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March 1985

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Note: Our system comes with the famous Phoenix Bios, currently used by several major computer manufacturers who claim excellent IBM compatibility.

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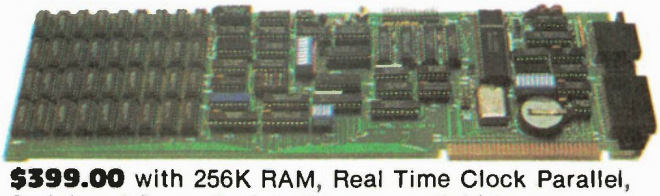

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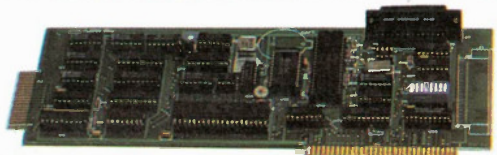

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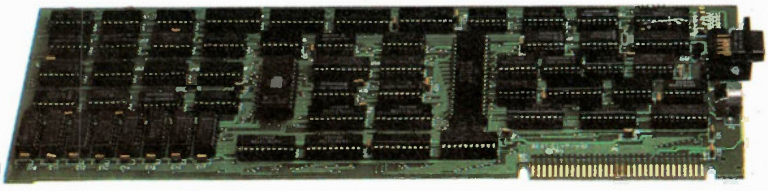

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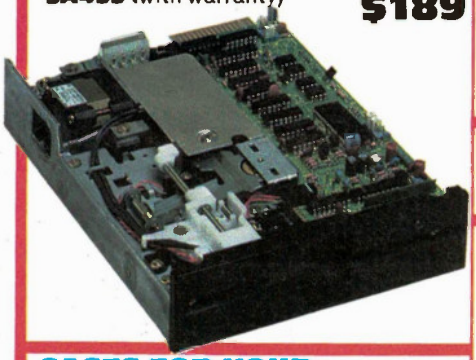

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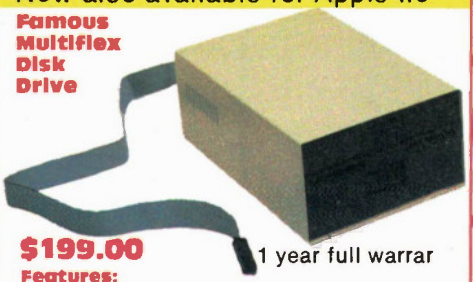

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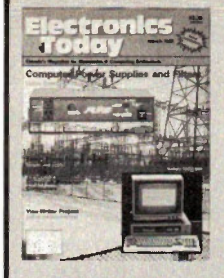

Our Cover

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Electronics Today

March 1985

Vol. 9 No. 3

Canada's Magazine for Electronics & Computing Enthusiasts

Sanyo Review, p.42

Power Supplies, p.11

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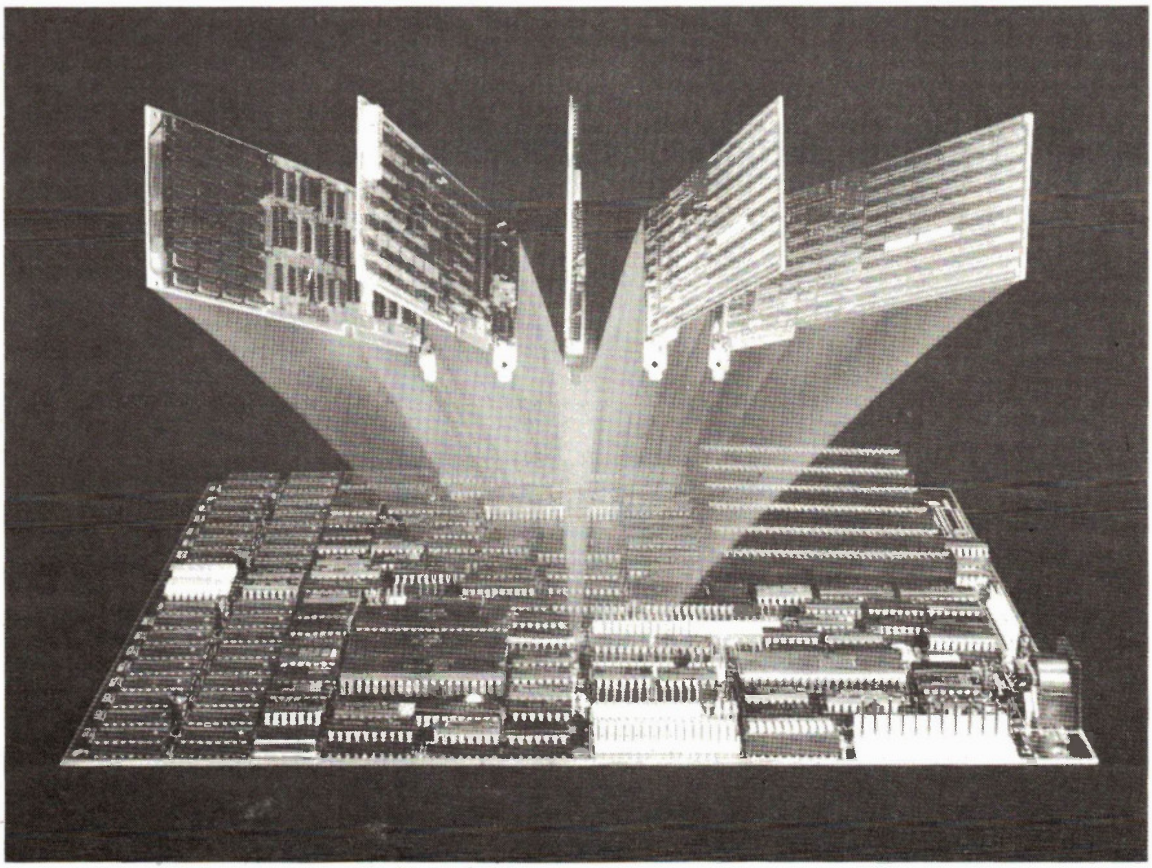
First Look At The ACS 1000



A new IBM-compatible mother-board from a Canadian firm, with high speed, up to 1 MB of memory and many built-in features.

By Bill Markwick

SOLKAN Research of Surrey, BC, has introduced an IBM-compatible board that should prove to be an industry leader. Assembling your own computer can now consist of nothing more than fastening the motherboard into a case along with disk drives and a power supply. The board lists at $799 and provides you with just about everything necessary.

Basic Features

The printed circuit is on an 8 1/2 x 12 inch board which holds, among other things, an 8088-2 high-speed CPU. It can run at either the standard frequency of 4.77 MHz or the high performance speed of 8 MHz. A socket is provided for an optional 8087 coprocessor for high-speed arithmetic calculations.

The 1000 is normally fitted with 128K of RAM; space is provided for up to 256K if you use 64K chips, or 1 megabyte if you use 256K chips. There's also 32K of user-definable ROM.

A real-time clock is implemented with an SAF3019 chip which gives a time-of-day display as well as a calendar function.

Six IBM-compatible slots are installed for adding optional equipment. These should be more than adequate, because most of the functions you'd use them for are installed on the motherboard anyway.

The floppy disk controller is based on the Intel 8272 IC and can handle up to four drives. It resides on the board itself rather than in one of the slots. Also included is a SASI-compatible hard disk interface, also part of the main board.

I/O

To get signals in and out of the board, there's the expected IBM-type keyboard connector plus two serial ports and one parallel port. The serials can be assigned port numbers 1 to 4 by jumpering, and one of the ports can be jumpered to either TTL or RS232 standards. The parallel port is Centronics-compatible for use with a printer or other parallel device.

A modem interface is fitted near the expansion slots, making it easy to add a modem for telecommunications; again, it isn't necessary to use expansion slots for this.

The power connector is the PC/XT 12-pin type, making power supply installation a simple add-on. Finally, there's a reset button that's missing from the IBM; this reboots the computer in case of software problems.

BIOS

The ACS 1000 BIOS, the Basic-In-Out-System that manages the commands from the disk operating system, is fitted into the ROM space and takes up 8K, leaving 56K of available space for user-defined ROM. Its biggest selling point is that it is said to be completely compatible with any software written for the IBM PC, XT, AT or compatibles. It supports a variety of disk operating systems: PC DOS, MS DOS, CP/M 86, and Concurrent DOS. Complete compatibility is one of the most desirable features of any work-alike, and a spokesman for Solkan Research stressed that the ACS 1000 will run absolutely anything written for the IBM, including the Microsfot Flight Simulator.

Graphics Controller

Another product from Solkan is the GraphAx 2020 High Resolution Graphics Controller for the PC/XT and compatibles. It has five planes, 32 colours, four 512-colour palette maps, 40 MHz bandwidth, and 640K bytes of memory. The display resolution of 1280 x 800 pixels can be software-switched to 1200 x 900 for those converting medium-resolution PC/XT software to high-resolution. The 2020 takes up no memory space on the motherboard and is said to be one of the fastest drawing controllers in its class.

Lastly

Solkan Research has begun manufacturing the ACS 1000 in Canada, something that would be a breakthrough for the Canadian high-tech industry. The 1000 is billed as a single-board computer that really is a single board; it seems to be a comprehensive collection of all the best features of compatibles on one PCB.

Electronics Today hopes to have an ACS 1000 for a proper review as soon as their production permits. Then we can take a closer look at what promises to be a remarkable piece of hardware. In the meantime, further information can be obtained from Solkan Research, 9274-194th St., Surrey, BC V3T 4W2, (604) 888-3999 or 888-2606. ■

Hitachi, Ltd., has developed a group of new thin film alloys which have the unique property that their color can be reversibly changed between two colors by heating them to different temperatures.

The new alloys consist of two or three basic metals such as cooper, silver, zinc and aluminum. For example, the color of a silver-zinc alloy changes from silver to pink when heated to higher than 300°C and then rapidly cooled to room temperature. When it is heated again, this time to the temperature range of 100 to 300°C, the color changes back to silver.

By using this characteristic, digital "1" or "0," information can be recorded on a disk coated with the thin film alloy. A laser diode can be used for heating. The laser beam is focused on a very small spot of the disk and digital information is recorded by controlling the temperature of the spot.

Commenting on the significance of new alloys, Dr. Osamu Asai, Deputy General Manager of the Hitachi Research Laboratory where the development of the new alloys is being conducted, said, "The new thin film alloys will find applications in many products, especially in erasable optical disk memories."

Xerox Canada Inc., through its 22 retail outlets, will market products of Houston's Compaq Computer Corp. Compaq, founded in 1982, had sales of $110 million in its first full year of operation in 1983, which made it the most successful start-up company in history. With the recent announcement that Xerox will support the IBM PC and compatibles on its Ethernet network, the Compaq computer products have access to network services of file, print, mail and terminal emulation. In addition to Compaq and its own computers, word processors, electronic typewriters and copiers, Xerox Canada Inc. markets Apple, Epson, and Diablo products in all its Xerox Stores.

Remote Control For HERO

The Remote Control is available in three different models, both kit and assembled. Each model 75.43 MHz, 75.67 MHz and 75.87 MHz. This allows HERO I to be very versatile as a classroom instruction aide where students and teachers can both be in control of the Robot. The Remote Accessory provides all the teaching functions of the Robot's hand-held unit which controls all motors and their operation. The Remote also allows the user access to every HERO I keyboard function which includes the ability to enter, check and modify programs and to select operating modes.

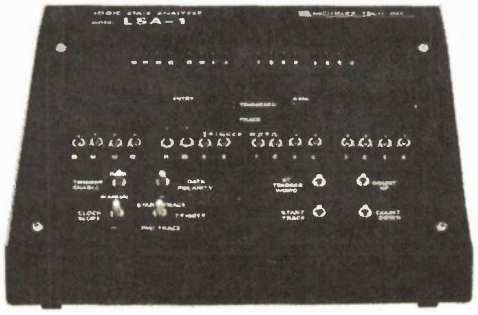
In addition to the control offered by the Remote Accessory, it also features a convenient RS-232C port that operates at 300 baud. By connecting any compatible computer to the Remote, programs can be loaded via radio frequency signals into HERO I from up to 100 feet away.

The Accessory consists of two units. The easily-installed receiver mounts inside the Robot and is made up of an AM superheterodyne type with a microprocessor decoder. It features a low power mode when not in use to conserve battery power. A small omnidirectional wire antenna on the Robot allows reception of commands from the transmitter. The attractively styled remote transmitter has a self-contained 6-volt DC rechargeable battery that provides power for five or more hours of operation. An AC plug-in battery charger is included for the transmitter.

For more information contact: Heath Company, 1020 Islington Ave., Toronto, Ont., M8Z 5Z3.

Circle No.58 on Reader Service Card

Accidentally omitted from our look at logic analyzers in last month's issue was the Multiflex Low-Cost Logic State Analyzer. It allows you to monitor 16 points such as address busses or logic lines. The user can select a bit pattern expected to appear at these points, and the Analyzer will trigger and record the next 1023 bit patterns. For software debugging, it can monitor data flow as the program is executing, including memory read ad write, interrupts, or combinations. Any number of units can be hooked together to expand the capabilites. The Analyzer is available assembled ad tested for $295 from Exceltronix, 319 College St., Toronto, Ont. M5T 1S2, (416) 921-8941.



Circle No.57 on Reader Service Card

continued on page 58

ETI Special Reader Offer

ZX81/TS1000 Products at Genuine 50%-80% Savings!

1. Memotech Memory Expansion

16K Mempak Stackable Add-on Memory: can be used to extend capacity of existing 16K ZX81 or TS1000 to 32K

Originally $99.00 **$49.95**

64K Memopak Originally $200.00 **$99.95**

When we started offering ZX81 some months ago, no one could have predicted the enormous demand. The prices were incredible but the demand more so.

So, what do you when you have a winner? You come up with another. ETI has made special arrangements for the supply to readers of a wide variety of ZX81 and TS1000 software and hardware. But order quickly — many of the originally offered products sold out completely in a short time; we expect the same thing to happen and it is first come, first served.

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$19.95

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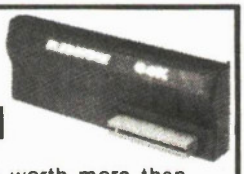
Designed for ZX81/TS1000. 47 keys with proper keycap, legends, full space bar and life estimated at 20 million cycles! Simple plug-in connection.

Originally $145.00 **$59.95**

4. 64K RAM



The ICs alone are worth more than the cost of this complete cased 64K memory expansion (8 x MK 4564). Plugs in directly to ZX81 or TS1000. Expands the Z80A CPU to its addressable maximum.

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5. Software Assortment

Eight software packages (our choice) of games utilities, etc. Works out at less than $4.00 each!

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6. Speech Pak $99.95

Let your ZX81/TS1000 do the talking! Synthesizes all the letters of the alphabet, numbers to a million plus many complete words. Operated under keyboard control. Built in speaker with volume control.

7. Health and Fitness

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8. ZX FORTH
Programming language

FORTH is an interactive compiled language with the simplicity of BASIC at ten times the speed. ZX-FORTH is a full implementation, with 250 commands. It works on 16-bit numbers, has some 32 bit routines, includes a 60-page user/programmer manual.

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9. HOME & BUSINESS MANAGEMENT

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Computer Power Supplies and Filters

Do you need failsafe protection for your computer? Does the computer crash for no reason? Uninterruptible supplies and line filters may be your answer.

By Bill Markwick

DATA stored in a computer's memory can represent a fortune in terms of time it took to get it there.Should the power be interrupted for even a fraction of a second, the memory will reset to nothing at all, and even if the file is safe on a disk, there's still the annoyance of having to set things up all over again.

Another prevalent problem is the voltage spike on the power lines. Even though the power itself is not interrupted, the usually fast risetime of the spike can bypass the computer's internal regulator and introduce a weirdness. Sometimes it's a complete crash with or without permanent damage, and sometimes it's a few bytes changed here and there, causing unpredictable results.

The former problem can be solved with an Uninterruptible Power Supply, and the latter responds well to simpler and less expensive power line filters.

Transients

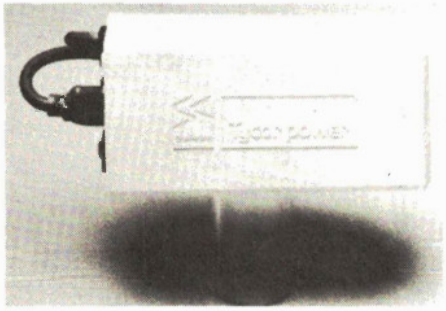
The whole problem arises from the monstrous size of the power company's distribution grid.The great lengths of cables, the switching stations, lightning and the many appliances connected result in anything but "clean" power. Induced voltage spikes can be as short as a nanosecond or as long as several of the 60 Hz cycles. Voltages can vary from just above line voltage to as much as 20,000 volts, though spikes this large will generally be attenuated before they reach the outlet (thank goodness).

The shorter spikes have no noticeable effect on appliances such as lights or motors; their thermal or mechanical inertia doesn't let them change in time. If they get into your computer circuitry, however, the very high speed of today's chips lets them respond to the intruding voltage.

At this stage, you may be tempted to ask why the computer's internal regulator won't do the job. It could, of course, if computers were fitted with proper filtering, but the majority of power supplies are designed to handle only slow variations in line voltage, say, plus-or-minus ten percent. The faster transients can zip over the regulating circuitry. In addition, the transient may appear as "common-mode": it's on both line and neutral and can be measured from these wires to ground. This type of spike ignores regulators.

The 300 PC from American Power Conversion, 89 Cambridge St., Burlington, MA., costs $595 US and will supply up to 300 VA at 115 VAC. Service time is 30 minutes at 60 watts.

The Elgar SPR 201 from Jerome and Francis, 1015 Prospect Ave., Vancouver, BC, can supply 200 VA for 25 minutes and costs $1223 Canadian. A 350 VA model is available.



A Tycor power line filter which removes spikes and oscillatory transients is available in 1, 3, and 5 ampere models from $229 to $489, from Scarsdale Computer, 1 Scarsdale Rd., Don Mills, Ont.

Undervoltage

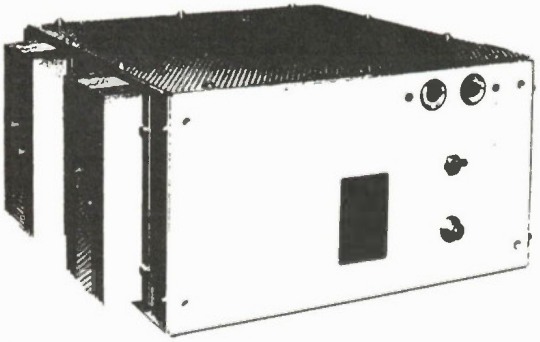
This is loosely defined as power line voltage which falls below 80% of normal; this will usually cause uncertain operation with computers equipped with linear regulators, though most modern micros have switching supplies which operate down to 90 volts. The brownout is rather rare in Canadian power grids; if you should encounter them, a constant-output-voltage transformer can at least give your computer a bit of a head start against falling voltages. This type of transformer does little for removing transients or oscillatory spikes, but a well-shielded unit will remove common-mode noise.

UPS

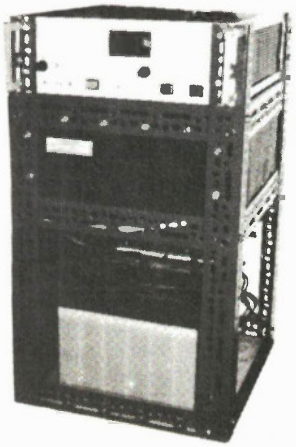
The Uninterruptible Power Supply, or UPS, is the only possible way to deal with total power failures. The usual method of operation is to drive an inverter from the rectified power line which is backed up by a battery; the output of the inverter is nominally 120 VAC at 60 Hz. If the power fails, current is drawn from the battery, eliminating any switchover time. The battery may be a sealed lead-acid type, or even an automotive battery; operating time during a failure naturally varies with the load, but at the very least should give the user time to save everything to a disk.

