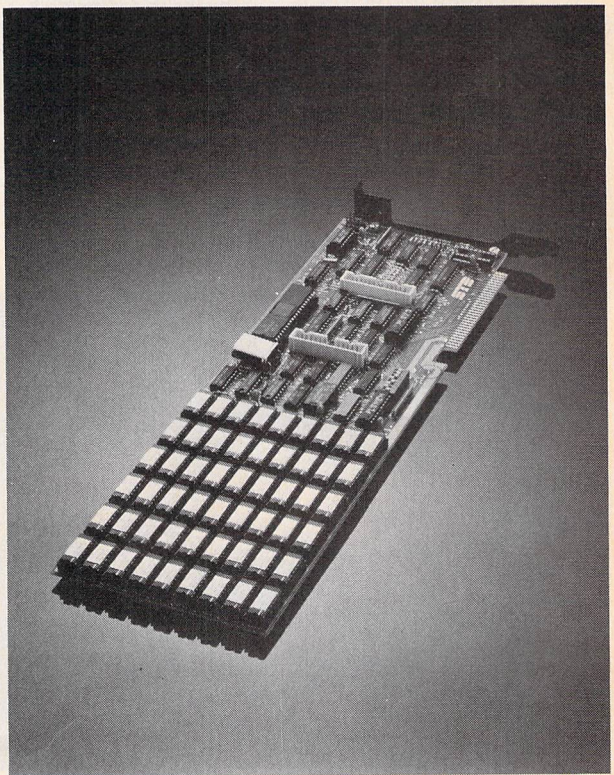
Moving along to the very high-priced gadgets brings us to accessories designed for IBM-compatible computers. Just about any accessory you can think of is

IF YOU UPGRADED your VIC-20's RAM with an additional 8K, add a Ramax Jr. from Apropos Technology, and up it to 32K.

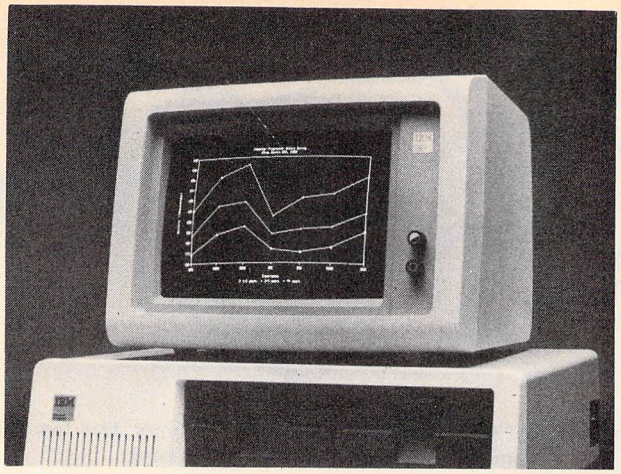


FITTING OUTSIDE the Apple's cabinet, this fan unit from Jameco helps keep things nice and cool.

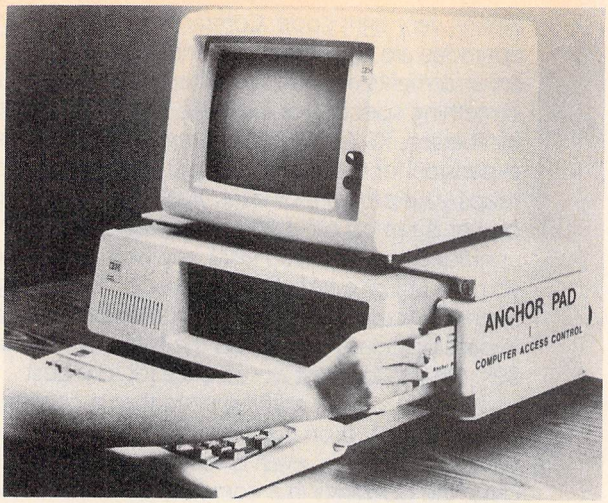
made available by aftermarket vendors; and if what you want isn't available today, wait until tomorrow. Leading the list of IBM-compatible accessories are the *memory upgrades*, which are often combined with some other necessary features generally sold as a separate plug-in module. For example, the *RIO PLUS* board (STB Systems, Inc., 601 North Glenville, Suite 125, Richardson, TX 75081) can be loaded with 64K to 348K RAM, has a serial port for a printer or modem, a parallel port, a game port, and a battery operated clock/calendar that remembers the date and time even when the computer is turned off. And if the RIO PLUS doesn't have enough RAM for your needs, you can add a 512K *piggyback* board for a total upgrade of 768K RAM. Or maybe you're into graphics but aren't ready for the



The R10 PLUS from STB SYSTEMS can be loaded with 64K to 348K RAM, boasts a serial port for a printer, a parallel port, a game port, and a battery-operated clock/calendar.



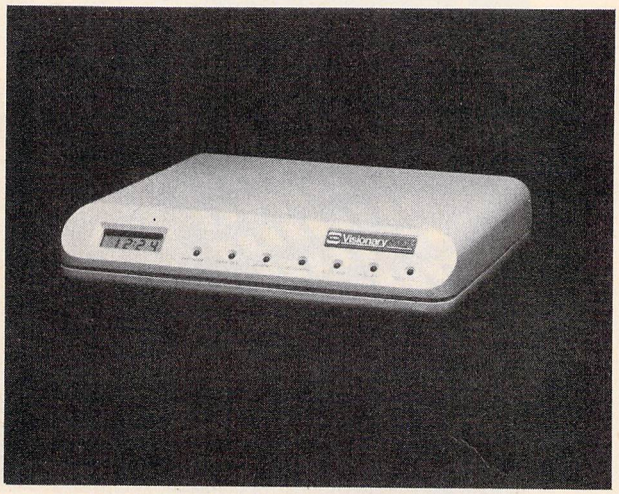
THE HERCULES GRAPHIC CARD from Hercules Computer Technology delivers high-resolution graphics on both monochrome and color monitors.



COMPUTER ACCESS CONTROL from Anchor Pad International uses encoded magnetic cards to restrict access to a computer, display, drive or printer.

extra expense of an RGB color monitor: monochrome would be just fine for your Lotus 1-2-3 graphics. Then look into something called a HERCULES graphic card (Hercules Computer Technology, 2550 Ninth St., Berkely, CA 94710). It delivers high-resolution graphics on both monochrome and color monitors. Many of the RAM upgrade plug-ins can have their memory partitioned to serve as an independent printer spooler, or as a RAMdisk. For those of you unfamiliar with the term, a *RAMdisk* is a block of volatile RAM that emulates a floppy or hard disk, but unlike the mechanically-delayed access of a disk's files, the RAMdisk response is almost instantaneous. As a general rule, the user creates a mirror image of the desired disk data or program in the RAMdisk, which is assigned a drive identifier, such as "M:," "C:," etc. As far as the computer is concerned the RAMdisk is a conventional disk drive that is accessed the same as a mechanical drive, except the response is instantaneous. Most RAM upgrades require a software routine to partition the memory for use as a spooler or RAMdisk.

While we're on the subject of theory, how about a modem such as the *Visionary 1200* (Visionary Electronics, 141 Parker Ave., San Francisco, CA 94118), which has 48K of non-volatile CMOS RAM, its own microprocessor, an internal clock, auto-answer, auto-dial, redial, auto-log on, and data capture. It operates completely independent of the computer. On-board software allows the unit to send and receive messages (data) automatically, even when the host computer is switched off. You can load its memory with data and program the modem to transmit at a specific time, or have the modem turn itself on and receive and store data—which you later load into the computer at your leisure. But whether your computer is a budget special or an IBM-compatible with every imaginable accessory, when you come down to the nitty-gritty, it's the software and data that has the real value.



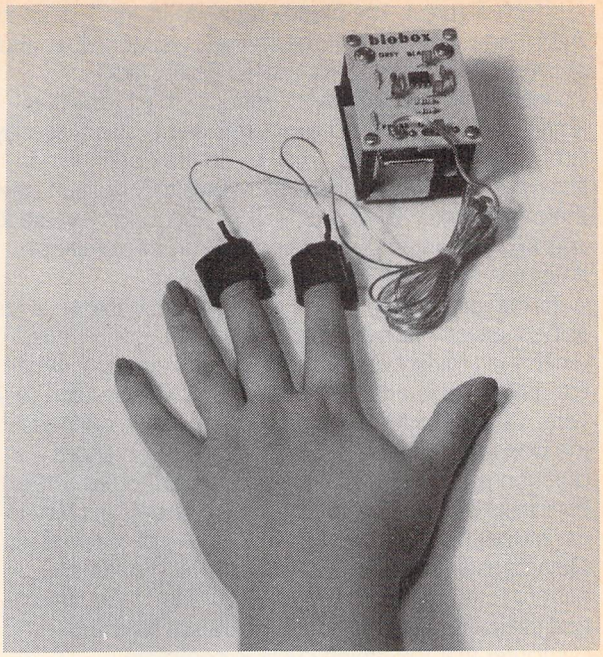
THIS MODEM FROM VISIONARY ELECTRONICS has 48K of non-volatile RAM, its own microprocessor, an internal clock, auto-answer, auto-dial, redial, lots of other goodies.

Protecting the computer

One of the ways to protect individual data and/or restrict general access to a computer is with a device called a Computer Access Control ($100-$300 from Anchor Pad International, Inc., 3224 Thatcher Ave., Marina Del Rey, CA 90291.) It uses either a key or a system of encoded magnetic cards (resembling a credit card) to allow only authorized persons access to a computer, display, disk drive, or printer.

The list of gizmos and gadgets for personal computers is almost endless. We have just touched on a few unusual ones. Between the low-cost accessories for the home and family computers and the *budget-busters* for the IBM-compatibles is just about anything you can imagine. The major difficulty is usually finding where to purchase what you need because the computer stores stock just a fraction of the available accessories—and they are primarily for the most popular computers. But dogged determination will usually uncover exactly the accessory or peripheral you're looking for—though in some instances be prepared to mortgage the old homestead. Except for the gizmos intended for home and family computers, upgrading accessories don't come cheap.