Needless to say, this is an expensive way to go; these days, the UPS may cost more than the computer it powers. However, there are some situations, such as security, airlines, etc., where a power outage is intolerable; some evidence of the

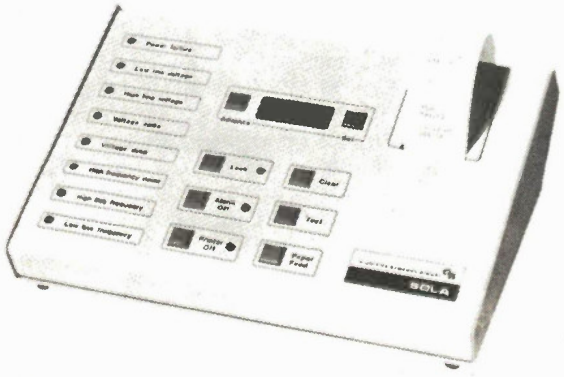
The Micromate power conditioner from Oneac, 1 Rayborn Cres., St. Albert, Alberta is available in ratings from 1.8 to 6.25 amperes; a lamp indicates when the unit is protecting against interference.



A general-purpose sine inverter, the Nova 5060-12 changes 12 VDC into 500 VA at 120 volts for running any type of electronic equipment; $1235 from Interworld Electronics and Computer Ind., 1442 Pemberton Ave., North Vancouver, BC.



A wide range of UPS from 500 VA to 3 KVA is available from KB Electronics, 1289 Marlborough Ct., Unit 12, Oakville, Ont. Typical service time is 30-40 minutes, with custom models up to 4 hours or more.



Besides transformers and UPS units, Sola Electric also make a line of power monitors which can record and print out the type of power problem and the time of occurrence; 377 Evans Ave., Toronto, Ontario.

popularity of the UPS for large users is the fact that the US sales run into the many hundreds of millions of dollars.

Filters

Most micro users are probably willing to take a chance on the non-occurrence of a complete power failure. However, we're all plagued with transients occasionally, and the most economical way to deal with these is the in-line lower line filter. They're usually a small box that plugs into the wall and sports an outlet or two for the computer and peripherals.

Generally, the filters take two basic forms, or a combination of the two. The cheapest way to go is the "clipper" or spike suppressor. These use gadgets such as the thyrector, really a series of back-to-back zener diodes. At some predetermined overvoltage, they break over and begin conducting, absorbing much of the spike. Their advantage is that they are very small and can be built into a power bar, or into the computer itself; their disadvantage is that there's a necessary safety margin to keep them from triggering on normal voltages, and the spike that may be allowed through may wreak some havoc.

The second type is the LC filter, similar to a large audio low-pass. There may be several cascaded stages of chokes and capacitors, giving a substantial attenuation of transverse-mode spikes, i.e., spikes which appear between line and neutral. In some units, common-mode spikes are attenuated as well; for instance, the Tycor filter is said to work equally well in either mode, removing 99% of transients.

Sometimes manufacturers combine both filtering and surge suppressors to give the best of both. Even if a large spike is still large after passing through the chokes, it will be cut down to size when it activates the surge suppression devices.

Static

Don't underestimate the power of static to cause confusion; it rivals the power line transient as a troublemaker. Generally you can quickly tell if static is at fault; the computer goes crazy at the same time that you jump from a static snap. The best cure is a humidifier; some relief is to be had from the conductive mats that sit under your computer or under your chair. These are usually grounded to the power outlet box through a 1 megohm resistor; this drains off the static charge without allowing the fast risetimes that spook your computer.

We stress that the examples and illustrations shown are meant to be representative and are not a comprehensive listing of all equipment available. Your local computer dealer can advise you regarding specific applications. ■

Moorshead Publications

Almost Free Apple DOS Software

While CP/M is a wonderful thing in its own right, the Apple computer can also, and usually does, operate under DOS. For this reason, there's a multitude of programs available for it. Below, we offer a mini-multitude of our own.

The following programs will operate on any Apple][+, //e, //c, or true compatible operating under DOS 3.3. Apple users operating only under ProDOS may have to make alterations to some programs.

Almost Free Apple DOS Software #1

Picture Coder: All Apple HiRes pictures take up 36 sectors in their binary form. This program creates a textfile of a program in memory, squeezing out the zero bytes, that can later be EXECd into memory. The textfile often takes up less room on the disk.

DNA Tutorial: Operating under Integer BASIC, this program might appeal to 'clone' owners. In actuality, though, it's an interactive low-res graphics tutorial of DNA in its inherent forms. And you thought your Apple was only good for games...

Toad: Speaking of games, this program is an Applesoft BASIC implementation of 'Frogger' that can be controlled with either a joystick or the keyboard. The user's high scores are saved to disk.

Function Plotter: A fairly extensive Applesoft BASIC program that takes any inputted function and plots it on the HiRes Screen.

Data Disk Formatter: Apple DOS disks need not be bootable to be useful. This binary program formats a disk without setting DOS on the tracks, conserving useful disk space.

BASIC Trace: A program for the advanced Applesoft programmer, this file, when EXECd, displays the hexadecimal locations of each Applesoft line number of a program in memory.

Gemini Utility: A word processor pre-boot for Gemini printer users, this BASIC program initialises the printer's font or pitch before you boot your word processer.

Payments: This BASIC program allows you to keep track of payments and credits to and from up to 100 accounts on a single disk. A sample account is included.

Databox: A small but useful database program in Applesoft BASIC. Sample files are included to get you started.

Nullspace Invaders: A quick BASIC HiRes game testing coordination and judgement as you manipulate a monolith through mysterious gates.

Almost Free Apple DOS Software #2

Amort: A monthly amortization program that calculates monthly payments to an inputted figure, calculates principle, interest on every balance, and prints out the resulting chart.

Voiceprint: An unusual program that uses the HiRes screen to sample sounds inputted through the cassette jacks at the back of your Apple. Sampling rate and other variables can be controlled, and two sounds may be compared side-by-side.

Calc NOW!: Written in BASIC, this spreadsheet program is somewhat slower than VisiCalc, but still offers the power you expect from a spreadsheet. With sample files.

Cavern Crusader: A mix of BASIC and binary programming, winning this HiRes game is difficult, to say the least. For every wave of aliens shot in the cavern, there's always a meaner bunch in the wings.

Newcout: With source file. This binary program replaces the I/O hooks in the Apple with its own so you can operate your Apple through the HiRes screen. Comes with a character set.

Charset Editor: A utility to help you create your own character sets to use with Newcout.

Calendar: A BASIC utility useful for finding a particular day of any inputted month and year, or for printing out any given year.

LCLODR: With source. This binary utility BLOADs any given file into the 16K language card space at $D000. The source is useful in showing how to use DOS commands through assembly language.

Cristo Rey: An animated HiRes BASIC program showing Cristo Rey by moonlight. For apartment-bound romantics.

ATOT: That's an acronym for 'Applesoft to Text'. EXEC this textfile to produce a textfile of your program.

Applesoft Deflator: This program takes a textfile made by ATOT and squeezes it, replacing PRINT statements with '?' and removing unnecessary spaces from the listing.

Almost Free Apple DOS Software #3

General Ledger: A fairly massive BASIC General Ledger program. This program creates a number of files, so it's best put on a separate disk before implemented.

EE-Design: A shape design aid program written in BASIC. Allows the user to plot shapes in HiRes and either save them to disk or print them out.

Quickzap: A disk sector utility that reads a given track and sector into memory and allows you to alter it, and optionally write it back to disk.

Softgraph: A complete graphing program written in both Applesoft and binary that enables you to see your data done up professionally in pie, line or bar charts.

IntelliCalc: An intelligent calculator with three memories and a 'paper tape' readout. Data may be inserted at any point.

Poker!: An Applesoft BASIC implementation of the game that has ruined many a marriage. Fortunately, you can afford to lose your electronic paycheque to you Apple... for now.

Polar Graphics: Similar in some ways to Function Plotter, this Applesoft program supplies a number of attractive functions in REM statements that you may utilize to plot out on the HiRes screen.

Clock and Clock II: Two Applesoft digital clocks. When your Apple's doing nothing better, it can now remind you of the time you're wasting. One has an alarm function.

Flowers: With source. A binary program that prints a border of flowers to the HiRes screen. The source is invaluable in showing how to handle HiRes shapes in assembly language.

Convert Utility: A BASIC program that converts numbers between decimal, hexadecimal, binary and disk sectors.

ProDOSfix.TXT: Apple clone users who've purchased ProDOS will note that it doesn't work on their machines. This text tutorial explains why, and how to remedy the problem.

Fine Print: The majority of this software has been obtained from on-line public access sources, and is therefore believed to be in the public domain. Any remaining programs were written in-house. The prices of the disks defer the cost of collecting the programs, debugging them, reproducing and mailing them, plus the cost of the media they're supplied on. The software itself is offered without charge.

Moorshead Publications warrants that the software is readable, and if there are any defects in the medium, we will replace it free of charge. While considerable effort has been made to ensure that the programs have been thoroughly debugged, we are unable to assist you in adapting them for your own applications.

Each disk is

$19.95

or, as an introductory offer you can order all three for

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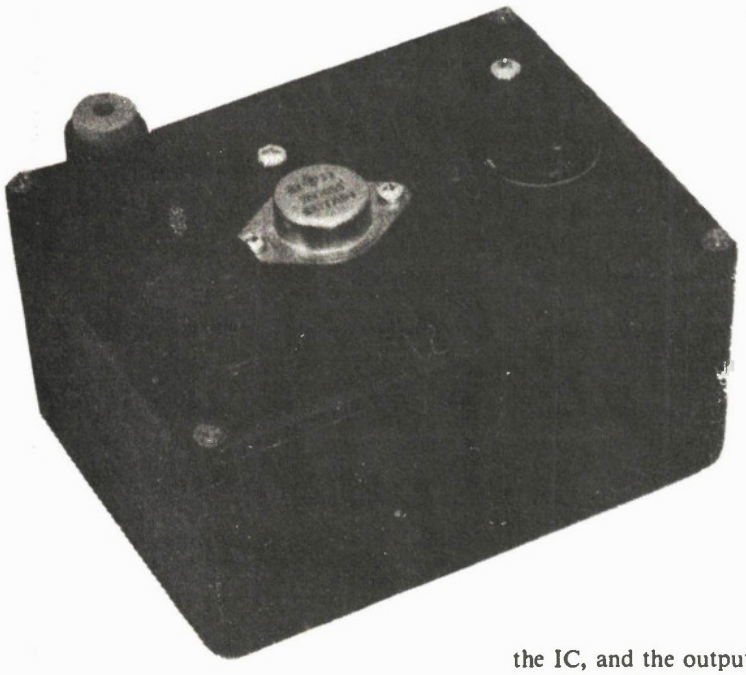


Power Supply

A low cost black box which saves the cost of replacing batteries on low-power applications.

By D.J. Silvester

WITH a 9-volt battery costing around $3 and the same power from an outlet costing only 1/2000th of this amount, a small low power PSU is a cheap solution. The circuit used here has been running a portable radio for the last 15 years, and when one capacitor failed, it was decided to build it up on a PCB, instead of simply repairing the breadboard which had supported it for most of its life. This is also a simple circuit and ideal for a first project. It illustrates the principles of an op-amp at the same time, and should repay the effort of building for at least ten years.

The PSU is based on the use of an op-amp (operational amplifier) to detect a voltage error at the output, and to apply a correcting current to the transistor which provides the output. Figure 1 shows the basic circuit using IC1's internal transistors. R1 and ZD1 produce a constant voltage at the non-inverting (+) input to the IC, and the output is returned to the inverting (-) input. Any difference in voltages between the two inputs will be amplified about 20,000 times.

If a positive voltage change is applied to the non-inverting input, the output will go more positive and if it is applied to the inverting input the output will go negative. If we now connect the output to the inverting input, the amplifier will hold the two inputs at the same voltage and the output will consequently come to the same voltage as ZD1. If, however, only a proportion of the output voltage is fed back, the output voltage will be greater than ZD1's voltage and proportional to the amount of feedback.

Turning to Figure 2, we can see the same basic arrangement as in Figure 1, with additions to turn this into a full 9 volt power supply unit.

The Circuit

Transformer T1, bridge rectifier BR1 and capacitor C1 convert the power line input to about 18VDC, but this DC voltage will contain a ripple component at 120 Hz when power is drawn from the supply. This leftover signal must be removed before the power is drawn. Consequently, this point is only connected to the main supply to IC1 and the regulator transistors. IC1 contains circuitry which rejects variations on its power input lines, so the ripple will not affect the supply's output voltage.

ZD1 and R3 provide a stable 5.6V to the non-inverting input of the IC, while R4, R5 and RV1 are arranged so that the 9V available at the output will be reduced to 5.6V at the inverting input to IC1, but will vary if the output voltage changes. The input of IC1 is fed to Q1 and Q3, which together act as a high gain high current pass transistor to regulate the output voltage.

We now have the feedback loop shown in figure 1.

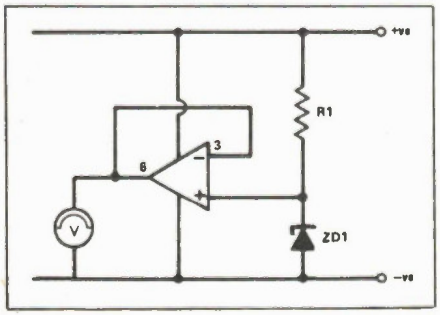


Fig. 1. The basic power supply circuit of the PSU using the internal transistors of IC1.

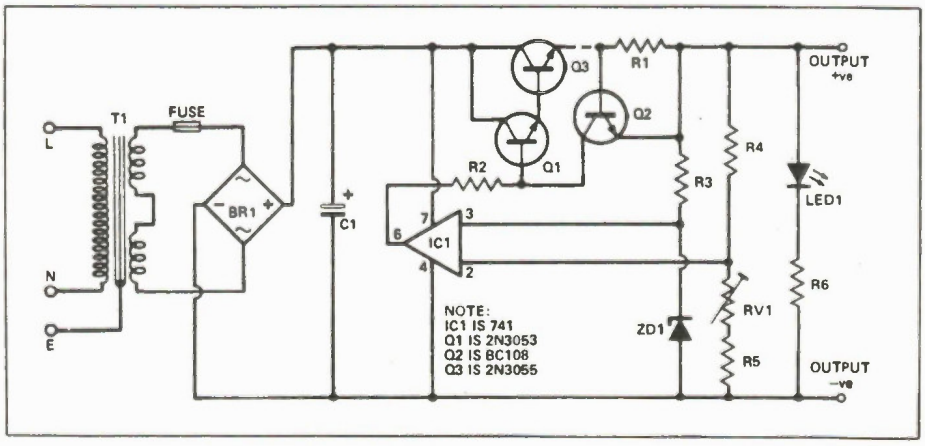
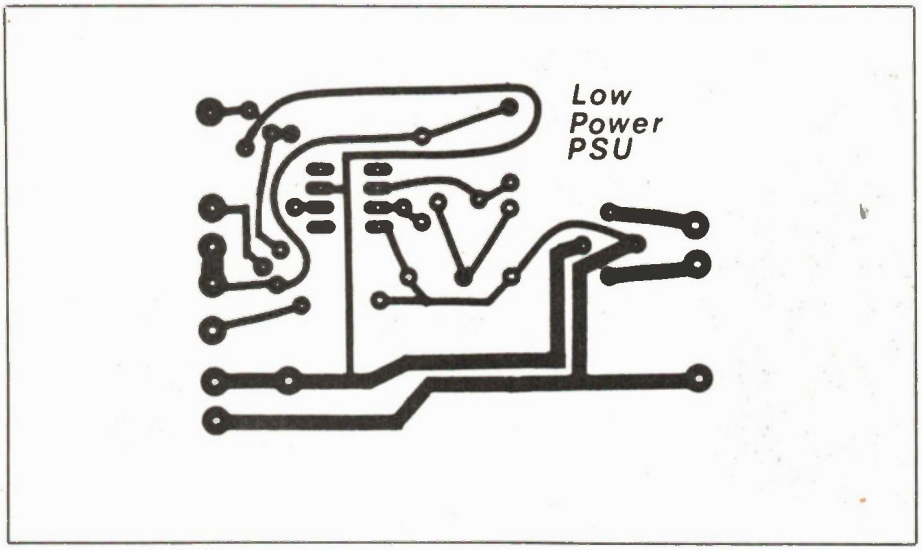


Fig. 2 The full circuit diagram.



The printed circuit layout for the power supply. A veroboard layout is also provided as an option; see the last page of the project.

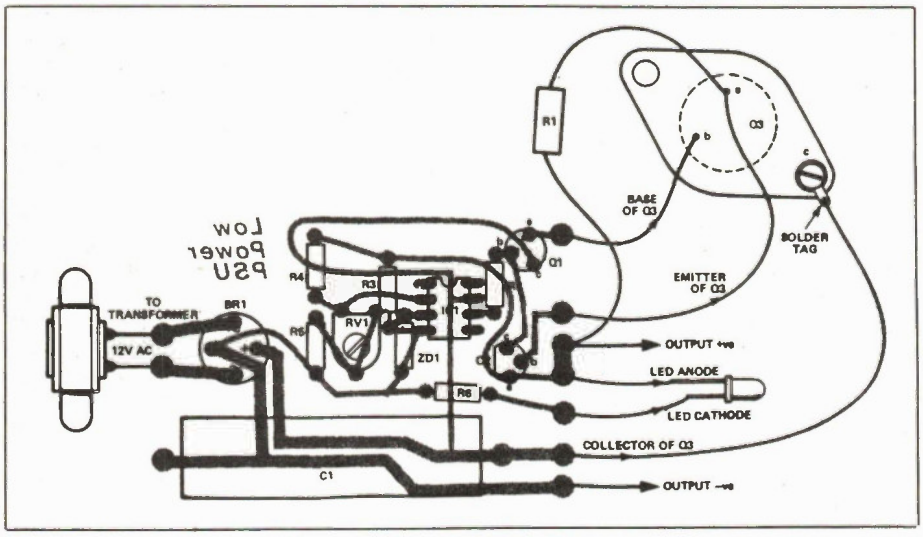


Figure 3. The PCB layout. Note that several components are not mounted on the PCB. Q3 is chassis mounting and case for its mounting bolts. For safety, add a fuse between BR1 and T1.

If the output voltage drops slightly, the voltage to the inverting input of IC1 will drop and the output from IC1 will rise. This will increase the current through Q1 and Q3, and offset the voltage drop. Because of this compensation, the voltage at the supply output will remain very close to 9V for any current drawn, equivalent to a battery with an internal resistance of below 0.01 ohms.

To prevent the supply being damaged by drawing an excessive current, R1 and Q1 are included. When the voltage across R1 reaches about 0.6V, Q2 is turned on and this draws current away from Q1 and Q3. In this case, the output voltage drops while the output current remains constant. In fact, it is possible to short circuit the supply without any damage resulting (but we don't suggest that you try this).

To increase reliability a fuse is placed between the transformer and bridge rectifier, so that in the event of a component failure this fuse will blow rather than damage other components.

Construction

All the components except the transformer, the fuses, the LED, transistor Q3 and resistor R1 are soldered onto the PCB, as shown in Figure 3. The PCB should be built first, using an IC socket for IC1. Don't insert IC1 until after the DC supply has been tested (see below). The transistors, Zener diodes, capacitor C1 and bridge rectifier are all polarised components, so take care that they are the right way around.

Before soldering in C1, two small right angle brackets must be glued to the plain side of the PCB to form supports for the board, and C1 then soldered into place over the brackets. Take care that the brackets do not touch any of the component leads, or the unit will short out, causing severe damage.

Having built up the PCB, attach wires for the inputs and outputs shown in Figure 3. The box lid is used to hold all the remaining components, with the box acting as a cover. Place the components on the lid and move them around till you have a satisfactory layout. Make sure that the supply to the transformer cannot short out to the case. Drill holes in the case for the transformer, fuse, output terminals, transistor and the power cord.