BUILD THE BIO-BOX



You can build this biofeedback monitor for your TRS Model I or Model III.

JIM BARBARELLO

■Biofeedback uses an electric device to monitor certain bodily functions and relays how those functions are changing. As you consciously vary your behaviour (thoughts, mood, etc.) you can immediately see how your efforts are affecting your level of tenseness. With practice, you can learn which variations help you to reduce stress. Knowing this, you can practice conscious control of those emotions.

We're not claiming any medical benefits, but it is accepted that biofeedback can help control everyday minor stress. Practice, and it may be able to help you too.

What we're offering here is a hardware biofeedback interface for your Model I or Model III with associated software that allows you to use the interface and document the results of your trials in a tabular format. The interface (called the BioBox) is simple and inexpensive to build. It monitors the changes in galvanic skin resistance (GSR) between two adjacent fingers on one hand. GSR is a measure of your level of excitation or tenseness. The BioBox is battery powered for safety, requires no modification of the Model I and can be used on the Model III as well. (See the section on "Model III differences.")

The hardware

We'll call the GSR R_{BIO} and measure it with two probes connected to the BioBox. Look at the schematic

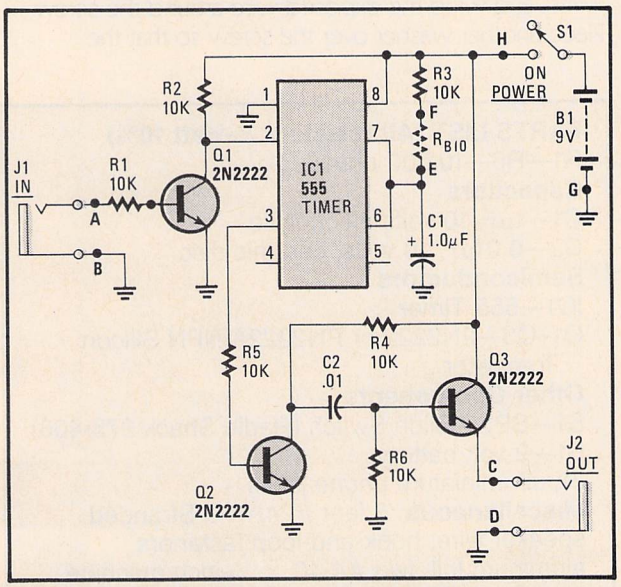


FIG.1—SCHEMATIC DIAGRAM FOR THE BIOBOX shows the relative simplicity of the circuit. The entire unit is built on a printed circuit board.

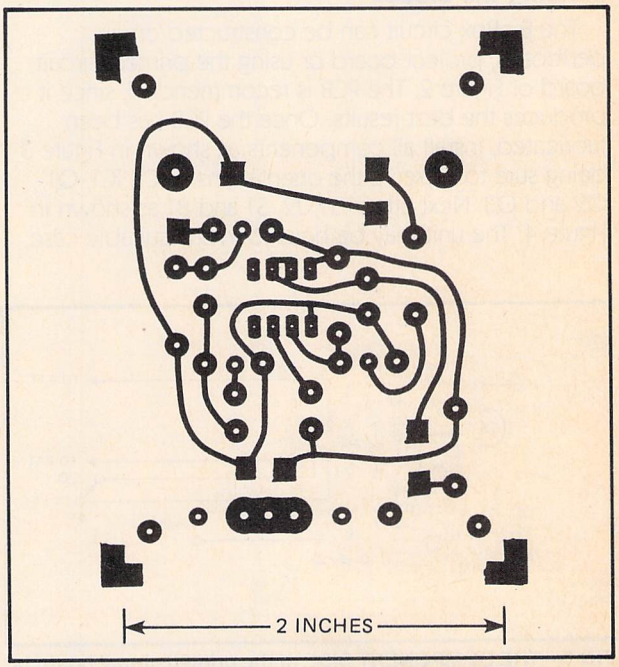


FIG.2—LAYOUT OF THE PRINTED CIRCUIT BOARD is shown full-size for those who want to construct their own.

diagram, Figure 1. The BioBox receives its input from the AUX (large grey) connector on the cassette cable, and provides its output to the cable's EAR (black) connector. Under software control, a short, positive-going pulse is provided to J1. This pulse is inverted by Q1 to trigger IC1 (a 555 timer IC). In the configuration shown, pin 3 of IC1 immediately rises to 9 volts. It stays there for roughly C1 × (R3 + R_{BIO}) seconds (where R3 and R_{BIO} are in megohms, and C1 is in microfarads). After this time, pin 3 returns to zero volt.

At the junction of R4 and Q2's collector, the voltages appear exactly opposite of those at IC1, pin 3. Thus, when the timing cycle starts, C2 sees zero volts. When the timing cycle ends, C2 sees a positive transition to 9 volts. C2 and R6 form a differentiator which converts the positive transition (step) into a positive, short duration pulse. Note that the emitter of Q3 has a 100-ohm resistor connected to it. This resistor is actually in the Model I but forms an electrical part of the BioBox. Q3 acts as an emitter follower, providing sufficient current to the low impedance (100 ohm) load. This positive pulse provided through J2 signals the computer that the timing cycle is complete.