If you wire the power cord straight into the unit, make sure you use a cable clamp or anti-strain grommet (various

PARTS LIST

Resistors
R1 ..... 2R2 3 watt wire wound
R2, 3, 4, 6 ..... 33OR 1/4 watt
R5 ..... 43OR 1/4 watt

Potentiometer
RV1 ..... 22OR horiz. preset

Capacitor
C1 ..... 4700uF 25V electro

Semiconductors
Q1 ..... 2N3053
Q2 ..... 2N929
Q3 ..... 2N3055 **or** 2N3054 low current
ZD1 ..... 400mW, 5.6V Zener
IC1 ..... 741 op-amp
BR1 ..... 1A 50V bridge rectifier
LED1 ..... Red LED with mounting clip

Miscellaneous
T1 ..... 6-0-6V 500mA chassis mounting

Mounting kit for Q3, diecast aluminum box approximately 120 x 90 x 60 cm; two terminal posts; 500mA slow blow fuse and fuseholder; input socket for cable grommet; wires; solder etc.

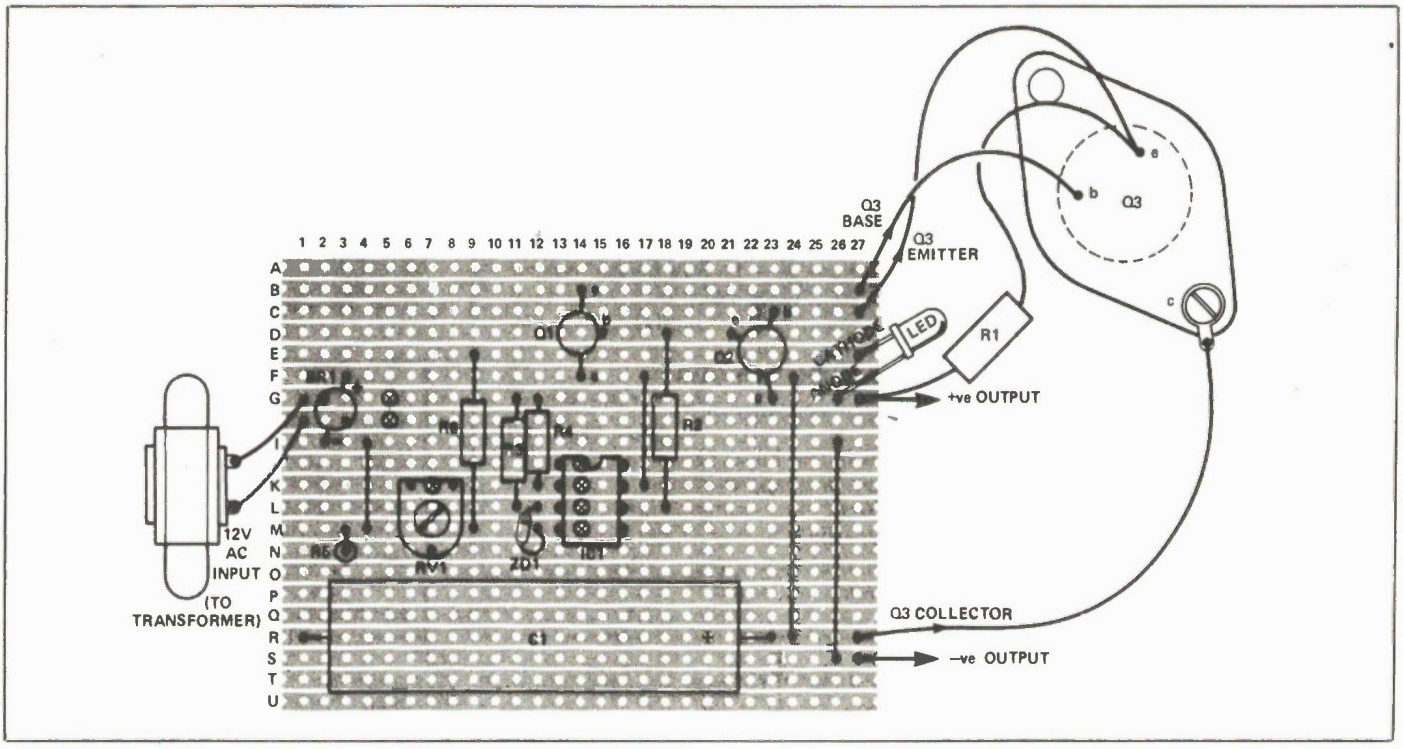


Figure 5. For those who do not want to use a PCB, we have included a Veroboard layout. Take care with soldering to avoid track bridges, and heed all notes about fuses and high voltage handling.

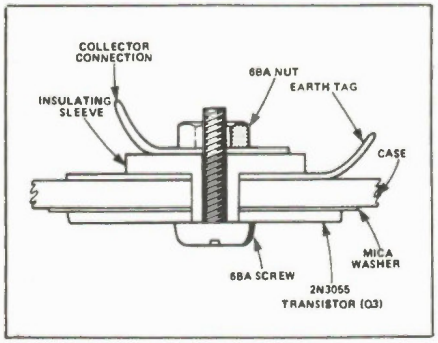


Figure 4. A detail of the bolt which holds on Q3, with the ground tag and collector connections.

kinds are available) to ensure that the cable cannot pull loose from its connections.

Screw the transistor Q3 to the box, using a mica washer between the base and the box, and two insulating sleeves around the screws. A solder tag will need to be placed onto one screw to provide Q3's collector connection, and a second larger solder tag under one of the insulating sleeves to form a ground connection to the box. This ground connection goes directly to the power ground lead. Fix the remainder of the components to the box, the PCB being attached by glueing the brackets to the box lid.

Finally, complete the wiring to the PCB. R1 hangs in free air between the emitter of Q3 and the output terminal post.

Testing

At this stage IC1 should not yet have been plugged into its socket. Switch on the power and check for 120V supply to the transformer and 12VAC output. Measure the DC across C1, which should be about 18V but may vary slightly. If all is well, switch off and monitor the voltage across C1 with a meter until it falls to zero. Now insert IC1 and switch on again. The LED should light up (if not, check the polarity of the connections), and an output voltage should be obtained. This output may be set to 9V by rotating RV1.

Switch off and disconnect from the outlet. Touch all the components (make sure the power is disconnected first); none should have become warm. If all is well, cover any exposed line power points with insulating tape and close the box.

All the components used in this project are common and easy to obtain; you may find different suppliers offer different standard case sizes, so make sure you choose one big enough to take all the components.

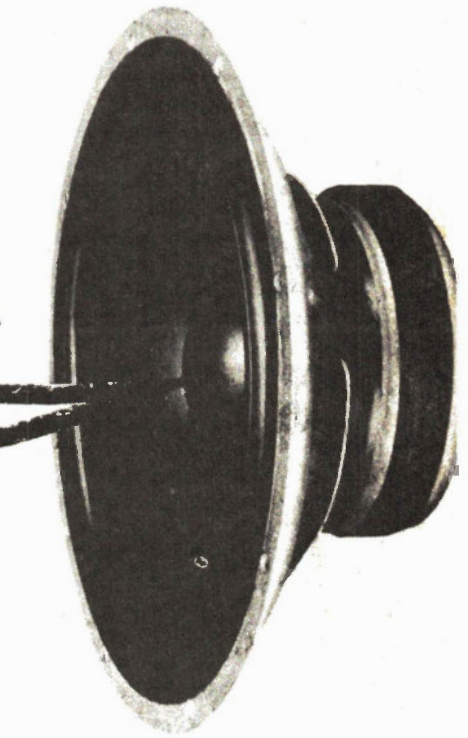
Alternatives

Some comments may be useful to constructors who want other output voltages and currents. The pass transistor Q3 is usable up to about 7 amps continuous current, for long term reliability, and a power dissipation of 100 watts on a suitable heat sink. For high current operation, and retaining C1 at 4700uF, this will be a maximum of 2.5A (the capacitance in uF should equal about 2000 times the current in amps).

The transformer will need to have a higher current rating, so that the transformer AC current equals 1.6 times the continuous DC output current from the supply, or the transformer will be seriously overloaded. Also, R1 will need to be reduced so that at the rated current, maximum voltage across R1 will be 0.6V. These low value resistors can be simply made by using higher value resistors in parallel.

For higher value voltage supplies, the values of the resistors in the R4,R5,RV1 chain must be altered to retain the 5.6V input voltage. As a guide, the current through the resistor chain is 10mA. Additionally, the output voltage from the transformer will need to be increased, but an upper limit of 20VAC (equivalent to 28V rectified DC) is set by the 30V maximum DC input rating to the 741 IC. No other changes should be needed. ■

Designer's Notebook



Have you heard... we look at the unwanted sounds in the system and how to manage them.

By Kevin Crabshawe

NOISE, whether you like it or not, is always present in any electronic circuit. By definition, noise is any unwanted signal – so, although in everyday terms, noise is just unwanted sound (say, your next-door neighbour playing his 200-watt-per-channel quadraphonic music system at full steam), in electronics the term noise is used to describe those signals which prevent an electronic circuit or system from doing its required job, perfectly. Examples of noise in electronic circuits and systems are the crackling on a bad telephone line, the hiss from a replayed cassette recording, record surface noise, or 'snow' on a poor-quality television picture.

There are two main types of noise. One of the types, interference, may with safeguards and precautions be reduced to a level which is insignificant and has little or no effect on the circuit or system. We shall be looking at interference in great depth later; its effects, how it occurs, and how to prevent it. Interference is the type of noise which is generally created in an electronic circuit or system by the close proximity of another circuit or system. A good example of interference is the low frequency hum generated by a hifi amplifier. The hum, at a frequency of 60 Hz or 120 Hz, is generated initially within the amplifier because of the close proximity of the amplifier's power supply. The power supply is line-powered and so low-frequency noise at 60 Hz and/or 120Hz (if full-wave rectification takes place in the power supply) is picked up by the amplifier. It is the amplifier's job in life to amplify signals, and so the hum picked-up from the power supply is amplified along the required sound.

This is normally no problem when the sound you want is there, but when it isn't, say, between tracks or when your disk finishes, the hum may be quite noticeable. Some amplifiers use special techniques and methods to reduce the hum produced at the output, so much so that it may be inaudible, but it is always there to some greater or lesser extent.

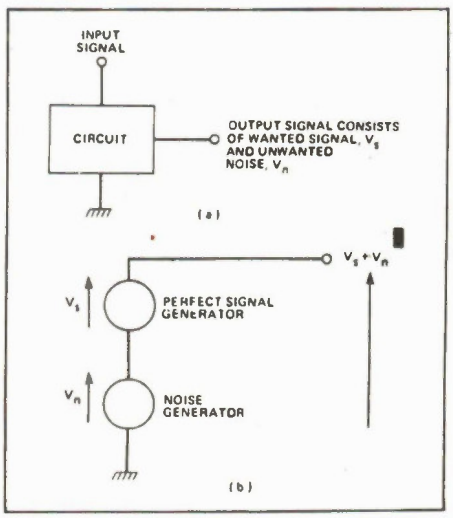


Figure 1a. Block diagram of a circuit generating unwanted noise; 1b shows the same circuit split into noiseless and noise producing sections.

Manmade Noise

Interference noise is, in fact, manmade noise, and because it is manmade it can usually be reduced, It generally has some pattern or form which makes it distinguishable from the other main type of noise – random noise. Random noise (sometimes called fundamental noise) is more difficult to reduce because it is caused by the basic physical properties of the components in the electronic circuit and system themselves, An example of random, fundamental noise is the background hiss which you can hear between pieces of music when listening to your radio. In this example the random noise is produced from two sources: the individual components within the set, and from the sky itself. We'll see how such noise is produced, shortly.

When we discuss noise, it is convenient to consider it as a small, unwanted voltage which is superimposed upon the wanted signal voltage. If, for example, we have a circuit performing a particular task as in Figure 1a, the wanted signal voltage is Vs. This signal voltage may be the output of an audio amplifier used to drive a loudspeaker, or it may be the output voltage of an electron gun driving circuit of a television, or any number of wanted signals.

The unwanted noise voltage, superimposed upon this wanted signal is Vn. The total output of the circuit in Figure 1a is thus Vs plus Vn.

We may, in fact, consider the circuit of Figure 1a to be a noisy circuit or, as is more usual, think of it as being a prefect, noiseless circuit, with a separate noise generator. Figure 1b shows an equivalent circuit to that of Figure 1a, and we can see that a perfect noiseless voltage generator with a series noise voltage generator replaces the noisy circuit. The output of this equivalent circuit, Vs + Vn, is the same as before – only the internal concept differs.

Equivalent circuits are a common method in electronics of representing complex circuits and concepts, often having unknown quantities, by replacing them with known, simple circuits and components which follow the basic electronic laws such as Ohm's law. Although the example in Figure 1b is a simple one, the concept is true of all equivalent circuits, and we will see more complex equivalent circuits soon.

Signal to Noise Ratio

It is often convenient to think of the two voltages, Vs and Vn – the signal voltage and the noise voltage, as a ratio. But the ratio most commonly used, signal-to-noise ratio, is not just a simple ratio of the magnitudes of the voltages; it is a ratio of the powers associated with the voltages. So:

$$\text{signal-to-noise ratio} = \frac{\text{signal power}}{\text{noise power}}$$

The power associated with the two voltages is found by calculating the voltages' mean square value, i.e., the mean of the square value, and dividing this value by the circuit's output resistance such that

$$\text{signal power} = \frac{\overline{V_s^2}}{R}$$

and:

$$\text{noise power} = \frac{\overline{V_n^2}}{R}$$

Note that the line above the square voltages indicates the mean value. We can now define the signal-to-noise ratio as being:

$$\frac{S}{N} = \frac{\frac{\overline{V_s^2}}{R}}{\frac{\overline{V_n^2}}{R}} = \frac{\overline{V_s^2}}{\overline{V_n^2}}$$

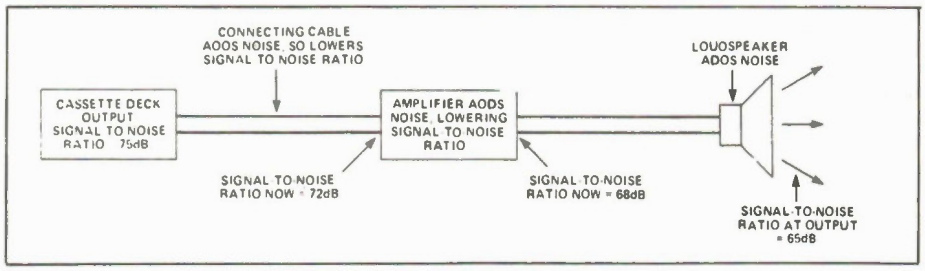


Figure 2. Block diagram of a hifi system, showing the sources of noise.

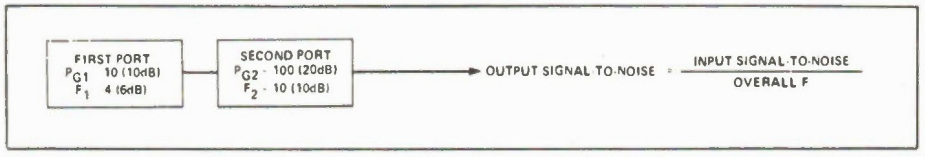


Figure 3. Calculating the noise generated by two sections of a system.

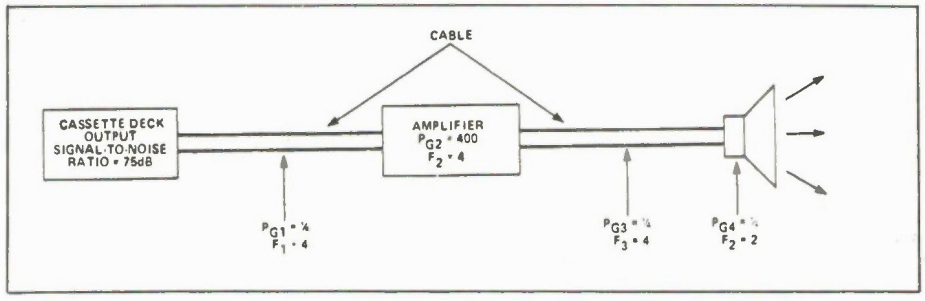


Figure 4. The power gain and noise factor of each of the sections shown in Figure 2.

Because the signal-to-noise ratio is a power ratio it is commonly expressed in decibels, where:

$$\text{signal-to-noise ratio (in dB)} = 10 \log_{10} \frac{S}{N}$$

$$= 10 \log_{10} \frac{\overline{V_s^2}}{\overline{V_n^2}}$$

Comparing Systems

A signal-to-noise ratio expressed in decibels is very useful if we wish to compare two or more similar systems with regards to their background noise. Good quality sound reproduction, for example, must have a signal-to-noise ratio of around 70dB or so to avoid that irritating hiss between pieces of music. This is the reason why cassette recorders often require some form of noise reduction facility (eg Dolby, dbx), as their basic output signal-to-noise ratio is only around 55dB.

Dolby B noise reduction adds approximately 10dB to this ratio, Dolby C a further 10dB, and dbx a still further 10dB.

In comparison a compact disk player has an output signal-to-noise ratio of around 90dB, which means that as far as a listener may detect, there is no noise at all. In reality, there is still noise present. It is simply so much weaker than the signal that it becomes undetectable to the ear.

Such a high output signal-to-noise ratio is not important in other systems: a 40dB ratio will allow a quite acceptable telephone conversation, and a 50dB television aerial signal will allow creation of an excellent picture on the television screen. Obviously, the required signal-to-noise ratio to give acceptable performance depends on the system itself, but the very fact that we know a system's output signal-to-noise ratio means we may compare it with similar systems.

Down the Line

When we combine two systems, or two subsystems, we have to remember that each system or subsystem has an effect on the output signal-to-noise ratio. The total signal-to-noise ratio must therefore be a combination of the individual effects. For example, let's look more closely at an audio system consisting of a cassette deck, amplifier, and loudspeaker, as shown in figure 2. The cassette deck is a good quality type, with Dolby C noise reduction facilities giving an overall signal-to-noise ratio of, say, 75dB. As we know, this is adequate for good quality sound reproduction.

Between the cassette deck and the amplifier is a length of connector, made of wire conductor. Now, you may think this connector cannot affect the overall system's signal-to-noise, but it does. Any length of wire has a definite resistance and

so the input of the wire (consisting of a wanted signal and unwanted noise) will be attenuated. The wanted signal will be attenuated the same amount as the unwanted noise. However, the very resistance of the wire will add some extra noise, so the output signal-to-noise ratio of the wire will be lower than the input signal-to-noise ratio. The output signal-to-noise ratio, which forms the input signal-to-noise ratio of the amplifier, will now be say, 72dB.

The amplifier will amplify both wanted signal and unwanted noise by the same amount, depending on volume, tone and other controls. So, the output signal-to-noise ratio of a perfect noiseless amplifier would be the same as the input signal-to-noise ratio. However, as you've guessed, no amplifier is perfect and some extra noise will be added by the very components such as resistors, capacitors, transistors, ICs etc., which form the amplifier. The amplifier's output signal-to-noise ratio is thus lower than its input signal-to-noise ratio and will be, say, 68dB.

In the same way as this, both the connecting wire to the loudspeaker, and the loudspeaker itself, contribute extra noise to the system and the overall signal-to-noise ratio of the whole system may be, say, 65dB.

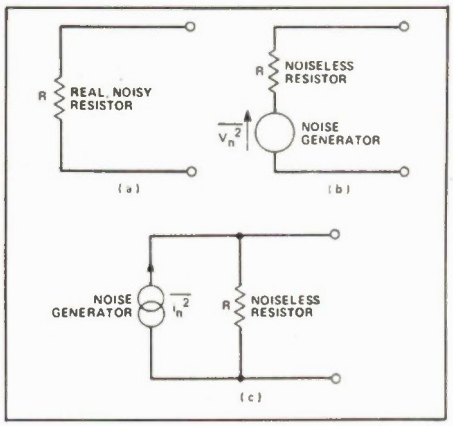


Figure 5. A single resistor, (a) broken down into 'noiseless' and 'noisy' sections (b) and further as a 'noiseless' resistor and a noise current generator.

Of course, the system chosen in this example and the signal-to-noise ratios are all arbitrary. The signal-to-noise ratios in other systems will be very different, but nevertheless the example shows that every part of a system causes a reduction of the signal-to-noise ratios of the signals passing through the system.

Calculating S/N

In the previous example the overall signal-to-noise ratio was derived simply by starting with the signal-to-noise ratio of the first subsystem (i.e., the cassette deck) and merely subtracting an arbitrary amount from this quantity for every other subsystem in the system. However, in real life things are not quite that simple, and a few general rules and formulae are required.

First of all, we need to know how much each part of a system reduces the signal-to-noise ratio. This is defined by what is known as the noise factor (and also known as the noise figure). The noise factor is given the symbol F and may be calculated from:

$$F = \frac{\text{input S/N ratio}}{\text{output S/N ratio}}$$

Because the noise factor, like signal-to-noise ratio, is a power ratio, it is commonly given in decibels where:

$$F(dB) = 10 \log_{10} \frac{\text{input S/N ratio}}{\text{output S/N ratio}}$$

However, as input and output signal-to-noise ratios are almost always given in decibels anyway, the noise factor

(in decibels) is calculated as F(dB) = input signal-to-noise ratio (dB) minus output signal-to-noise ratio (dB), because division of two numbers is effected by subtracting the logarithms of those two numbers. So, for example, an amplifier with an input signal-to-noise ratio of 70dB and an output signal-to-noise ratio of 65dB has a noise factor of 5dB.

The ideal noise factor of a system or subsystem will occur when the input and output signal-to-noise ratios are equal, and so F = OdB. This ideal noise factor is impossible of course, but noise factors of around 2dB to 10dB are common. The important point is that the lower the noise factor, the better the noise performance of the subsystem.

One final point before we move on to use noise factors in overall system signal-to-noise calculations, is that this idea of noise factor is rather simplified. The actual value of the noise factor depends to an extent on a number of other things, such as temperature, frequency range, and the previous stage's output resistance. However, for our purposes here, and in fact a great many practical purposes, the definition of noise factor given is adequate.

Overall Noise

Once we know each subsystem's noise factor we can begin to calculate the overall signal-to-noise ratio of the system. We do this by first calculating the overall noise factor.

Let's take the example shown in Figure 3 first, which shows two parts of a system connected directly with a small length of wire. The wire has negligible effect on the overall system. The first part of the system has a power gain of 10 (10dB) and a noise factor of 4 (6db). The second part of the system has a power gain of 100 (20dB) and a noise factor of 10 (10dB). Overall noise factor for the system is given by the formula:

$$F = F_1 + \frac{F_2 - 1}{P_{G1}}$$

where: F is the overall noise factor, F1 is the first part's noise factor, F2 is the second part's noise factor, Pg1 is the power gain of the first part. This gives us:

$$F = 4 + \frac{10 - 1}{10}$$

$$= 4.9 \text{ (about 7dB)}$$

We may now calculate the output signal-to-noise ratio if we know the input signal-to-noise ratio, from the formula:

$$F = \frac{\text{input S/N ratio}}{\text{output S/N ratio}}$$

because output S/N ratio = input S/N ratio over F. This procedure may be extended to allow us to calculate the output signal-to-noise ratio of a system with any number of parts, given the power gain and noise factor of each part. The previous example of cassette deck, amplifier and loudspeaker is redrawn in Figure 4, showing each part's power gain and noise factor. Note that the power gain of each connecting cable (and the loudspeaker) is shown as a fraction, because each is, in fact, a loss. They are passive parts which can provide no amplification - only attenuation.

Noise factors of such passive parts are related to the loss in that F = 1/power gain, so that the noise factor of the first connecting cable (ie, between cassette deck and amplifier) is:

$$F_1 = \frac{1}{1/4} = 4$$

Overall noise factor of the system is now calculated by an extended formula:

$$F = F_1 + \frac{F_2 - 1}{P_{G1}} + \frac{F_3 - 1}{P_{G1}\,P_{G2}} + \frac{F_4 - 1}{P_{G1}\,P_{G2}\,P_{G3}}$$

The formula may, in fact, be extended to cover any system of any number of cascaded elements.

Using this formula to calculate noise figure:

$$F = 4 + \frac{4 - 1}{1/4} + \frac{4 - 1}{100} + \frac{2 - 1}{25}$$

$$= 4 + 12 + 0.03 + 0.04$$

$$= 16.07\ (\approx 12 \text{ dB})$$

Cause of Noise

We have now looked quite closely at how we can calculate noise performance of a system provided we know the noise performance of each part. But, we still don't know what causes the noise in the first place, or where it comes from.

There are three main types of electronic random noise: thermal noise, shot noise, and flicker noise. Others exist but are of only small significance and will not be discussed here. Two of these three types of noise are known as white noise, because the noise occurs evenly at all frequencies. This is, of course, analogous to white light.

Thermal Noise

Thermal noise is often called Johnson noise. It occurs in any component which has resistance - so all components, even capacitors and inductors, produce thermal noise to some extent.

The noise power, Pn, generated by any resistor may be calculated from: Pn = K T B, where K is Boltzmann's constant (1.38 x 10 to the -23 J K to the -1), T is the absolute temperature and B the bandwidth of the system. As the noise is, however, random, we must define this as the average noise power.

We can now find the random noise voltage produced by a particular value of resistor if we remember that P = V2/R. This means that the square of the voltage to be:

$$V^2 = k\,R\,T\,B$$

But, in our earlier calculations of signal-to-noise ratios we used the mean square voltage, Vn2. For our purposes, we may consider the mean square noise voltage to be:

$$\overline{Vn^2} = 4V^2$$

so that:

$$\overline{Vn^2} = 4\,k\,R\,T\,B$$

A real resistor, shown in Figure 5a can thus be represented by an equivalent circuit consisting of a noiseless resistor, and a noise generator producing a mean square noise voltage (Figure 5b).

We could (but won't) go through a similar procedure to define a mean square current of value:

$$\overline{In^2} = \frac{4\,k\,T\,B}{R}$$

and represent the real resistor of Figure 5 by an equivalent circuit of an ideal, noiseless resistor with a noise current generator, as shown in Figure 5c.

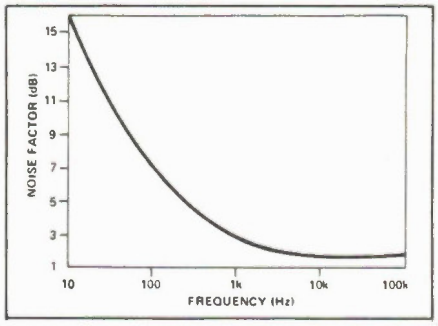


Figure 6. A graph of noise factor against frequency for a typical transistor.

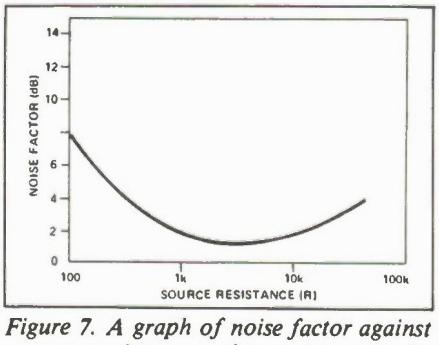


Figure 7. A graph of noise factor against source resistance: the noise can be minimised by the appropriate choice of source resistance values.

continued on page 32

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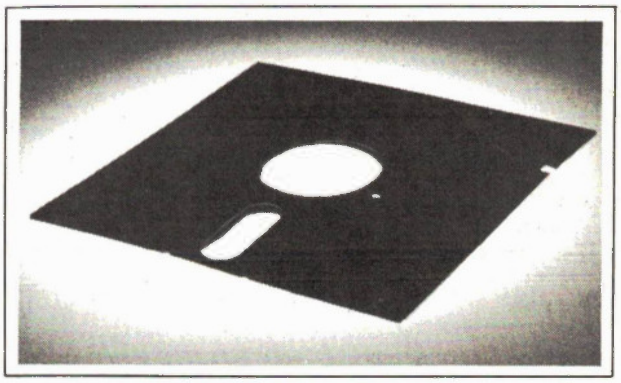

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Racquel.Pic: An Apple HiRes implementation of the CP/M teletype drawing offered in Almost Free Software Volume II.

HGR Dump: A BASIC editor that lets you preselect options before sending your HiRes picture to the printer. Written for a Dumpling-GX card, but easily modified.

HGR Invert: A fast binary program that displays the 'negative' of any HiRes picture in memory. BRUNning it again restores the picture.

Magfiler: A magazine article database in Applesoft BASIC. The February issue of CN! has already been entered to get you started.

Miniature Golf: A binary HiRes game of golf, with a truly wicked course. The sixth hole's a dandy.

Memtest: This short, two-sector binary program comes in handy when your Apple starts to hiccough. It writes and reads to memory from $0800 to $BFFF. Three passes and your RAM's in fine shape.

Forced Read, with source: A short binary program originally appearing in Electronics Today, this program has incredible error handling.

APCP/M: A handy utility for the Applesoft user who also dabbles in CP/M, this program will read a text file up to 16K in length from an Apple CP/M disk and write it to a DOS disk. Known affectionately as 'Reverse APDOS'.

DM II: From the Apple User Group of Sweden comes forth this DOS modifying program that allows you to change commands, error messages, catalog headers and volumes, and even fiddle with DOS entry points.

Star Patrol: An Applesoft implementation of the HiRes ADAM program appearing in the February edition of CN!. Your mission is to shoot elusive space bats.

Attenuators: An Applesoft BASIC program to aid calculating resistance and loss.

Capacitors: A similarly Applesoft BASIC program to help calculate capacitance and frequency response.

Side Two: IBM files

SD: An acronym for Sorted Directory, this program produces a more visually appealing directory than can be had from the MS-DOS DIR command.

FORTH: A small BASIC implementation of FORTH. You can expand the primitives or add new ones as they become necessary.

Datafile: Everyone needs a database manager. This one's written in Microsoft BASIC.

Blueterm, with source: A terminal program for the PC. Suggested hardware requirements include a modem...

Poker!: A BASIC program pitting you against your PC. Where's that straight flush when you need it?

Bandit: An alternative to that Las Vegas trip you've been planning. Appearing in the June issue of CN!, this BASIC program simulates a one-armed bandit.

CalcNOW!: A spreadsheet program written in BASIC. While very good at what it does, we don't expect Lotus to be nervous.

Cashacc: Written in BASIC, this is a cash acquisition and limited accounting package for the PC.

UnWS, with source: When you TYPE a WordStar file, you usually get garbage. This program strips the high bits from the WS file of your choice to make it legible again.

Note: Neither the Apple nor the IBM disk sides are bootable. Both Apple DOS 3.3 and MS-DOS are copyrighted disk operating systems, property of (respectively) Apple Computers Incorporated and Microsoft Corporation. In order to read the files on the Completely Free Software Disk, first boot a disk with either DOS 3.3 or MS-DOS on it, then either CATALOG or DIR the side that's relevant to your machine. From this point, you'll be able to run the applications programs, though it's suggested that you copy the files onto another disk.

All of the programs appearing on the Completely Free Software Disk have either been written in-house, or are believed to be in the public domain.

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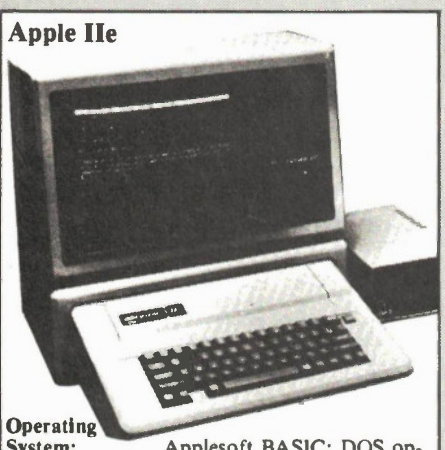
Computer Survey

The first part of a survey updating the various microcomputers that are available, beginning with some of the most popular home micros.

THE advent of personal computers has been dizzyingly fast compared to other technologies: we've gone from room-sized multi-million dollar behemoths to table-top models in just a few years, and the cost is within anyone's reach. Computers became the centre of an enormous industry, and ad agencies spread the word that anyone without one would be left out of the human race. Fortunately, the hysteria has died down now, leaving you to choose a computer to suit your purposes.

Here is a listing of some of the popular home computers available; we'll continue with more models next month. Please remember that prices and specifications change rapidly; the information shown was correct as we went to press.

Apple IIe



Operating System: Applesoft BASIC; DOS optional
Processor(s): 6502
RAM: 64K; optional 128K
Printer I/O: Parallel and serial cards available
Disk Drives: Optional; one or two 5 1/4" floppy
Cartridge Port? No
Screen Format: 40x24; optional 80x24
Lowercase? Yes
Graphics: 40x24, 280x192 or 560x192 pixels
Sound: Yes
Colour: Yes
Software Included: ProDOS with drive purchase
Manufacturer: Apple Computer Incorporated
Distributor: Authorised Apple Dealers
Suggested Retail: $1495.00; $2395 with monitor, drive and extended 80-column card

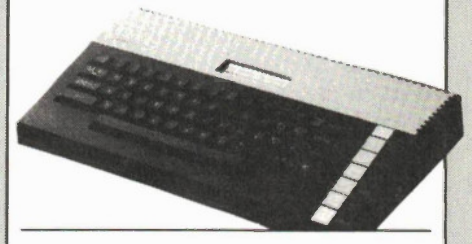
Description: The Apple IIe was introduced as a logical upgrade from the Apple II+. As it stands, the software and hardware base for the IIe is immense, but with the addition of a Z-80 co-processor card, the Apple IIe can also utilise the large base of CP/M programs and utilities. Unlike the Apple II+, the Apple IIe has lowercase characters, can utilise 128K and has, through a design quirk, 'double hi-res' graphic capabilities of 560 by 192 pixels. The IIe has an easily accessible monitor for machine language code entry in hexadecimal format.

Apple IIc

Operating System: Applesoft, ProDOS, DOS 3.3
Processor(s): 65C02
RAM: 128K
Printer I/O: Serial
Disk Drives: One 143K floppy; optional 2nd drive
Cartridge Port? No
Screen Format: 40 or 80x24
Lowercase? Yes
Graphics: 40x24, 280x192, 560x192 pixels
Sound: Yes; volume control and headphone jack
Colour: Yes
Software Included: Six tutorial disks
Manufacturer: Apple Computer Incorporated
Distributor: Authorised Apple Dealers
Suggested Retail: $1795.00; $1995.00 with monitor and stand.

Description: A portable version of the Apple IIe, the IIc has many standard features that are optional with the IIe, including 80 columns, a built-in drive, 128K, a serial printer port, modem port, joystick port, RGB port and a port for an external drive. Unlike the IIe, the IIc cannot be expanded from within, so unless a manufacturer develops a serial Z-80 add-on, it's unlikely that CP/M software can be implemented for the computer. Due to the nature of the CMOS 65C02 processor, some Apple software doesn't operate properly or at all with the IIc. Many software houses whose software is incompatible, however, are producing IIc versions of their product.

Atari 600XL



Operating System: BASIC
Processor(s): 6502C
RAM: 16K
Printer I/O: Serial
Disk Drives: Optional disk drive or cassette recorder
Cartridge Port? Yes
Screen Format: 40x24
Lowercase? Yes
Graphics: 320x192 pixels; 11 graphics modes
Sound: Yes
Colour: Yes
Software Included: BASIC
Manufacturer: Atari
Distributor: Many computer and department stores
Suggested Retail: $99.99

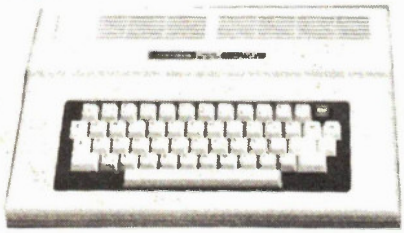
Description: The Atari 600XL is an upgrade from the 400 computer which had a flat membrane keyboard. The software base for the Atari line of computers is large, with an impressive array of games. The only compatibility restriction with the Atari line at present is memory. A 17K program won't run on a 600XL, but will operate properly on an 800XL. Memory expansion is available for the 600XL. Some features of the 600XL include a choice of 256 colours (128 of which may be displayed on the screen simultaneously), a help key, five text modes and four independent sound channels with a range of three and one-half octaves.

Atari 800XL

Operating System: BASIC
Processor(s): 6502C
RAM: 64K
Printer I/O: Serial
Disk Drives: Optional disk drive or cassette recorder
Cartridge Port? Yes
Screen Format: 40x24
Lowercase? Yes
Graphics: 320x192 pixels; 11 graphics modes
Sound: Yes
Colour: Yes
Software Included: BASIC
Manufacturer: Atari
Distributor: Many computer and department stores
Suggested Retail: $199.99

Description: Released in late 1983 as a replacement to the Atari 800, the 800XL looks the same and performs the same as the 600XL with the exception of having three times as much memory. The 800XL has an international character set and five text modes, as does the 600XL.

CoCo2



Operating System: BASIC, Extended BASIC and/or Color DOS
Processor(s): 6809E
RAM: 16, 32 or 64K
Printer I/O: Serial
Disk Drives: Optional 5 1/4" 156K floppy
Cartridge Port? Yes
Screen Format: 32x16
Lowercase? No
Graphics: 256x192 pixels
Sound: Yes
Colour: Yes
Software Included: BASIC
Manufacturer: Tandy Electronics
Distributor: Local Radio Shacks
Suggested Retail: $189.00 16K Standard; $249.00 16K Extended; $349.00 64K Extended

Description: CoCo2, short for Color Computer 2, was recently released as a replacement for the original CoCo which had flat, rectangular keys. The CoCo2 features a full typewriter-like keyboard plus an interrupt timer and its graphics capabilities range from 32 by 64 pixels in eight colours to 256 by 192 pixels in two colours with three intermediate formats. The 16K Extended BASIC CoCo2 has an additional 8K ROM that allows PEEK, POKE and USR commands, full-featured editing and tracing, and extended graphics handling from BASIC. The 64K Extended BASIC model is similar to the 16K Extended model, though only 32K of its 64K is accessible from BASIC unless Color DOS is implemented. The CoCo2's software base, while not as expansive as that of Apple or Atari, is nonetheless impressive and more than adequate for home use.

Coleco Adam

Operating System: SmartBASIC
Processor(s): Z-80A, others
RAM: 80K
Printer I/O: Includes letter-quality printer
Disk Drives: Two stringy tape drives
Cartridge Port? Yes
Screen Format: 36x25
Lowercase? Yes
Graphics: 256x192 pixels
Sound: Yes
Colour: Yes
Software Included: SmartBASIC, word processor, game
Manufacturer: Coleco Industries
Distributor: Coleco
Suggested Retail: $488.00

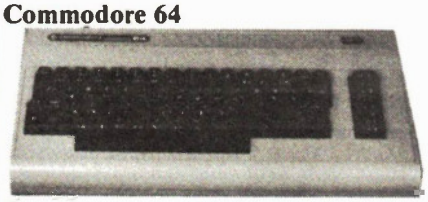
Description: The Coleco Adam system consists of a computer, a printer and two joysticks. A similar system is available for Colecovision game machine owners than upgrades their machine into an Adam system. The Adam was recently discontinued by the parent US firm, with existing stock being taken over by an unnamed distributor. However, Coleco Canada say that they will continue to sell the Adam throughout 1985. The letter quality printer that accompanies the Coleco Adam system makes the computer of interest to prospective purchasers: most letter quality printers cost more than the entire computer system. As the Adam's power supply is integrated into the printer, however, it's necessary to have the printer beside the computer during operation. SmartBASIC, a cassette-loaded operating system, emulates Applesoft, though CALL statements seem to be ignored. Adam's word processor is in ROM. Hardware-compatible to the Colecovision, the Adam can use all Colecovision game cartridges.

Commodore 16

Operating System: BASIC
Processor(s): 7501 (6502 compatible)
RAM: 16K
Printer I/O: Serial
Disk Drives: Optional 5 1/4" floppy
Cartridge Port? Yes
Screen Format: 40x25
Lowercase? Yes
Graphics: 320x200 pixels
Sound: Yes
Colour: Yes
Software Included: BASIC
Manufacturer: Commodore Business Machines
Distributor: Authorised Commodore Dealers
Suggested Retail:

Description: Commodore's new low-end computer has 16K of RAM (12K accessible from BASIC), an upgraded BASIC with extended graphics and disk commands, admirable colour control, a built-in assembler/monitor for machine language programming, a reset button, programmable function keys and a help key. The 16's cassette and joystick ports differ from those of the Vic and 64, so these peripherals are not interchangeable. Similarly, Commodore 64 or Vic-20 cartridges won't interface with the 16. The 16 has no user port, so Vic and 64 interfaces, such as modems and real-world controllers aren't compatible with the 16. Excepting the lack of a user port, the 16 appears to be a superior machine to the Vic-20, and third-party software and hardware manufacturers can be expected to take a strong interest in it in the months ahead.