The time between the positive pulse to the BioBox and the positive pulse back to the computer is directly proportional to the values of R3, C1 and R_{BIO}. Since R3 and C1 are constant, any change in duration is a direct result of a change in R_{BIO}. When R_{BIO} decreases, (with increased sweating caused by tension), the duration between pulses is shorter. When R_{BIO} increases (with increased calm), the duration is longer. So the duration is a measure of level of calmness. All we need is a software controller to send out the pulse to the AUX connector and count until it senses a pulse at the EAR connector. The resultant count can then be used in a BASIC program to determine the current level of tension.

Building the BioBox

The BioBox circuit can be constructed on a perfboard, project board or using the printed circuit board of Figure 2. The PCB is recommended, since it produces the best results. Once the PCB has been fabricated, install all components as shown in Figure 3 being sure to observe the orientations of C1, IC1, Q1, Q2 and Q3. Next attach J1, J2, S1 and B1 as shown in Figure 4. The unit may be housed in any suitable case, with the jacks and switch available for use.

The last item to be constructed (and perhaps the most important) is the bioprobe set. It consists of two identical bioprobes which are attached to the index and middle fingers of one hand. Its purpose is to make electrical contact with the skin surface. You will require one package of self-sticking hook-and-loop fasteners, five feet of #24 AWG stranded speaker wire (two-conductor zip cord), two #4-40 ×¼-inch machine screws, two # 4-40 nuts, four #6 washers, a small piece of ordinary aluminum foil and an X-Acto knife. The Velcro comes with two sets of hook-and-loop (*Velcro*) fasteners, each three inches by one inch. To begin, "unzip" about seven inches of the wire and tie a knot at the end of the separation. Now cut a 1-¼-in. × ¾ in. piece of the Velcro loop material. Cut one of the "hook" pieces to 3-in. × ¾in. Using the knife, cut a ⅛-in. square in one of the short ends of each of the pieces just formed (See Figure 5.)

Take a 3-inch × 2-inch piece of aluminum foil and fold it in half, then in half again to form a piece 1-½-in. × 1-inch. Fold each side over ⅛-inch to a final size of ¾-inch × 1-¼-inch. Remove the backing paper from the loop piece of Velcro and place the aluminum foil on the sticky surface so the ⅛-inch folds contact the surface.

On the end of the hook piece where you cut out the square, measure back ½-inch and make a cut in the backing paper only, so that the half-inch piece of backing paper can be removed. Leave the rest of the backing paper intact. Now place the loop piece on the exposed self-stick surface of the hook piece so the ⅛-inch squares align and the aluminum foil is in the middle. (See Figure 6).

Puncture the aluminum foil within the square, but do not remove the aluminum. We only want a hole that will pass a screw Insert a screw through the square so that the screw head rests against the hook piece. Place a single washer over the end of the screw. Strip ¾-inch of insulation from the end of one of the separated wires, and wrap the exposed wire around the screw. Place another washer over the screw so that the

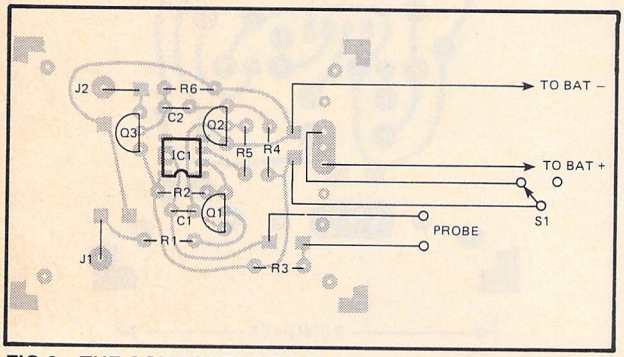


FIG.3—THE COMPONENT SIDE of the printed circuit board is also the panel for the BioBox. Parts placement and locations are shown here.

PARTS LIST (All resistors ¼-watt 10%)
R1—R6—10,000 ohms
Capacitors
C1—1μF, 10 volts electrolytic
C2—0.01μF, 10 volts, ceramic disc
Semiconductors
IC1—555 Timer
Q1–Q3—2N2222 or PN2222A NPN Silicon Transistor
Other Components
S1—SPST Slide Switch (Radio Shack 275-406)
B1—9-volt battery
J1, J2–miniature phone jacks
Miscellaneous: 5 feet #24AWG Stranded speaker wire, hook-and-loop fasteners, aluminum foil, two #4-40 × ¼-inch machine screws, #4-40 hex nuts, 4 #6 flat washers, PC-board, cabinet, etc.

insulation comes right up to the washer. Secure this assembly with one nut, but do not rotate the screw while tightening the nut. The foil makes contact with the screw and we do not want to break this contact.

Remove the remaining backing paper from the hook piece. Continually touch the sticky surface so the oils from your hand render it "unsticky." For a faster removal of the stickiness, simply apply a bit of ordinary talcum powder and rub it in.