Commodore 64



Operating System: BASIC
Processor(s): 6510 (6502 compatible)
RAM: 64K
Printer I/O: Serial
Disk Drives: Optional 5 1/4" floppy
Cartridge Port? Yes
Screen Format: 40x25
Lowercase? Yes
Graphics: 320x200 pixels; sprites
Sound: Yes
Colour: Yes
Software Included: BASIC
Manufacturer: Commodore Business Machines
Distributor: Authorised Commodore Dealers
Suggested Retail:

Description: Introduced in 1982 to complement the Vic-20, the Commodore 64 has become that company's best seller with a very large line of support from both Commodore and other software and hardware manufacturers. Features include SID, a 6581 synthesizer chip allowing programmatic control over ADSR, waveform and volume, 64K of memory (38K accessible from BASIC), eight sprites, redefinable characters and the ability to have 16 colours on-screen simultaneously. 80-column interfaces are available for word processing, as are Z-80 cartridges for CP/M usage.

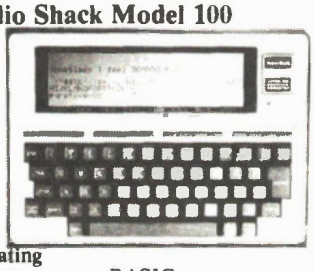
Commodore plus/4

Operating System: BASIC
Processor(s): 7501 (6502 compatible)
RAM: 64K
Printer I/O: Serial
Disk Drives: Optional 5 1/4" floppy
Cartridge Port? Yes
Screen Format: 40x25
Lowercase? Yes
Graphics: 320x200 pixels
Sound: Yes
Colour: Yes
Software Included: BASIC, word processor, spreadsheet, filer
Manufacturer: Commodore Business Machines
Distributor: Authorised Commodore Dealers
Suggested Retail:
Description: The plus/4, introduced alongside the Commodore 16 in late 1984 has everything the 16 features and more. About 60K of its 64K is accessible from BASIC, an RS-232 communications interface is provided, as are separate cursor keys. The three programs in ROM are the most used applications in home computing, so plus/4 users won't have to purchase spreadsheet, word processing and filing software. Spreadsheet figures can be displayed in text graphs. Unlike the Commodore 64, the plus/4 has neither a SID chip, nor sprite capabilities. Like the 16, however, the plus/4 has two-voice square wave sound and up to 16 colours with eight levels of luminance.

IBM PCjr

Operating System:
Processor(s): 8088
RAM: 64K; 128K enhanced
Printer I/O: Serial
Disk Drives: Optional 5 1/4" floppy; 1 DSDD 5 1/4" floppy enhanced model
Cartridge Port? Yes
Screen Format: 40x24 or 80x24
Lowercase? Yes
Graphics: 320x200 or 640x200 pixels
Sound: Yes
Colour: Yes
Software Included:
Manufacturer: International Business Machines
Distributor: Authorised IBM dealers
Suggested Retail: $998.00 Entry model; $1569.00 Enhanced model
Description: Announced in November 1983, the IBM PCjr joined IBM's personal computer line in early 1984. Though a powerful computer in its own right, critics had a field day over the cordless keyboard, which then had raised 'chiclet' rectangular keys. IBM corrected the situation with an impressive typewriter-style cordless keyboard which is now standard on all units. The entry level model PCjr is a cassette- and cartridge-based system with numerous programs available on cartridge, including Lotus 1-2-3. A program called 'Keyboard Adventure' is built into the PCjr's ROM. The entry level model is easily upgraded into the enhanced model which features 128K RAM and a double-sided, double-density disk drive. Further upgrading of both models is possible: the addition of RAM packs up to 512K, a second drive or a hard disk. As the December 24, 1984 issue of *Time* noted, the PCjr has about 40 per cent compatibility with the software base established for the IBM PC, but similar to the case of the Apple IIc, many PC software manufacturers are producing PCjr compatible versions of their products.

Radio Shack Model 100



Operating System: BASIC
Processor(s): CMOS 80C85
RAM: 8K or 24K; expansion up to 32K
Printer I/O: Parallel and serial
Disk Drives: Optional expansion and 5 1/4" floppy
Cartridge Port? No; ROM socket
Screen Format: 40x8 LCD
Lowercase? Yes
Graphics: 240x64 pixels
Sound: Yes
Colour: No
Software Included: BASIC, word processor, filer, appointments, telecommunications.
Manufacturer: Tandy Electronic
Distributor: Local Radio Shacks
Suggested Retail: $799.00 8K; $1099.00 24K
Description: Weighing less than four pounds, the Model 100 has a full-size typewriter-style keyboard with eight programmable function keys, a bar code reader port, rechargeable batteries (an AC adapter is optional), and a built-in modem. The modem, operated through the TELCOM program in ROM, is direct-connect and features auto-dialling. The Model 100 is about the size of an 8 1/2" by 11" piece of paper, and is two inches thick. While the software base for the Model 100 is not as large as that of Apple, Atari, IBM or the Commodore 64, the Model 100 has a number of business applications written for it which may make it ideal for the writer or businessman at home or, owing to its portability, in transit.

Spectravideo SV-318

Operating System: BASIC
Processor(s): Z-80A
RAM: 32K
Printer I/O: Expansion bus
Disk Drives: Cassette driven; optional 5 1/4" floppy
Cartridge Port?
Screen Format: 40x24
Lowercase? Yes
Graphics: 256x192 pixels; 32 sprites
Sound: Yes
Colour: Yes
Software Included: BASIC
Manufacturer: Spectravideo
Distributor: Spectravideo Canada
Suggested Retail: $299.00
Description: Introduced in 1983, the SV-318 was a bit of an oddity; instead of cursor keys, it had a built-in joystick. More recently, the computer's design has been the catalyst for Microsoft's MSX standard which, employed in Japan and Europe, has recently been introduced in North America. Spectravideo should have a new MSX computer available soon. The SV-318 has flat rubber keys, ten programmable function keys and with memory expansion and the addition of a disk drive is CP/M compatible.

Spectravideo SV-328

Operating System: BASIC, or CP/M with disk system
Processor(s): Z-80A
RAM: 80K
Printer I/O: Optional expander available
Disk Drives: Cassette driven. Optional 5 1/4" floppy
Cartridge Port? Yes
Screen Format: 40x24. Optional 80 column cartridge.
Lowercase? Yes
Graphics: 256x192; 32 sprites
Sound: Yes
Colour: Yes
Software Included: BASIC
Manufacturer: Spectravideo
Distributor: Spectravideo Canada
Suggested Retail: $499.00
Description: Also released in 1983, the SV-328 is similar in many respects to the SV-318, though the joystick has been replaced with individual cursor keys and a numeric keypad, the keyboard is typewriter quality, and the unit has 80K of RAM. The SV-328 is 100% compatible with the SV-318, though naturally a program more than 32K in length won't run on the unexpanded SV-318. With the addition of a disk system, the SV-328 operates under the CP/M operating system. ■

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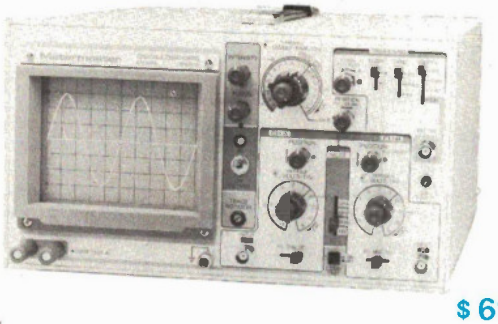

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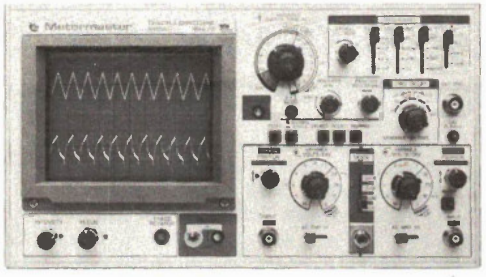

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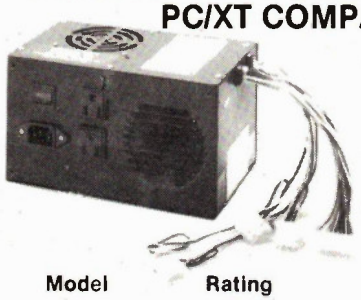

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Model	Rating	Output			
		+5V	+12V	−12V	−5V
CPS-1100	100W	10A	3.5A	0.5A	0.5A
CPS-1130	1300W	15A	4.3A	0.5A	0.5A

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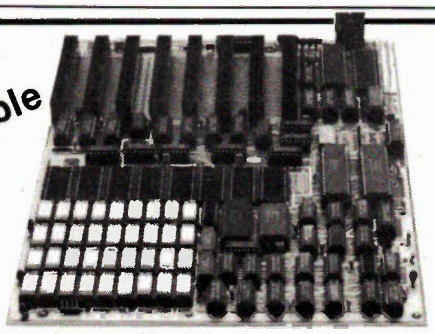

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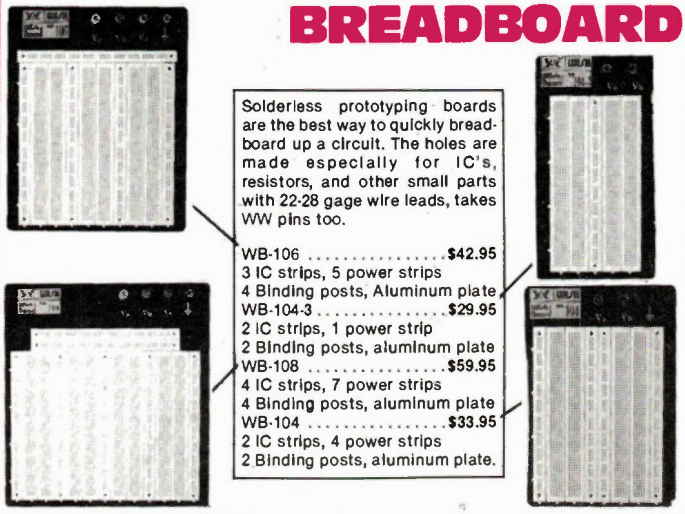

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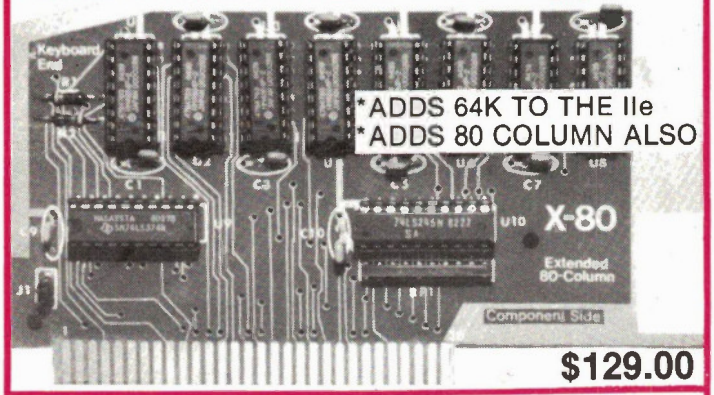

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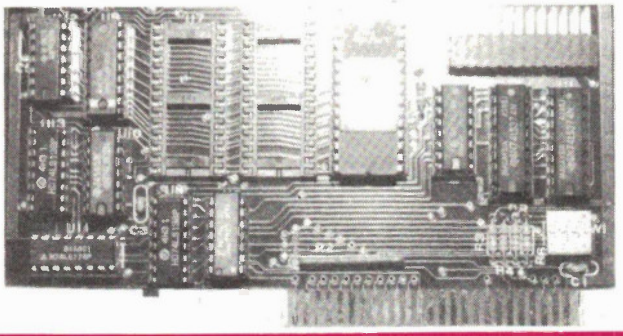
An APPLE II+, APPLE IIe precision parallel printer card for use with EPSON and GEMINI (and similar) to generate multiple fonts, sizes and near letter quality printing. The printer steppers are controlled to give multiple and incremental strike capability to achieve the above.

COMPLETE WITH CABLE **$119.00**



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A great buy, a pack of 7 brand new GE NICADS giving 8.4v at 4 Amp hours. Each cell is 1.2v and separates easy. Used as 5V backup through a 7805. Gives 5v 1 Amp for 4 hours $14.95

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10 Pin RA 5 x 2 ..... $1.00

1 ROW STRAIGHT HEADERS

Gold ..... $8¢ per pin
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Gold ..... $8¢ per pin
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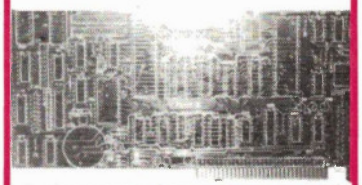

A clever copy of the AST I/O + TWO board with real time clock, game I/O calendar, and parallel and serial ports. A real good short card with assembly data $24.95

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Here's a new great IBM deal that is really good for those of you who are getting into your own system building. This deal includes:::

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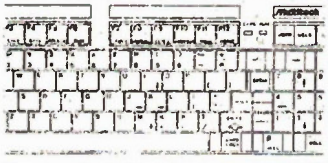

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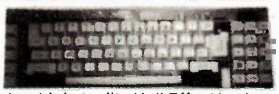
ASCII KEYBOARD



This is a high quality Hall Effect keyboard made by Microswitch of Canada for AES data and now bought by us for 10% of the $169.00 that AES paid for them in 10,000 lots. They are a very good word processing keyboard with both serial and parallel data outputs for use with APPLE and IBM type systems and come complete with a ribbon cable connector and complete pin-out. $24.95

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All boards come with a parts list and placement diagram. We have all the parts of the PCB's just ask for them.
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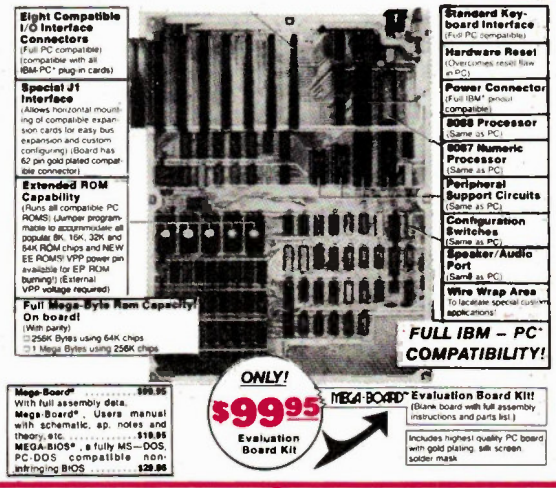

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With full assembly data.
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The basic MEGABOARD system with 64K, one 1/2 size DS/DD Disc Drive, Drive controller and Color Video board with MEGABIOS and manual and schematics $1450.00

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(L) 256K small memory card $19.95
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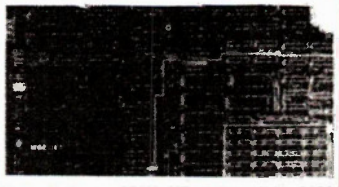
MBE-XT $49.95



Here it is, a 256K XT compatible 8088 machine that works like an IBM. Note has 8 slots on 0.8" spacing to use modern XT peripherals, unlike the BEST which has only 5 on 1" spacing. The MBE-XT will hold any legal or illegal BIOS or BASIC. We suggest the MEGABIOS, one of the better ones available.

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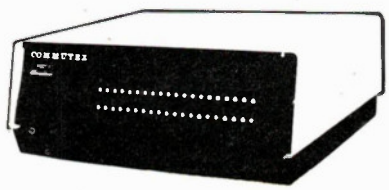

This intelligent controller features:

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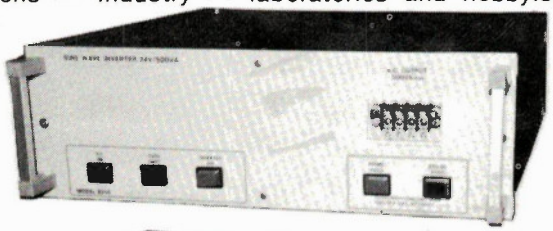

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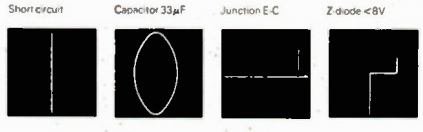

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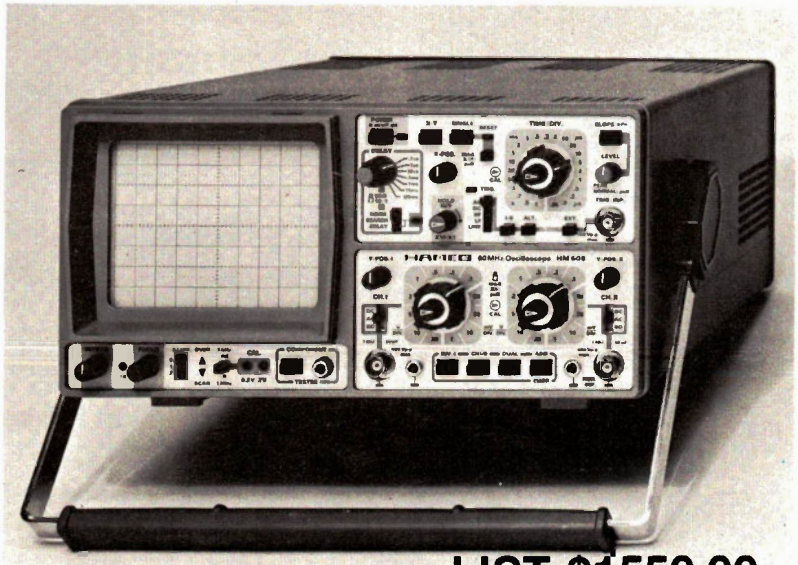

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continued from page 20

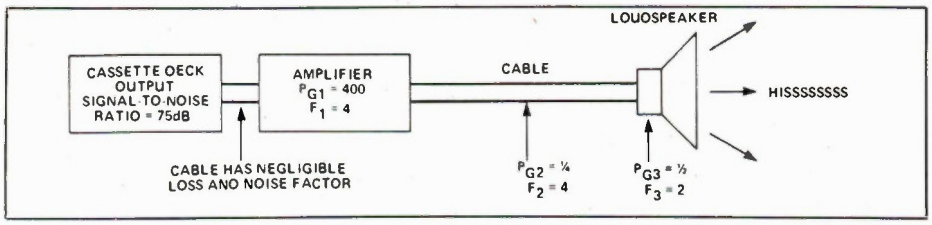

Figure 8. The example of Figure 3, here shown with short, low loss, low noise connections.

Shot Noise

Like thermal noise, shot noise is also a white noise, and so any calculation of it must also be dependent on bandwidth. Unlike thermal noise, however, shot noise occurs only in active devices such as semiconductors. It occurs due to the random nature of the flow of electrons through the semiconductor material.

Generally, shot noise is calculated as a mean square current.

$$\overline{i_n^2} = 2 e I B$$

where e is the electron charge 1.6019 x 10-19C, I is the DC current flowing and B is the bandwidth.

Flicker Noise

Of relatively minor importance, compared with thermal and shot noise, is flicker noise, which is sometimes called excess noise or 1/f noise. Unlike both thermal and shot noise, flicker noise is not a white noise and, in fact, as one of its names suggests, decreases with increasing frequency.

It is produced in semiconductors and resistors with an applied voltage, but is fortunately not significant in most components above about 1kHz.

In a very approximate way, the mean square noise current of flicker noise may be calculated from:

$$\overline{i_n^2} = \frac{B}{f}$$

where: f is the frequency at which the measurement is taken.

Transistors

We can illustrate the effects of noise in components by looking at a graph of noise factor against frequency for one particular component, for example a transistor. Figure 6 shows such a graph for a typical transistor, which is seen to be level over the range of approximately 1kHz and upwards. Below this, however, the noise factor rises rapidly due to the increased flicker noise.

Figure 7 shows a graph of noise factor against source resistance (ie output resistance of the preceding stage). We can see that noise factor is dependent to a large extent on source resistance, and so, by carefully choosing the resistance value, the noise factor may be optimised to a minimum level.

Getting the Best

With all of these types of noise, and their potential sources (every resistor, capacitor, inductor, transistor, diode in a circuit), it makes you wonder how it is that any circuit can ever work with an acceptable noise performance. After all, most circuits consist of a number of components and if each one has a noise factor of, say, only a few dB, surely the overall noise factor is going to be extremely high. This will mean that no matter how high the input signal-to-noise ratio is, the output signal-to-noise ratio is must be low.

Fortunately, as we shall now see, with careful design this need not be so. Let's take, for an example the system we have already seen, of a cassette deck, amplifier and speaker with lossy connecting leads. We previously calculated that the noise factor is 12dB for the amplifier, speaker and leads. So, if the cassette deck gave an output signal-to-noise ratio, of, say, 75dB (it has Dolby C noise reduction), the output signal-to-noise ratio of the whole system is:

$$75 - 12 = 63\text{dB}$$

which is not high enough for good quality audio reproduction.

However, Figure 8 shows the same system but with the amplifier positioned very close to the cassette deck (in terms of connection length) with a connection of negligible loss and noise factor. We can now recalculate the system noise factor as:

$$F = F_1 + \frac{F_2 - 1}{P_{G1}} + \frac{F_3 - 1}{P_{G1}\ P_{G2}}$$

$$= 4 + \frac{3}{400} + \frac{1}{100}$$

$$= 4.1 \text{ (about 6dB)}$$

which will provide an output signal-to-noise ratio of:

$$75 - 6 = 69\text{dB}$$

just about acceptable for good quality audio reproduction.

This result illustrates that to keep a system's noise factor as low as possible it is vitally important to make sure that the first stage in the system has a high gain. In this way the noise factor formula becomes almost totally dependent on the first term in the formula - the first stage noise factor.

This is one of the reasons why all practical amplifiers have a high-gain, low noise pre-amplifiers as their input stage. ■

Configurations

This month we look at the most respected member of the linear IC family, the op-amp.

By Ian Sinclair

BEFORE the reason for the name becomes shrouded in the mists of history, perhaps it's just as well to look at the origins. Operational amplifiers were designed for analogue computers, which are machines used for solving mathematical equations. They do so not by using binary arithmetic as digital computers do, but by connecting up a network of components which represents either a mathematical relation or an equation. In the case of a mathematical relation (eg, $y = x$) the circuit will have an input, x, and an output, y, that will vary according to the relation set up and according to the value of x. Equations can be either ordinary (eg, $x + 4x + 3 = 0$) or differential (eg, $dy/dx + x = 0$); the circuit will be connected in a loop, and in the case of the ordinary equation it will give an output that represents the solution (or one of the solutions) to the equation. The solution to a differential equation is itself a mathematical relation (in the case of the example given above, $y = A\sin x + B\cos x$), so the circuit will have an input and an output (the coefficients of the equation, A and B, will be determined by the initial values of the circuit voltages, but that takes us a bit beyond the present scope of this article).

An essential part of representing a mathematical operation in electrical terms is an amplifier with very high gain whose frequency response can be modified by using negative feedback. Typical operations that can be simulated by amplifiers of this sort include the mathematically important ones of differentiation and integration (Fig. 1), and the amplifiers which were designed for these purposes very reasonably became known as operational amplifiers.

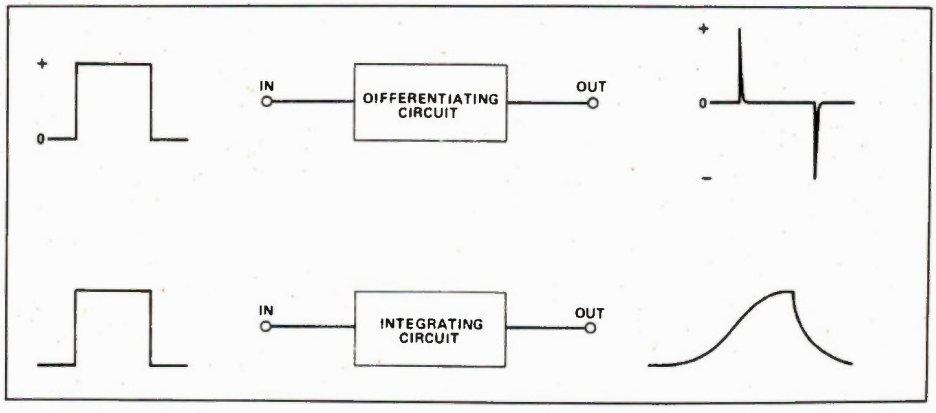

Fig. 1 The operations of differentiation and integration performed on a square wave.

The Perfect Specimen

The specification for a perfect operational amplifier was that it should have infinitely high gain, infinitely high input resistance, zero output resistance, and as much bandwidth as was needed — it was particularly important to have the gain maintained right down to DC. Analogue computers are still produced, though they don't have the importance they once had, and the operational amplifiers which were once made using tubes, and then transistors, are now made as ICs. The requirements are still pretty much the same, because our current definition of an operational amplifier is a high gain DC-coupled amplifier whose behaviour can easily be controlled by using negative feedback. Since the behaviour (gain, bandwidth, shape of gain-bandwidth curve) is so easily modified by the use of negative feedback, the operational amplifier is the nearest thing we have to an all-purpose amplifier, and that's why operational amplifiers were among the first linear ICs that were produced.

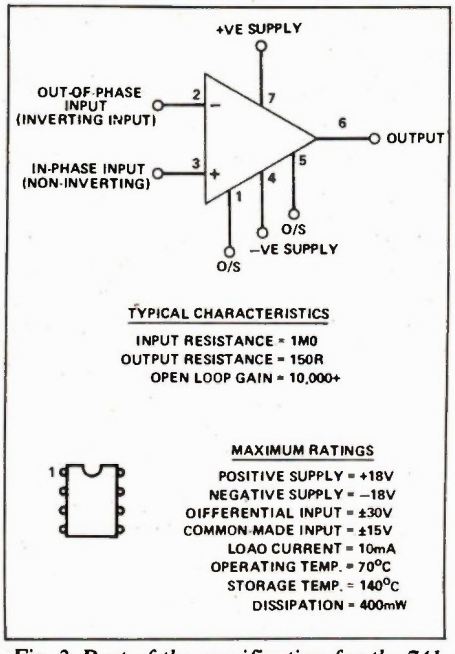

Fig. 2 Part of the specification for the 741 op-amp.

To start with, consider the typical specification of one of the best-known op-amps, the 741. This is illustrated in Fig. 2, to show how close we can get to the ideal specification. One point of importance is the bandwidth. If you use a 741 at its full gain, you must expect the bandwidth to be very severely limited — less than 100 Hz at maximum gain. Some care has to be taken if 741s are used in audio circuits, because in some feedback circuits that include filtering the chip may be working at a very high gain at the ends of the bandwidth, even though its midband gain is low.

Offset Problems

Getting down to configurations, the main

point about op-amp circuits is how to bias them. Very few applications call for the 741 to be operated as a differential DC amplifier at full gain, but for these applications a balanced power supply is needed. Additionally, some form of input offset balancing will be needed. This is necessary because there are bound to be some very small mis-matches between the resistors and transistors that make up the two input circuits (more on this later). The gain of the op-amp is so high that any imbalance will be amplified up, so that with both inputs tied to zero, the output of the op-amp will not be zero by quite a margin.

Manufacturers usually specify typical and maximum *input offset voltage* and *input offset current*. These are the differences between the input voltages and the input currents (with both inputs very close to zero volts) needed to obtain an output voltage of zero. With the 741 and many other op-amps there are offset trim connections that allow you to trim out the voltage offset. A circuit for the 741 is shown in Fig. 3. However, the input currents will still be slightly different, and there may be the odd circuit for which this will need to be taken into account.

The offset adjustment will have to be repeated at intervals, because the settings

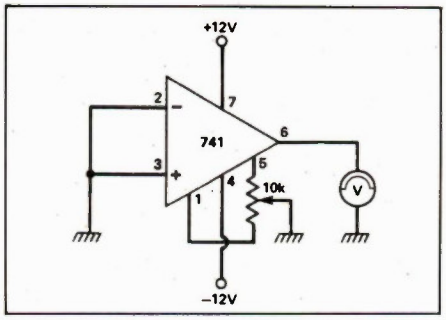

Fig. 3 Using the offset adjustment to balance out the internal currents.

drift. The effect of temperature and time conspire to make the output voltage change (drift) away from zero, so that an op-amp at full gain is a rather unstable device which needs frequent checking. Fortunately, we seldom need to make use of the full gain of the op-amp, and most of the circuit configurations make use of feedback bias circuits.

Figure 4 shows one of the most common bias methods. The circuit uses a balanced power supply, and bias is obtained by connecting a resistor between the output and the out-of-phase or inverting input (marked as -). The in-phase or non-inverting input (+) is connected to earth, so that the output voltage will be almost zero, just enough to apply the correct offset voltage (which is usually less than a millivolt) to the inverting input. The gain of this circuit depends on the resistance of the signal source. If we represent this as a resistor in series with the input, R1, thenthe gain is simply -R2/R1 (the — sign indicates that the signal is inverted).

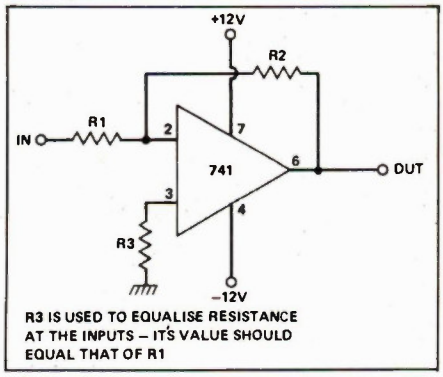

Fig. 4 The feedback bias system in a circuit which uses the out-of-phase, or inverting input for signals.

This circuit is DC-coupled throughout, but if we do not need DC gain, then a single-ended supply version can be constructed, as indicated in Fig. 5. Capacitor coupling must then be used to

avoid shorting out the bias voltage, choosing capacitors with low leakage, and the supply voltage must be adequate. The quoted minimum voltage across the chip is 3 V.

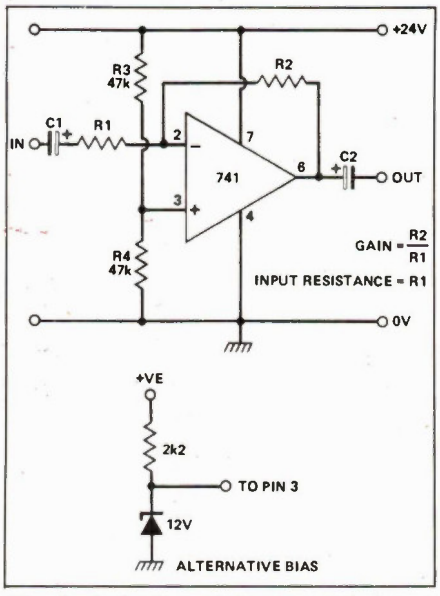

Fig. 5 A single-ended power supply version of the Fig. 4 circuit.

When this configuration is used, the inverting input voltage remains practically constant when a signal is applied. When a balanced power supply is used, in fact, the inverting input is virtually at earth voltage, and this 'virtual earth' effect means that signals applied to the input terminal (one end of R1) are flowing through R1 to a point which is as good as grounded as far as signals are concerned. This makes the input resistance of the circuit equal to the value of R1, and it limits the application of the circuit to some extent, because if the input resistance is to be reasonably high, then the feedback resistor R2 will have to be of an unreasonably high value to achieve a modest gain. If the feedback resistor has too high a value (in the megohm region), then the bias currents at the input of the chip, typically 200nA, will cause voltage drops which we can't ignore without making our calculations go considerably astray. The input resistance of the op-amp itself is large, but the use of negative feedback to the same input as the signal makes the input resistance low because of the 'virtual-ground' effect.

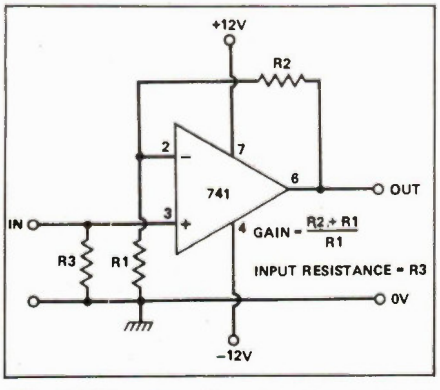

Fig. 6 Using signal input to the in-phase, or non-inverting input of the 741.

Improved Impedances

Another configuration of the op-amp is illustrated in Fig. 6. This time the input is taken to the non-inverting input, and the inverting input is used only for the feedback. In this balanced version of the circuit, the input resistance can be higher, because the resistance R3 does not control the gain of the amplifier, and the source resistance is of no interest unless it is unusually high. The gain is given by (R2+R1)/R1.

It's quite straightforward to combine the biasing arrangements of Fig. 5 with the non'inverting circuit of Fig. 6. However, a word of caution: all those resistors and all those capacitors combine to form low'pass filters, and at frequencies around their cut'offs, these will all produce considerable phase-shifts and this may lead to what you've designed as an amplifier actually turning out to be an oscillator!

Slewing About

The 741 type of operational amplifier has a lot of merits, but it is a design which is now showing its age. Much more recent designs have, in particular, wider bandwidths, and are impressively better in one respect — slew rate. The slew rate of an operational amplifier is the maximum rate-of-change of output voltage expressed in volts per microsecond, and it affects large signals (which change by a greater voltage) more than small signals. The point is that if the maximum rate of change of voltage is 1 V/us, then a 10 V change would need 10 us, and a 10 V signal is limited to one tenth of the bandwidth of a 1 V signal. the effect in practical terms is that the useful bandwidth of the amplifier for sine waves depends on the amplitude of the waves, and the shape of output for a square wave input also depends on the amplitude of the wave.

Slew rate limiting is caused by stray capacitances within the chip. When voltages change, these stray capacitances have to be charged or discharged, and the amount of current which flows in the input stages is very small, not enough to allow these capacitances to be charged or discharged quickly. All amplifiers suffer from this to some extent, but slew rate is much less of a a problem for discrete component circuits whose circuits are not DC-coupled and which can therefore use large currents and small values of load resistors. The typical slew rate of the 741 is 0.5 V/us, and this is rather poor in comparison with more modern designs such as the Motorola MC1741S, which has a slew rate of 15 V/us.

The other feature of the 741 which causes problems is that the peak amplitude of signal output must not be allowed to approach the supply voltage limits, because the internal biasing is no longer effective if this is done. This restriction can be quite irksome if the op-amp is to be used with low voltage single-ended supplies, and an alternative for such applications is the current difference amplifier (CDA), of which the best known example is the National Semiconductor LM3900N. This chip is an operational current amplifier whose internal circuitry, though remarkably similar to that of the 741, allows operation at output voltage levels very close to either of the supply voltages.

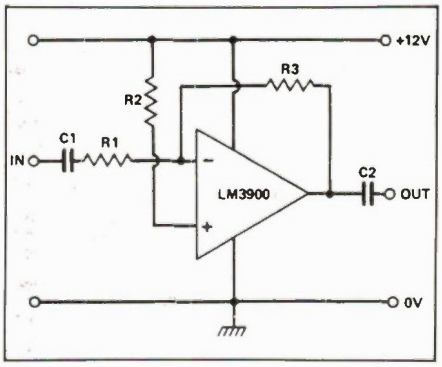

Fig. 7 A typical LM3900 circuit

The design principles for CDAs are very different from those used in the 741. The output voltage depends on the difference between the currents at the two inputs, and the circuits that use these chips are distinguished by large resistor values. In the circuit of Fig. 7, for example, if we aim for an output voltage which is half of the supply voltage, then, remembering that the current through R3 must be the same as the current through R2. Since the input currents are very low, these resistor values have to be high, and values of several megohms are common. The voltage gain in the circuit shown is R3/R1, as for the 741 type of amplifier, but the voltage swing at the output can reach very close to the supply voltage limits. Current difference amplifiers are used mainly in circuits which operate at the lower ranges of frequency because of the effects of stray capacitances on the very large value bias resistors. ■

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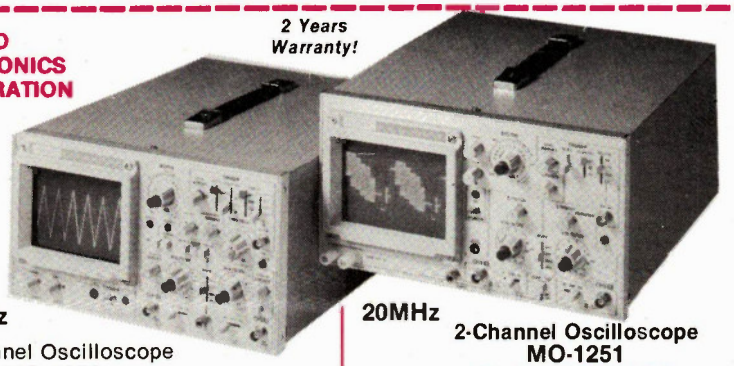

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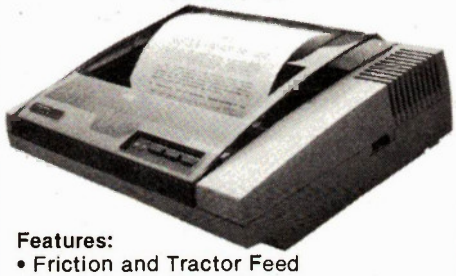

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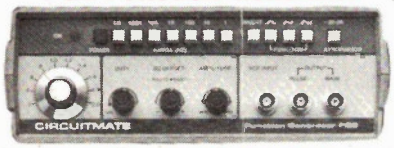

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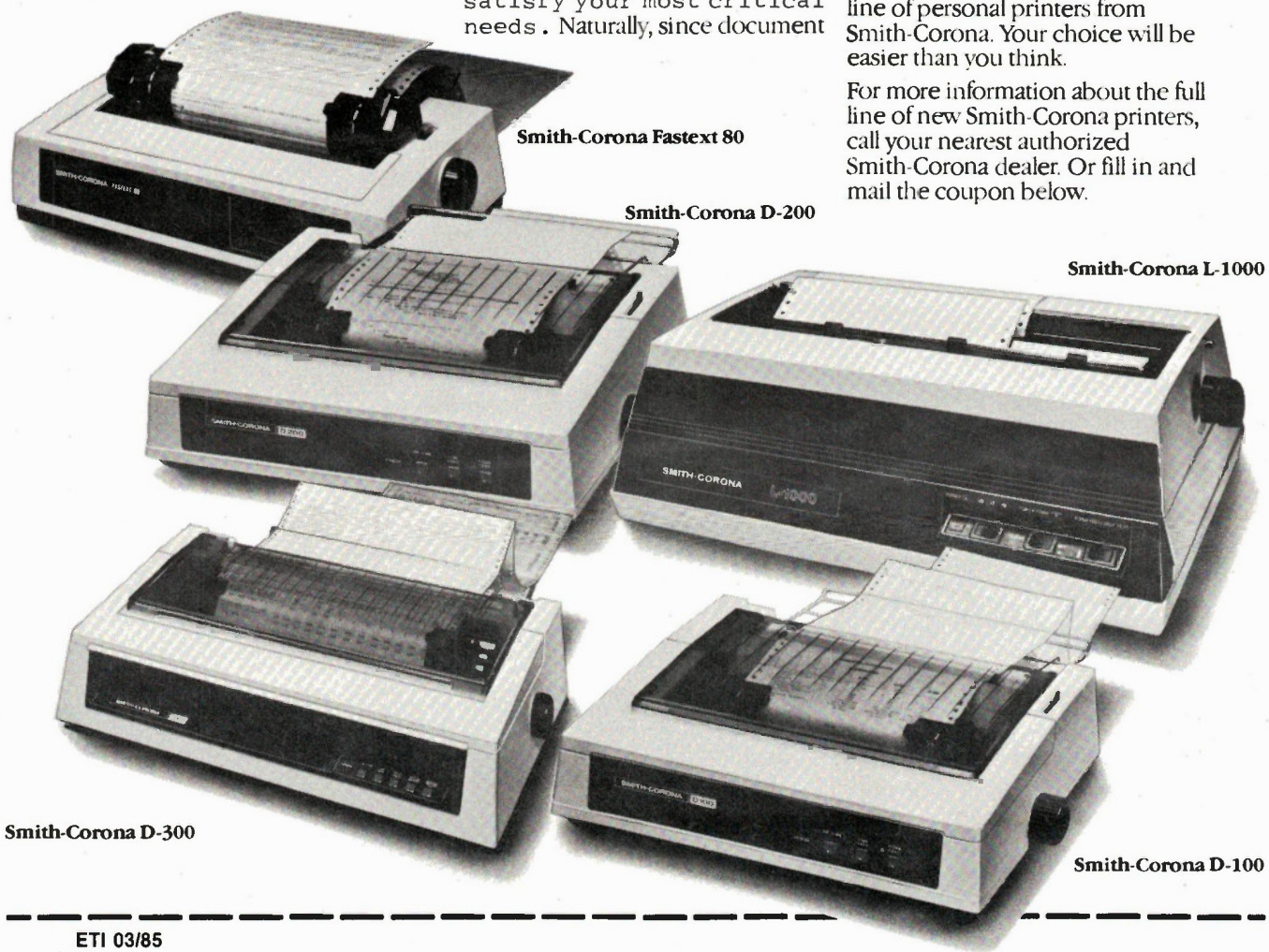

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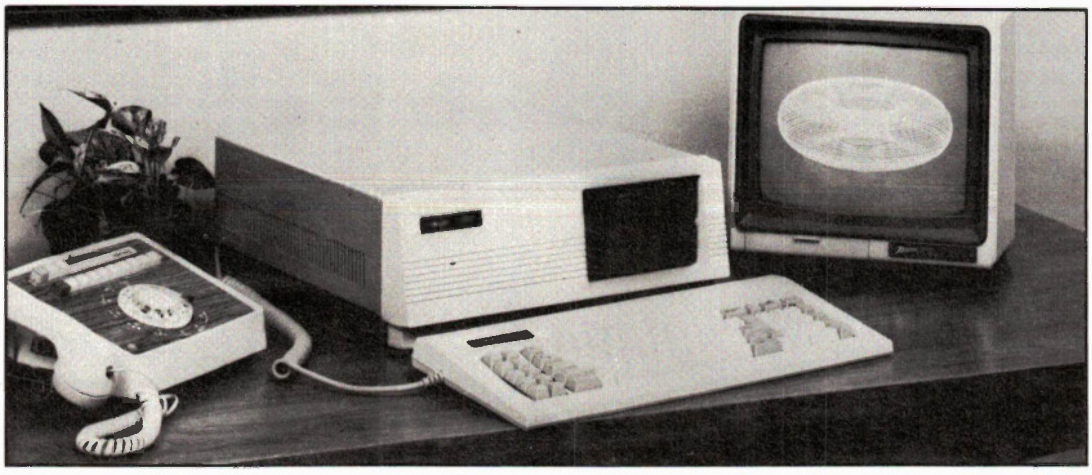

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Circle No. 28 on Reader Service Card

By Roger Allan

Electronics in Action

Medical electronics, a new light pen, and a robot turtle.