Repeat these steps to make another bioprobe exactly like the first. Strip ¼-inch of insulation from the free end of the zip cord. Pass this end through an opening in your case and attach either conductor to either of the two remaining holes in the PCB. Snap a nine-volt battery into place at B1, place S1 to the OFF position and reinstall the circuit in your case.

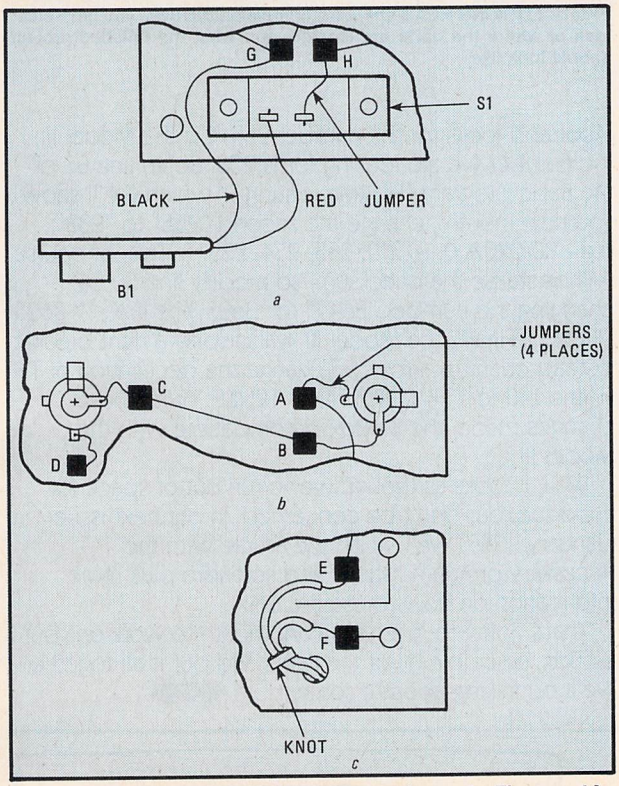


FIG.4—JUMPER REQUIREMENTS are shown in Figures 4A, B, and C. Refer to text for full details and explanations.

The BioBox software

There are two separate elements of software. The first is the machine language subroutine utility. The second is a BASIC program that uses the information provided by the machine language subroutine to perform the biofeedback monitor/human interface.

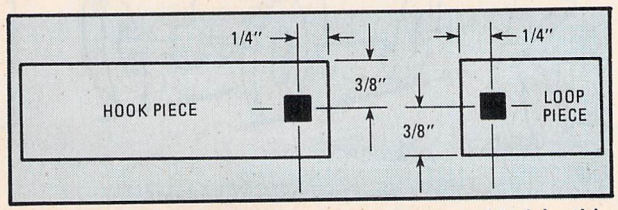


FIG.5—FINGER PROBE dimensions are provided in this drawing. Refer to the text for additional details.

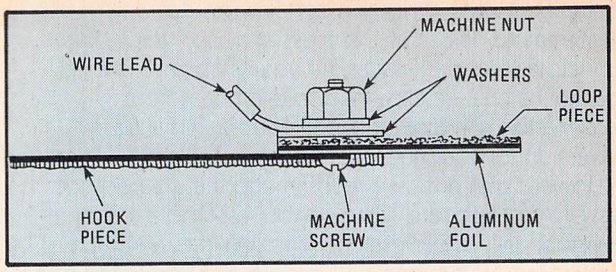


FIG.6.—TO FASTEN, tighten the nut without turning the screw head. Do not tear the foil.

Program Listing shows the machine language subroutine for the Model 1. This subroutine is also contained in DATA values of our BASIC program where, during operation, it will be POKEd into protected memory and called upon via the BASIC USR function. If you're not interested in how it works, you can skip the next section.

Program Listing Table 1 has been ORGed (originated) at 0, since it contains relocatable code and can be placed anywhere in memory. Line 110 disables any interrupt, such as the disk system 25-millisecond real time clock. Lines 120 through 170 send out a positive pulse of sufficient duration to trigger the BioBox.

Next, we initialize our variables. Line 180 sets the DE register pair to 1. This is our counting increment, which will be added to the HL register pair (initialized to zero in line 190). We loop through line 200-240. Each time through, we check to see if a pulse has been sensed from the BioBox. If not, we increment HL and then check to see if it has incremented past FFFFH to 0 (causing a carry). This would occur if the timing cycle took too long, or a fault had occurred. If there has been no carry, we loop back to J1 and continue monitoring.

If a pulse has been sensed, or a carry produced, we proceed to J2 where any interrupts are re-enabled (line 250). Finally, we call the ROM routine at OA9AH to transfer our count to the BASIC program.

Let's review

Chances are that if you're like most people who build projects from magazines such as this, you like to work carefully and slowly, and you should. In this issue, you have been given all of the construction details and some of the rationale behind the BioBox. What you will be getting in the next (January) issue, will be Program Listing II and detailed information on how best to use the BioBox.