IN matters dealing with the great questions of life and death, time is a reality 'the purchase price for which exceeds gold' according to one poet. Every medical practitioner faces this reality (*sans* the gold) at least once a week during their professional career. As for patients, who have not had to wait a few days, if not a week, for the results of various medical tests to come back from the laboratory? The waiting, as usual, is always the hardest part.

There is, however, a new machine from France which will help in this sort of situation. Manufactured by Secomam, the ABC device is a biochemical analysis machine for the general practitioner and laboratory technician. Using a combination of micro-electronics and optics, the device performs analyses of the calorimetric measurement of a given solution; the calorimetric analysis using white serum; the kinetic analysis of enzymes; calibrated kinetic analysis and the measurement of optical densities.

It is user friendly. Dialogue with the machine is carried on in conversational English or French, whereby the user defines and program the analyses that are to be kept permanently in the machine's memory by entering the characteristic parameters of the function to be carried out by the machine (e.g., the type of measurement, wave length, temperature coefficients, calibration, etc.). A future reference to a particular analysis will then be sufficient to have the device carry out the requested calculation using the parameters stored in its memory. These calculations may be performed rapidly: 7 seconds for calorimetry and one to three minutes for enzyme kinetic analysis.

For example: calorimetric analysis is carried out by the device through the use of a standard measurement or coefficient, while when using white serum, the device optically measures the difference between the serum and its final coloration. There are two mechanisms for performing the kinetic analysis of enzymes. The first takes three minutes to perform. In the first minute, two initial points appear on a graph to show any hyperactivity. These points are not included in the subsequent calculations. During the following two minutes, four upper and four lower points are calculated, together with their average.

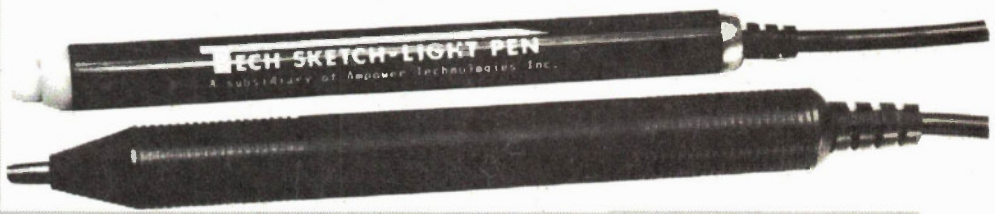
In the second method of enzyme analysis, two slopes appear on the graph. If the difference between them is greater than ten percent, the result is confirmed and the results are automatically printed by the machine. Otherwise, the device carries out a third measurement that is automatically compared with the second results of the second analysis. At the end of six minutes, if the slope of the graph does not level out, the measurement stops without confirming the results.

The device also allows the user to check the density of any solution through the use of spectrophotometry. Its weight is 22 kg. Readout is digital with an inbuilt paper printer for permanent records.

On second thoughts, while this device will buy time for the medical practitioner, I'm not at all sure I want to know I'm deathly ill that quickly.

ABC,
SECOMAM,
9, Rue de l'Escouvier Z.I.,
95200, Sarcelles,
France

Light Pens and Teaching



Light pens have been available for quite some time. They haven't always been particularly useful, depending on some optical realities which in the home sometimes got a bit fuzzy, almost as if they were something of a fad.

Recently a company in California developed one they call the *Touch Tip.* It comes in two version, one designed for high-resolution monitors, the other for standard TV sets. It is a bit up-market as it does not require the user to have to refer to the keyboard, possessing a touch-sensitive switch built into its tip (hence its name). For a complete breakdown as to how light-pens operate optically and electronically, see 'Bar Codes', *Electronics Today,* Nov 1984.

continued on page 59

Sanyo MBC-550

A low-cost MS-DOS computer from Sanyo, available with a variety of options.

By Bill Markwick

SANYO has a wide range of options for its MBC-550 series of MS-DOS computers; we were supplied with a 555-2 equipped with two 360K double-sided drives and 256K of RAM. The others, which are listed at the end of the review, differ only in RAM and disk drives and range from $1095 to the $1895 of our review model.

Unpacking

With the basic computer came a Sanyo CRT-30 green monitor ($199.95), a video cable, and a software package. The software consisted of systems disks, WordStar, SpellStar, MailMerge, InfoStar and accompanying documentation for the programs and the computer itself. The lower-priced models come with only WordStar,CalcStar and MS-DOS.

The computer itself is nicely finished in a gray steel cabinet and has a detachable keyboard connected by a coilcord. On the rear panel is a switched outlet which, incidentally, has an internal noise filter to suppress interference from non-Sanyo monitors. There are also slots for an optional RS232 connector and an optional joystick port. A Centronics-compatible printer port comes out through a D-type connector, and there are DIN sockets for the RGB colour output and keyboard input. The monochrome output is via the usual phono socket.

Just above the RGB socket is a slot for yet another video output. This is for the output of the 550-VB video card, an optional accessory which gives much better compatibility with IBM-type software; we'll get back to that in more detail later.

Taking the top off reveals a neat layout of drives and printed circuits, all connected by ribbon cable and connectors; these should make changing or servicing parts simple, and in addition, the main PCB slides out in a sort of drawer. A very quiet fan is located under one of the drives.

Lighting It Up

A bit of confusion sets in here. The MS-DOS was in two versions:one which ran the provided WordStar and CalcStar nicely, and one which was undocumented (at least, they didn't send any) and apparently refused to boot through the regular monochrome output. It turned out that the optional video display board that we had prefers its own version of MS-DOS; it's identified by having GW-BASIC on the label. Once we switched the video cable to the display board's own socket we found that it had actually booted correctly. Both systems have an 80 character by 25 line display.

The jazzier operating system will also run regular software such as WordStar, but had trouble displaying the simpler BASIC; it likes GW-BASIC, an extended version with superior graphics.

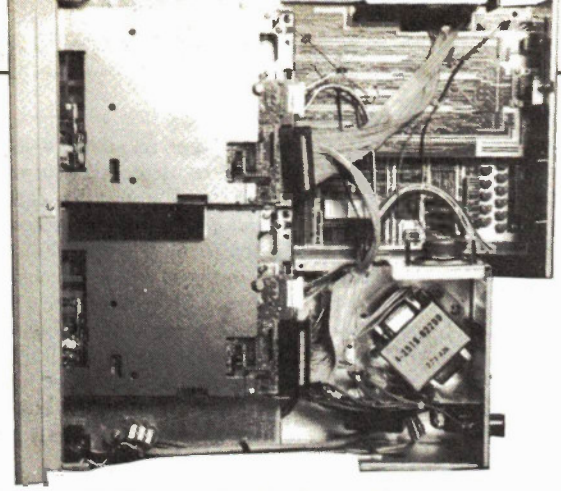
So if you find that non-Sanyo software looks weird (or dead) on your 550, you probably have booted the wrong operating system or you don't have the video display board (which can be identified by the presence of a 10-pin D-type video connector as well as a phono socket).

The two disk drives were the quietest I've ever come across. Because the red light on the drive indicates which drive is selected rather than the read/write function, it's usually difficult to tell whether the drive is running or not; you have to put your ear right up to it to hear much of anything.

Software

WordStar and CalcStar, as I mentioned, will run with either version of the operating system, but screen updating seems to be faster with the video display board in use. This is the great weakness of all MS-DOS computers; the 16-bit 8088 CPU is a whiz at calculating, but whenever it has to access any I/O function, it goes through a lengthy interrupt procedure that slows everything down to a treacly dribble.

As an example of how the video board improves the speed, the ordinary operating system and monochrome output listed a 15K textfile in 75 seconds. With the extended system and video board, the same file took 45 seconds to scroll up. It's also interesting to note that



The 555 with the top removed, showing the works-in-a-drawer approach.

The 550-series keyboard, somewhat condensed from other MS-DOS compatibles.

my creaky 8-bit CP/M system listed a similar file in 30 seconds.

This is not meant to demean the Sanyo system; most PC-DOS/MS-DOS computers are like this. Needless to say, the optional video board is highly recommended, not only for displaying IBM-type software, but for its general improvement in speed.

The next step was to secure a handful of various programs and check out compatibility. Where else can you play video games and get paid for it? In general, most PC-DOS and MS-DOS programs ran successfully as long as you used the video board output and booted with Sanyo's system. Certain programs didn't make it; according to a spokesman from Sanyo, the 550 doesn't like programs which have their own unique operating system, and he gave the Microsoft Flight Simulator as an example. On the other hand, the 550 series is aimed at business users, and all business applications loaded and ran properly. Peculiar operating systems seem to go hand and hand with some game software.

The Keyboard

Economy models have to cut corners somewhere, and the 550s have a stripped-down keyboard. For instance, the ten IBM function keys are condensed to five dual-function keys; the Shift key accesses the alternates. There's no ALT key; a translation table in the manual explains that this is now CRTL-Shift. The Insert and Delete keys are combined, Print Screen is missing, and Scroll Lock is replaced by a Break key.

The keyboard is very comfortable to use; it's closer to an electric typewriter in format than the IBM-style. The one thing that everyone found hard to get used to is the large distance between Shift keys (10 inches); this causes your text to fill up with arrows and asterisks until you get used to stretching a bit further for the Shift.

The cursor keys are incorporated in the numeric pad and accessed with the Num Lock. They're a delight to use in BASIC: just cursor up anywhere, make a change, and tap the Break key; the cursor returns to its previous position with your editing completed. They work nicely in WordStar as well, although the Linefeed key (IBM's End key) has now become CRTL-J (Help Menu). The numeric 2 key in WordStar now moves the cursor to the bottom of the screen.

Sanyo Meets Racter

During software testing, one of the programs I loaded in was "A Conversation With Racter", the famous mock-artificial-intelligence program that holds a sort of wild-eyed "conversation" with the user. An excerpt:

Me: Tell me about the Sanyo 555.
Racter: I won't tell you about the Sanyo 555. When a computer marries an artist, their children are correctly creative.
Me: Are you a Sanyo computer?
Racter: No. Bill, the programmer. Achoo! This'll break you up! Silicon! Silicon! If you drain sherry is that silicon? No, silicon is a contract and an ambiguity.
Me: Again, are you a Sanyo?
Racter: Ah, yes. It's true. Hi-tech humans and soft computers should get along.

I'm not sure what this sort of thing added to the general situation, other than the fact that Racter's many accesses to the disk were done quickly and quietly.

BASICs

The two BASICs included (if you have the display board) are Sanyo BASIC and GW-BASIC from Microsoft. Sanyo's is similar to most Microsoft versions in its basic commands, but includes beautiful full-screen editing and quite a set of graphics commands. There are 8 colours available, and graphics display with a resolution of 640 by 200 pixels. There is also a way of designing huge graphic displays up to 32768 by 32768 pixels by using the WINDOW and VIEW statements; the graphics screen can then scroll around the large map.

Another interesting feature of Sanyo BASIC is the use of the CRTL key to give you keywords. For instance, the familiar CRTL-C is no longer "Break" but writes CLOSE to the screen for file-handling. Similarly, CRTL-G no longer beeps, but writes GOTO. The Break function has its own key, and you can still get the sound by typing BEEP.

Incidentally, the Sanyo has the worst-sounding beeper I have ever heard, a loud raucous raspberry that caused one of the comedians in the office to remark that we should install a voice synthesizer in the 555 so it could say "Excuse me".

The GW-BASIC was on the system disk that required the video card. It also has the keyword system, though in this case you press CRTL-Shift and a letter key (ALT on the IBM). It has the usual comprehensive graphics (Paint, Draw, Line, Screen, etc.) and the same 640 by 200 pixel resolution.

GW also has a sound function which is missing on the Sanyo BASIC. The Play command allows you to play a tune, selecting the notes and their duration, background or foreground, etc. It's kind of an awkward way to make music, but at least it'll add to your programming impressiveness.

Both BASICs have a set of graphics characters available with the Graphics key; this key changes the alphanumerics to various lines, angles, and shading textures. This feature is in ROM rather than software and so is also available in MS-DOS if you can think of anything to do with it.

Expanding

Should you be the purchaser of a strip-

ped-down model, you won't have any trouble upgrading it. Additional drives can be installed with nothing more than a screwdriver to remove the lid. The memory can be expanded 64K at a time to a total of 256K just by inserting RAM chips into the onboard sockets; since the 8088 can address one megabyte, the 256K limit would seem to be due to a lack of board space for the necessary socketing.

An 8087 arithmetic coprocessor socket is fitted next to the 8088, and adding the coprocessor will speed up calculations; most people will probably want to wait around rather than pay the price for this Intel chip (the cheapest I've seen is $200).

The MBC-232C serial card fastens to the back panel and plugs into the motherboard, giving you an RS-232C output which has a default baud rate of 1200, though it can be set to any other rate.

Sanyo also has colour monitors, joysticks, etc.

Docs

Sanyo's documentation consists of two binders. One is general information about the hardware, MS-DOS, and BASIC; the other is a thick instruction manual for the accompanying software. All manuals were well written and produced, though little is included for the heavy-duty programmer; there isn't any explanation of the DEBUG program, for instance. However, for the intended business market the documentation is excellent. I had never used CalcStar before, and the included tutorial soon had me doodling through the spreadsheet in no time.

Like other manufacturers, Sanyo is faced with the problem of how much to say about BASIC. Their manual is adequate, but not up the level of the CalcStar explanation. Again, they may feel that the intended market is not concerned with complex program generation.

In General

In general, you'll have to go on a long search to find a better deal. All you need besides the computer is a monitor and if desired, a parallel-port printer. There are no extra plug-ins to buy, although, as I mentioned, the optional video controller display card is a very good idea. The machine may not appeal to computer "hackers", because the memory is limited to 256K and there are no expansion slots as found on many IBM work-alikes. However, it has everything it needs for most small business applications.

While the machine is not 100 per cent compatible with IBM, it will run all popular MS-DOS business software; Sanyo dealers should have information on compatibility with specific programs.

Quick Reference

Sanyo MBC-550 Series

CPU: 8088
RAM: 128K to 256K
I/O: Centronics parallel, RGB video, monochrome video
DOS: Microsoft MS-DOS
Models: 550: 128K, 1 160K drive, $1095. 550-2: 128K, 1 360K drive, $1295. 555: 128K, 2 160K drives, $1595. 555-2: 128K, 2 360K drives, $1895.
Source: Local dealers, or contact: Sanyo Canada Inc., 50 Beth Nealson Drive, Toronto, Ont. M4H 1M6 (416) 421-8344.

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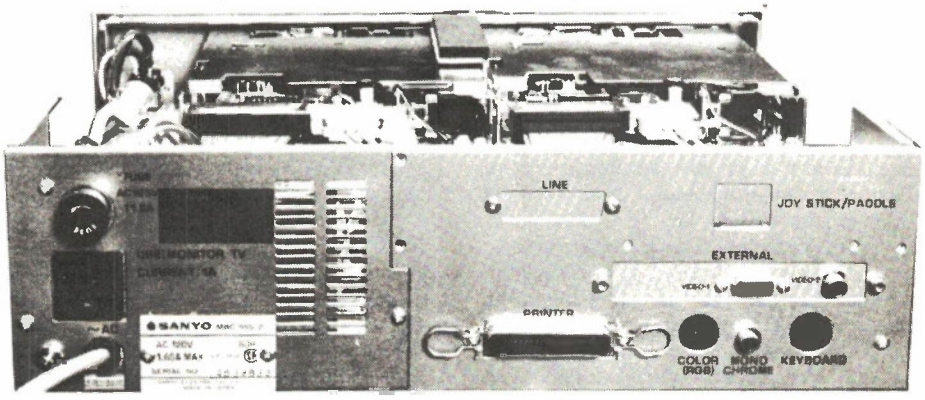
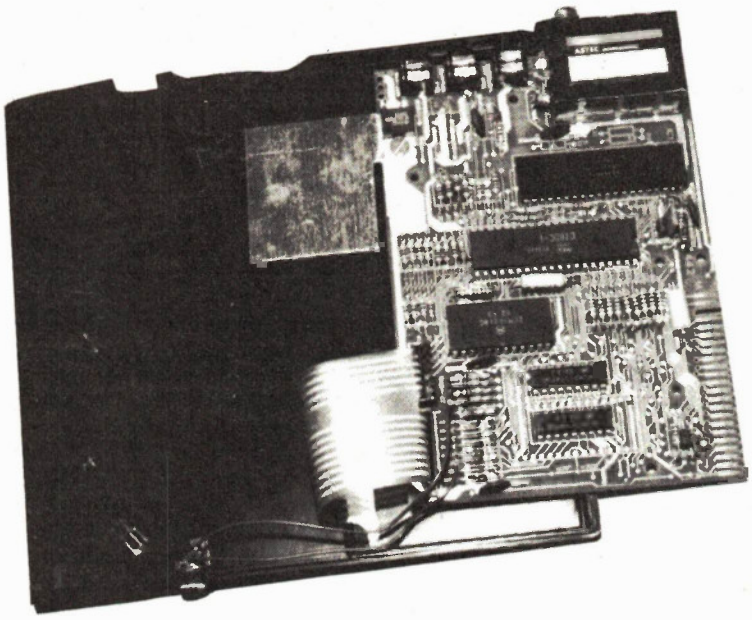


The rear panel, showing the optional video card connections.



A VIC-20, ZX81, or Commodore 64 can become a communications device for the severely handicapped.