Working slowly and carefully, you should be well-able to compelte the construction by the time you receive the next issue of this magazine. However, we suggest that you assemble the parts, put the unit together, and look it over carefully for such things as solder bridges, excess rosin, and other problem-causing trivia. Stranded wires, such as those that connect the probes to the circuit board, have a way of escaping, and an almost-invisible strand can cause trouble later on.

An interesting point

You might find it interesting to note that since the BioBox operates on galvanic change in skin resistance, it

also makes an excellent lie detector, which can be a lot of fun at parties. While we certainly do not recommend its use as a professional polygraph, the principles are identical and if you establish a line of questions that are designed to elicit humorous information, the BioBox can indeed be an amusing diversion for your guests.

Toward that end, we recommend that you do not simply "breadboard" the unit, but assemble it as carefully and as professionally as you can. Making it look more professional will enable it to command more respect and more credibility.

Other applications

As you work with the unit, other applications are bound to occur to you, and are worth consideration. As an example, since the probes measure skin resistance, it is conceivable that a pair of metal prods could be attached to these, the prods implanted in the potting soil of a plant, and you should be able to thereby indicate when the plant needed additional water.

The important value of the BioBox is that it enables you not only to record, but to store the results of any input information, for recall at any time in the future.

It's a computer accessory that is truly limited only by your own imagination, and one that you will put to excellent use many, many times.

Model III differences

In Program Listing 1, line 140 checks the cassette "ear" input and looks for the number 255. On the Model III, the number we are looking for is 233. So, in line 80 of the Basic program (Program Listing 2, which we'll show you next month), change the second "255" to "233" (i.e.- 80 DATA 0, 0, 219, 255, 254, 233...). This, of course will decrease the checksum, so modify line 50 by changing the number "3647" to "3625."(i.e IF K<>3625 THEN...). Finally, the Model III will display a right bracket instead of an up arrow. So change the declaration of T$ in line 140 to T$ = CHR$(94) + "TENSE." With these changes made, the BioBox is compatible with the Model III.

Well, it looks as though we've run out of space for this issue, but don't be concerned. In our next issue (January, 1985) we'll finish the article with the necessary program listings and software plus more information on how to use the unit.

That's going to give you a full month to work on your BioBox, assemble all of the parts and put it all together: We'll be talking about it some more.

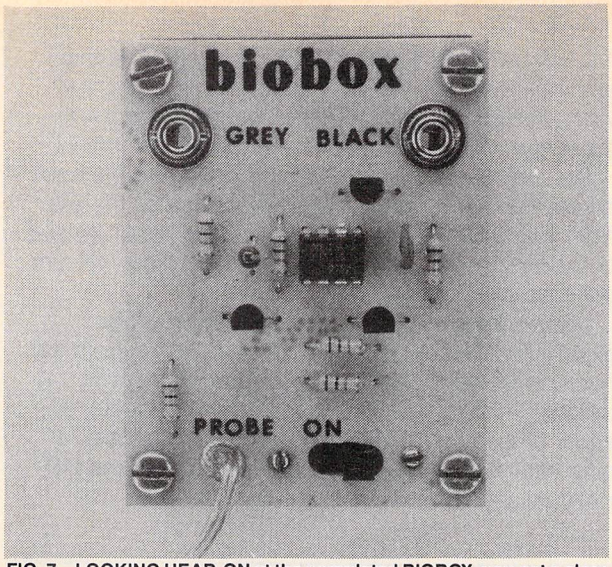
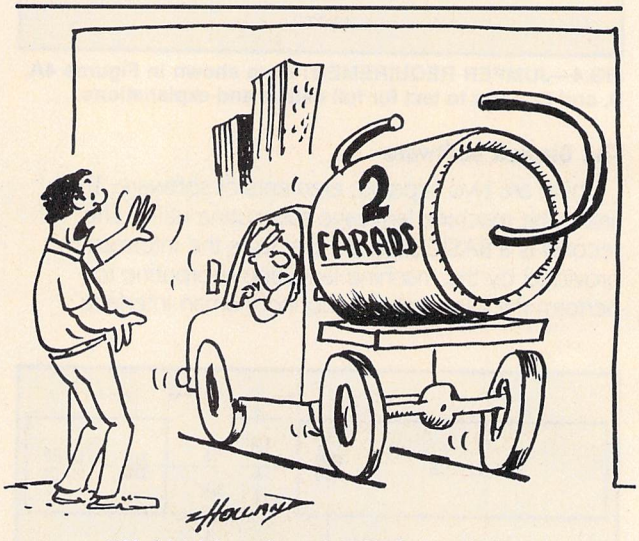


FIG. 7—LOOKING HEAD-ON at the completed BIOBOX, you get a clear idea of where the parts are located, and what the finished project should look like.

PROGRAM LISTING 1

```
                ØØØ1Ø        ;BIOBOX MACHINE
                             LANGUAGE DRIVER
                ØØØ2Ø        ;(REQUIRES BIOBOX
                             HARDWARE).
                ØØØ3Ø        ;VERSION 1.Ø - 19 FEB 1983
BFØ4            ØØØ4Ø        ORG  48900  ;FOR 32K
BFØ4 F3         ØØØ5Ø        DI   ;DISABLE 25 MS
                                  INTERRUPT
BFØ5 3EØ1       ØØØ6Ø        LD   A, 1   ;"AUX" OUT TO
BFØ7 D3FF       ØØØ7Ø        OUT  (255),A ; Ø.8 V D.C.
BFØ9 Ø64Ø       ØØØ8Ø        LD   B,64   ;KEEP IT THERE
BFØB 1ØFE       ØØØ9Ø JMP    DJNZ JMP    ;FOR AWHILE.
BFØD 3EØØ       ØØ1ØØ        LD   A,Ø    ;RETURN "AUX"
                                          OUT
BFØF D3FF       ØØ11Ø        OUT  (255),A ;TO Ø.4 V D.C.
BF11 11Ø1ØØ     ØØ12Ø        LD   DE,1   ;INCREMENTOR
BF14 21ØØØØ     Ø13Ø         LD   HL,Ø   ;COUNT
                                          STORER
BF17 DBFF       ØØ14Ø J1     IN   A, (255);CHECK "EAR"
                                          IN.
BF19 FEFF       ØØ15Ø        CP   255    ;TRIGGER
                                          SENSED?
BF1B 28Ø3       ØØ16Ø        JR   Z, J2  ;IF SO, DONE.
BF1D 19         ØØ17Ø        ADD  HL,DE  ;OTHERWISE,
                                          HL=HL+1
BF1E 3ØF7       ØØ18Ø        JR   NC,J1  ;COUNT<65536
BF2Ø FB         ØØ19Ø J2     EI          ;RE-ENABLE
                                          INTERRUPTS
BF21 C39AØA     ØØ2ØØ        JP   ØA9AH  ;RETURN HL TO
                                          USR VAR.
ØØØØ            ØØ21Ø        END
ØØØØØ TOTAL ERRORS
J1      BF17 ØØ14Ø  ØØ18Ø
J2      BF2Ø ØØ19Ø  ØØ16Ø
JMP     BFØB ØØØ9Ø  ØØØ9Ø
```



"Hold it! I said two MICRO *farads!"*

PATCHING WORDSTAR

You can use the INSTALL program to modify or "patch" Wordstar for use with your Epson MX-80 printer.

KIRK VISTAIN

■I bought the Epson *MX-80* printer because it offered such features as superscripts, subscripts, italic and double-width, features that I really wanted. But these were not even listed as options in the WordStar program. Despite all my efforts, the printer kept ignoring my requests for these.

Now, after a few keystrokes and some concentrated effort, I'm getting what I paid for, and all it took was a little "patching."

An applications program, such as *WordStar*, is made up of many lines of numbers and mnemonics (English-like names for variables, such as DEL1 for Delay 1), called code. When we use a special program to change some of this code, we are said to be "patching."

Fortunately, *WordStar* comes with an INSTALL program. This allows us to easily customize a system. Unfortunately, trying to figure out how to do this from reading the "documentation" is frustrating unless you have a degree in computer science.

Desired modifications

I basically wanted to access five special Epson MX-80 functions from within *WordStar*. According to the printer manual I could enable them with the following ASCII (*A*merican *S*tandard *C*ode for *I*nformation *I*nterchange) characters (See Table 1).

To make things more interesting, we'll find that the ASCII codes used to control the printer must be converted to their hexadecimal (base 16) values before being entered into the patch areas. Don't let this intimidate you. I'll list both ASCII and hex values for all the functions.

Of course, any text fed to the printer is also in ASCII. So how does it know when to interpret the code as text, and when as a command? Well, some ASCII characters are specifically reserved for control. But there aren't enough of those to cover all Epson options.

TABLE 1

FUNCTION	ON	OFF
1. Compressed type	S1	DC2
2. Double Width type	ESC W 1	ESC W 0
3. Italics	ESC 4	ESC 5
4. Superscript	ESC 2 0	ESC H
5. Subscript	ESC S 1	ESC H

So we have to use the escape (ESC) code. Its hexadecimal value is 1B. By prefixing this number at the head of an ASCII command string, we tell the printer to interpret the next character as a command. How does the Epson know when to exit the command mode? We include this information as the first number in the patch. Let's begin.

Making the changes

To begin with, we'll assume that you have a properly installed *WordStar* program for your machine. Make a copy of it using the facilities of your operating system. Never make changes to the distribution disk! You should be running an installed copy, and the original should be filed away. We are now going to alter one of those copies.

Load the *WordStar* INSTALL program. It will ask you whether you want a normal, first-time installation. You answer "NO" and are given four choices. B or C will be the correct answer. You will then be prompted to give the file name of the pre-installed *WordStar* to be modified. This is usually WS.COM. You will then be asked to name the new version.

Something like WSA.COM would do nicely.

You will then see several menus in succession and be asked to designate your terminal type, etc. Since you are modifying an otherwise working program, you should answer "U" which indicates "no change." Continue until you reach the query "Are modifications to *WordStar* now complete?" Answer "No."

This enables the patcher routine. Individual patch locations are identified by a mnemonic followed by a colon. For example, PALT: is the entry point for the alternate type patch. If you don't use a colon, you'll get an error message.

An actual patch consists of a string of numbers. The first one usually designates how many others are to follow. The rest are ASCII or other special codes. Remember that all the numbers are entered in hexadecimal, or base 16 format. Decimal numbers will not be recognized by *WordStar*. See Table 2.

TABLE 2
DOUBLE WIDTH TYPE

MNEMONIC	HEX VALUE	ASCII
RIBBON:	03	
RIBBON:+1	1B	ESC
RIBBON:+2	57	W
RIBBON:+3	01	
RIBOFF:	03	
RIBOFF:+1	1B	ESC
RIBOFF:+2	57	W
RIBOFF:+3	00	

We used the ribbon-change area for double-width type. We won't be needing that function on a dot-matrix printer. The Epson manual, Appendix B, incorrectly lists 61H as the code; 57H is the correct one.

Use of double-width type requires you to adjust line lengths to account for half as many characters horizontally. Also, the double-width command is a toggle, which means that the first invocation turns it on,

TABLE 3
ITALIC TYPE

MNEMONIC	HEX	ASCII
USR1:	02	
USR1:+1	1B	ESC
USR1:+2	34	4
ROLUP:	02	
ROLUP:+1	1B	ESC
ROLUP:+2	35	5
ROLDOW:	02	
ROLDOW:+1	1B	ESC
ROLDOW:+2	35	5

the second off. This is unlike some other features which require different commands for on and off. (Table 3.)

Now a ^PQ will turn on italics and either a ^PT or ^PV will turn it off. Although you might have thought we would use the ROLUP and ROLDOW patches for scripting, since they correspond to *WordStar* commands for these functions, it doesn't work.

Subscripts and superscripts

Scripting on the Epson is done with a special type font. This font is enabled with an "ESC S n" string where "n" determines whether a "sub" or "super" is printed. If "n" is "0" printing occurs at the top of the line. If non-zero, printing occurs at the bottom. An "ESC H" turns either off. See Table 4.

TABLE 4

MNEMONIC	HEX	ASCII
USR2:	03	
USR2:+1	1B	ESC
USR2:+2	53	S
USR2:+3	01	
USR3:	03	
USR3:+1	1B	ESC
USR3:+2	53	S
USR3:+3	00	
USR4:	02	
USR4:+1	1B	ESC
USR4:+2	48	H

Compressed type

Our next change will be to the alternate type patch area, called PALT:, where we'll install the compressed type option. On the Epson MX-80, an ASCII SI (Shift In) enables compression and DC2 (Device Control 2) shuts it off. The patch in Table 5 will accomplish this.

TABLE 5

MNEMONIC	HEX	ASCII
PALT:	01	
PALT:+1	0F	SI
PSTD:	01	
PSTD:+1	12	DC2

Also, this is the only patch for which we don't use the escape code. When the MX-80 gets the Shift In (SI) command, it starts to print in italics. The Device Control 2 (DC2) code shuts italics off.

I forgot to initialize the printer before each test run. Functions set in one test would remain in the printer's memory and interfere with the next printing run in unpredictable ways. I needed to turn the printer off and back on again, which would have reset all functions.

Fortunately, there is a way to do this automatically. We patch the printer initialization area, which sends out a code to reset all special functions and TOF (Top Of Form), at the beginning of any printing run. It also sets the printhead to the left margin of the paper. It's just as if you'd turned the printer power off and then on again, but it's done in the software. Refer to Table 6.

TABLE 6

MNEMONIC	HEX	ASCII
PSINIT:	05	
PSINIT:+1	1B	ESC
PSINIT:+2	40	
PSINIT:+3	1B	ESC
PSINIT:+4	4F	O
PSINIT:+5	0D	CR

New *WordStar* printer commands

Now that we've modified WordStar, we need to use the following codes, some of which are different from those for which *WordStar* is initially set. All of the commands in Table 7 are accessed from the *WordStar* printing menu, so must be preceeded by ^P.

TABLE 7

COMPRESSED TYPE	A
STANDARD TYPE	N
DOUBLE-WIDTH TOGGLE	Y
ITALIC ON	Q
ITALIC OFF	T or V
SUPERSCRIPT ON	E
SUBSCRIPT ON	W
SUB/SUP/DOUBLE OFF	R

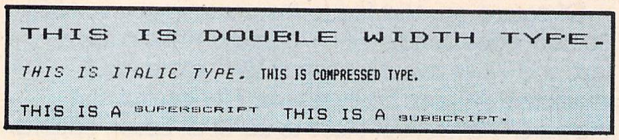


FIG.1—WHEN YOU COMPLETE the patching job, you'll find that your Epson MX-80 printer and the *WordStar* program can provide even more printing versatility.

See Figure 1 for samples of the results.

These modifications to WordStar ought to help you get the most from its partnership with the versatile Epson MX-80 printer. There are even more patches which can help you customize *WordStar* to match your own needs. But that's another story.◀●▶