By Ron D.C. Coles

Visu Writer

IF you are aware of anyone who is unfortunate enough not to be able to communicate in the way we normally take for granted, i.e., by speaking, writing, typing or by some other means which requires the use of hand movements, then this method, which is mainly software, will permit a Sinclair ZX81/T.S.1000, Commodore Vic or Commodore 64 to become a powerful device which could restore the ability to communicate.

These software programs were written by Trevor Awalt, who was stirred by the plight of a friend whose wife had become ill with a muscular disease. The illness had left her almost totally paralysed, without the ability to speak or to move her hands. Trevor came to the rescue with a program he wrote for the ZX81/TS1000. He later improved and rewrote the program for the Commodore Vic, and the Commodore 64.

The program, which requires the 16K RAM Pack with the Sinclair, will display on the screen the alphabet, numbers from 0 to 9 and punctuation marks. There are also the characters +, −, , and * which are actually functions. The + indicates Next Menu, the − indicates Previous menu, the indicates a space or new line, and the is the instruction to erase the last character or word. When the Z key is pressed, the cursor, which is in inverse video, will increment slowly from left to right, stopping momentarily above each column of letters or words. If the Z key is pressed when the cursor is stopped, it will descend vertically down the selected column pausing momentarily on each character or word in the column. The Z key can then again be pressed on the desired character or word, and the selection will be displayed on the top of the screen with the cursor reverting back to the start ready for the next choice. In this way, the handicapped person can construct words and sentences and can communicate with only the need to press one key.

Basic Operation

When this program was originally written, the handicapped person was not even able to press a normal computer key which completely eliminated the use of the Sinclair keyboard, so a simple pressure switch was connected into the ZX81/TS1000, as shown in the photo. The pressure switch was then positioned so that a slight movement of the patient's head was sufficient to provide the required input condition to the computer.

Earlier in 1984, as the prices of computers dropped, Trevor acquired a Commodore VIC, and realizing he now had more flexibility, started to improve Visu Writer. He included an audible alarm when the word HELP! is selected, and a screen dump program to permit letters to be composed on the screen and then dumped to a printer while still using the single key or remote pressure switch. The convenience of a joystick port also made the attachment of an external pressure switch much simpler, removing the need for someone to get inside the computer to solder on wires. This latter consideration was of utmost importance to many people who otherwise might be put off by the prospect of doing surgery on their computer.

Further upgrading of the Visu Writer for the Commodore 64 has permitted the number of word menus that have to be selected to be decreased because of the 64's increased screen capacity of 40 columns over the Vic's 22 columns. Therefore, more words have been added to each menu. The selection of the screen dump feature in both of the Commodores uses the symbol () which appears on the function column of each menu.

The Software

The programs for the Vic and the 64 are very similar. The main difference between the Commodore and the Sinclair versions is that the screen data must first be loaded into a file. This is done by first loading the file program "menu data" into the computer and then running this program in order tocreate a sequential file. Once this is done and the file has been created, the main program, Visu Writer, is loaded and run in the normal way. Once the file program has been run, it automatically creates and saves the file on tape or disk. Therefore, for all subsequent loads, only the main Visu Writer program need be loaded as this program will search for the menu data file which should already be on the same tape or disk (before starting, make sure that you have enough capacity on your tape or disk to save the two programs and one file).

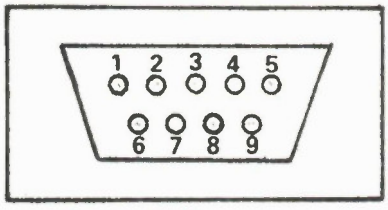
Once the programs have been loaded, the screen fills with instructions. The instructions are the same for all three computers, the menu can be changed forward by selecting +, or backward by selecting −. Each menu appears on the lower half of the screen, separated by a horizontal line, leaving the upper half of the screen for the text. The menus are arranged alphabetically and contain 15 words per menu on the Sinclair, 10 words per menu

on the Vic version, and 20 words per menu on the C64 version. This gives a total of 75 words on the Sinclair, 70 words on the Vic and 80 words on the C64. The first menu contains the alphabet and punctuation etc. The remaining menus contain a selection of words. The words were chosen from the specsheet of National Semiconductor's Speech Synthesiser Chip Set (DigiTalker) and also from words that were likely to be used by someone who was disabled. The words range from "AGAIN" to "YES". Also, the user can jump back to the start to read the instructions again by selecting the * function. This is a useful feature for clearing the screen or for those with short memories.

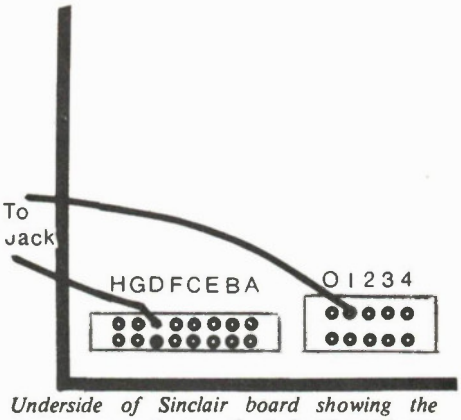
Operating

Some points to note are: the program requires the 16K RAM Pack for the Sinclair, and the 8K expansion for the Vic; the C64 has oodles of memory. In the C64 version the screen takes a few seconds to initialize after pressing the key (or switch) when starting from the instructions; don't turn off the computer thinking that something is wrong. There are also minor changes to make in the Commodore versions in order to change from tape to disk. In the listings shown, the Vic program is written for tape, and the C64 is written for disk. You will notice that line 25 reads "open1,1,0,etc". The second 1 identifies the datasette, the same line in the C64 version reads "open1,4,0 etc". In this case, the 4 identifies the disk drive. This line and also line 20 in the "MENU-DATA" program will require changing, depending on which storage device is used. *Due to space restrictions we were unable to print the VIC-20 listing of Visu Writer. If you would like a copy of the software on tape, contact Ron Coles at the address given at the end of this article.*

The speed of the cursor can be adjusted by changing the appropriate line. In the Sinclair, it's line 5910 where a FOR-NEXT loop is used to slow the cursor; if the speed needs to be increased, then the number 25 should also be decreased and vice versa. On the Vic and on the C64, the line number is 3010. In these programs, the speed of the cursor is changed by adjusting the value of 50.



Commodore joystick connector pin numbers.



Underside of Sinclair board showing the jumper connections to the jack. The jack can be loose or mounted to the case.

It has been suggested that the alphabet menu should be laid out in the QWERTY format. This may prove to be an advantage for a person who had been used to typing before becoming disabled. Also, some of the words in the word menus may not be appropriate. The great advantage of the computer is that these features can be changed by simple manipulation of the software, as follows:

```
  10 REM **VISU-WRITER**
  20 REM **SEPT 84**
  30 REM **TREVOR AVALT**
  45 CLS
  46 LET S=1
  47 LET EL=32
  48 LET SL=1
  50 LET DS=((PEEK 16397)*256)+P
EEK 16396
  60 GOSUB 6000
  70 GOSUB 5800
  80 CLS
  85 POKE (DS+1),4
  90 GOTO 7000
 110 POKE (DS+496),4
 115 GOSUB 5800
 120 POKE (DS+496),0
 130 FOR P=1 TO 15
 140 NEXT P
 200 REM **COLUMN MOVE**
 210 FOR I=DS+499 TO DS+523 STEP
 3
 220 POKE I,4
 230 GOSUB 5900
 240 POKE I,0
 250 IF FLG=1 THEN GOTO 300
 260 NEXT I
 280 GOTO 110
 300 REM **ROW MOVE**
 310 LET R=I+66
 320 FOR I=R TO R+132 STEP 33
 330 LET V=PEEK I
 340 POKE I,(V+128)
 350 GOSUB 5900
 360 POKE I,V
 370 IF FLG=1 THEN GOTO 450
 380 NEXT I
 400 GOTO 110
 450 REM **FUNCTION BRANCH**
 460 IF V=21 THEN GOTO 4200
 470 IF V=22 THEN GOTO 4400
 480 IF V=18 THEN GOTO 4600
 490 IF V=19 THEN GOTO 4800
 500 IF V=23 THEN GOTO 45
 510 GOSUB 4000
 530 GOTO 110
1000 REM **WORD PART**
1005 POKE (DS+496),4
1010 GOSUB 5800
1100 REM **WORD COLUMN**
1110 POKE (DS+496),0
1120 FOR P=1 TO 15
1130 NEXT P
1135 LET I=DS+499
1140 POKE I,4
1150 GOSUB 5900
1160 POKE I,0
1170 IF FLG=1 THEN GOTO 1300
1180 FOR I=DS+502 TO DS+518 STEP
 8
1190 POKE I,4
1200 GOSUB 5900
1210 POKE I,0
1220 IF FLG=1 THEN GOTO 1300
1230 NEXT I
1250 GOTO 1000
1300 REM **WORD ROW**
1310 LET R=I+66
1320 FOR I=R TO R+132 STEP 33
1330 LET V=PEEK I
1340 POKE I,(V+128)
1350 GOSUB 5900
1360 POKE I,V
1370 IF FLG=1 THEN GOTO 1500
1380 NEXT I
1400 GOTO 1000
1500 REM **WORD FUNCTION**
1520 IF V=21 THEN GOTO 4200
1530 IF V=22 THEN GOTO 4400
1540 IF V=18 THEN GOTO 8200
1550 IF V=19 THEN GOTO 8400
1560 IF V=23 THEN GOTO 45
1570 GOSUB 2000
1580 GOTO 1000
2000 REM **PRINT WORD**
2010 LET V=PEEK I
2020 POKE (DS+S),V
2030 LET S=S+1
2040 GOSUB 5000
2050 IF V=0 THEN GOTO 2080
2060 LET I=I+1
2070 GOTO 2010
2080 POKE (DS+S),4
2090 RETURN
4000 REM **PRINT CHARACTER**
4010 GOSUB 5000
4020 POKE (DS+S),V
4030 LET S=S+1
4040 GOSUB 5000
4050 POKE (DS+S),4
4060 RETURN
4200 REM **NEXT MENU**
4210 IF MNU=1 THEN GOTO 7200
4220 IF MNU=2 THEN GOTO 7400
4230 IF MNU=3 THEN GOTO 7600
4240 IF MNU=4 THEN GOTO 7800
4245 IF MNU=5 THEN GOTO 8000
4250 IF MNU=6 THEN GOTO 7000
4400 REM **LAST MENU**
4405 IF MNU=1 THEN GOTO 8000
4410 IF MNU=2 THEN GOTO 7000
4420 IF MNU=3 THEN GOTO 7200
4430 IF MNU=4 THEN GOTO 7400
4440 IF MNU=5 THEN GOTO 7600
4450 IF MNU=6 THEN GOTO 7800
4600 REM **SPACE**
4610 LET V=0
4620 GOSUB 4000
4640 GOTO 110
4800 REM **ERASE CHARACTER**
4810 GOSUB 5100
4820 POKE (DS+S),0
4830 LET S=S-1
4840 GOSUB 5100
4850 POKE (DS+S),4
4860 GOTO 110
5000 REM **FWD SCREEN PTR**
5010 IF S<=EL THEN GOTO 5080
5020 LET S=S+1
5025 LET SL=S
5030 LET EL=S+31
5040 IF S<463 THEN GOTO 5080
5050 LET S=1
5060 LET SL=S
5070 LET EL=S+31
5080 RETURN
5100 REM **RVS SCREEN PTR**
5110 IF S>=SL THEN GOTO 5190
5120 LET S=S-1
5130 LET EL=S
5140 LET SL=S-31
5150 IF S>0 THEN GOTO 5190
5160 LET S=461
5170 LET EL=S
5180 LET SL=S-31
5190 RETURN
5800 REM **KEY PUSH**
5810 IF INKEY$="Z" THEN GOTO 583
0
5820 GOTO 5810
5830 IF INKEY$="" THEN GOTO 5850
5840 GOTO 5830
5850 RETURN
5900 REM **KEY**
5910 FOR P=1 TO 25
5920 IF INKEY$="Z" THEN GOTO 596
0
5930 NEXT P
5940 LET FLG=0
5950 RETURN
5960 IF INKEY$="" THEN GOTO 5980
5970 GOTO 5960
5980 LET FLG=1
5990 RETURN
6000 REM **INSTRUCTIONS**
6010 PRINT AT 0,10;"VISU WRITER"
6020 PRINT AT 1,10;"▄▄▄▄▄▄▄▄▄▄▄"
6030 PRINT AT 3,0;"1:PRESS KEY T
O START CURSOR"
6040 PRINT "2:PRESS KEY AGAIN TO
 PICK COLUMN"
6050 PRINT "3:PRESS KEY AGAIN TO
 DO A "
6060 PRINT "  FUNCTION OR PRINT
THE LETTER,"
6070 PRINT "  NUMBER OR WORD."
6080 PRINT AT 10,10;"FUNCTIONS"
6090 PRINT AT 11,10;"▄▄▄▄▄▄▄▄▄"
6100 PRINT AT 13,0;"+  NEXT MENU
"
6110 PRINT "-  LAST MENU"
6120 PRINT ">  SPACE/NEW LINE"
6130 PRINT "<  ERASE(CHAR/WORD)"
6140 PRINT "*  START OVER"
6150 PRINT AT 20,6;"[illegible]
[illegible]"
6160 RETURN
7000 REM **MENU 1**
7010 GOSUB 9000
7030 PRINT AT 14,0;"▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄
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7050 PRINT AT 17,3;"+   A   F   K
P   U   Z   0   5"
7060 PRINT AT 18,3;"-   B   G   L
Q   V   .   1   6"
7070 PRINT AT 19,3;">   C   H   M
R   W   ?   2   7"
7080 PRINT AT 20,3;"<   D   I   N
7090 PRINT AT 21,0;"■   *   E   J
O   T   Y   ,   4   9"
7100 LET MNU=1
7110 GOTO 100
7200 REM **MENU 2**
7210 GOSUB 9000
7260 PRINT AT 17,3;"+  AGAIN     C
HAIR     DOOR   "
7270 PRINT AT 18,3;"-  AND       C
HANGE    DOWN   "
7280 PRINT AT 19,3;">  BATH      C
HECK     DRINK  "
7290 PRINT AT 20,3;"<  BED       C
LOSE     EYES   "
7300 PRINT AT 21,0;"■  *  BLIND
  DATE     FAN  "
7310 LET MNU=2
7320 GOTO 1000
7400 REM **MENU 3**
7410 GOSUB 9000
7460 PRINT AT 17,3;"+  FEET      H
AVE      HIGHER"
7470 PRINT AT 18,3;"-  FLOOR     H
EAT      IN     "
7480 PRINT AT 19,3;">  GET       H
ELLO     IS     "
7490 PRINT AT 20,3;"<  GREAT     H
ELP      IT     "
7500 PRINT AT 21,0;"■  *  HAIR
  HIGH     LATER "
7510 LET MNU=3
7520 GOTO 1000
7600 REM **MENU 4**
7610 GOSUB 9000
7660 PRINT AT 17,3;"+  LEFT      L
OWER     NO     "
7670 PRINT AT 18,3;"-  LESS      M
EAL      NOSE   "
7680 PRINT AT 19,3;">  LIKE      M
ORE      NOW    "
7690 PRINT AT 20,3;"<  LIPS      M
OVE      NUMBER"
7700 PRINT AT 21,0;"■  *  LOW
  MY       NURSE "
7710 LET MNU=4
7720 GOTO 1000
7800 REM **MENU 5**
7810 GOSUB 9000
7860 PRINT AT 17,3;"+  OFF       O
VER      RIGHT  "
7870 PRINT AT 18,3;"-  OK        P
ILLS     ROOM   "
7880 PRINT AT 19,3;">  ON        P
LEASE    SET    "
7890 PRINT AT 20,3;"<  OPEN      P
LUS      START  "
7900 PRINT AT 21,0;"■  *  OUT
  READY    STOP  "
7910 LET MNU=5
7920 GOTO 1000
8000 REM **MENU 6**
8010 GOSUB 9000
8020 PRINT AT 17,3;"+  THAN      T
RY       WATER  "
8030 PRINT AT 18,3;"-  THE       T
.V.      WINDOW"
8040 PRINT AT 19,3;">  TIME      U
NEASY    WIPE   "
8050 PRINT AT 20,3;"<  TIRED     U
P        WOULD  "
8060 PRINT AT 21,0;"■  *  TO
  WASH     YES   "
8070 LET MNU=6
8080 GOTO 1000
8200 REM **CURSOR DOWN**
8210 POKE (DS+S),0
8220 LET SL=SL+33
8230 LET S=SL
8240 LET EL=S+31
8250 IF S<463 THEN GOTO 8290
8260 LET SL=1
8270 LET S=SL
8280 LET EL=S+31
8290 POKE (DS+S),4
8300 GOTO 1000
8400 REM **ERASE WORD**
8410 FOR I=1 TO 2
8420 POKE (DS+S),0
8430 LET S=S-1
8440 GOSUB 5100
8450 NEXT I
8460 LET C=PEEK (DS+S)
8470 IF C=0 THEN GOTO 8520
8480 POKE (DS+S),0
8490 LET S=S-1
8500 GOSUB 5100
8510 GOTO 8450
8520 LET S=S+1
8530 GOSUB 5000
8540 POKE (DS+S),4
8550 GOTO 1000
9000 REM **CLR MENU**
9010 FOR K=15 TO 21
9020 PRINT AT K,0;"
                                "
9030 NEXT K
9040 RETURN
9050 STOP
```

Listing of the Sinclair version of Visu Writer.

In the Sinclair, the menus exist between lines 7050 and 8060. As you can see, by simply changing the letters and words, you can customize your own program to meet your particular needs. Remember that if you do modify the program, be sure that the new letter occupies the exact position of the old letter, and in the case of new words, the first letter of the new word must occupy the same location as its predecessor. Also, the word must not exceed 6 characters.

Changing the menus on the Commodores is not quite as simple. Here, the data files have to be modified, and that requires some careful planning before you start modifying the program.

In the Commodore, the screen is created by poking the appropriate screen display code which is read from the "menu data" file. You will notice, that the file program consists of lots of numbers. Each number is the code for a character. You will see an abundance of 32s; that's because 32 represents a space. The list of codes is in the back of the Commodore User's Guide. By carefully decoding the data file, you will see how each menu is constructed, and you will be able to change the codes to represent new words or to rearrange the order of the alphabet in the first menu. Remember not to change the starting position of any of

```
1 REMVISU WRITER
2 REM AUG 84
3 REMTREVOR AWALT
5 PRINT"■■"
10 POKE51,0:POKE52,88
15 POKE55,0:POKE56,88
20 CLR
25 OPEN2,8,2,"0:MENU,S,R"
30 FORI=22530TO23529
35 INPUT#2,D
40 POKEI,D
45 NEXTI
48 CLOSE2
55 S=1024
100 PRINT"■";TAB(6);"VISU WRITER"
110 PRINTTAB(6);"────────"
120 PRINT"1:PRESS KEY TO START CURSOR."
130 PRINT"2:PRESS KEY AGAIN TO PICK
    COLUMN."
140 PRINT"3:PRESS KEY AGAIN TO PRINT
    THE LETTER, SYMBOL,NUMBER OR WORD."
150 PRINT"OR TO CHANGE MENU,DELETE ETC."
160 PRINTTAB(7),"FUNCTIONS"
170 PRINTTAB(7),"  ─────────"
180 PRINT"+  NEXT MENU"
190 PRINT"-  LAST MENU"
200 PRINT">  SPACE/NEW LINE"
210 PRINT"<  ERASE(CHAR/WORD)"
220 PRINT"*  START OVER  "
225 PRINT"@  SCREEN DUMP"
230 PRINT"                    "
235 PRINT"          PRESS KEY TO BEGIN"
240 GOSUB5000
250 PRINT"■"
300 REM INIT SCRN
310 FOR SCRN=55296TO56295
320 POKESCRN,1
330 NEXTSCRN
350 REM DRAW LINE
360 FORLINE=1744TO1783
370 POKELINE,67
380 NEXTLINE
400 REM MENU#1
410 DS=22530:DF=22729
420 GOSUB5500
500 REM SET CURSORS
510 POKE1024,228
520 POKE1787,228
530 GOSUB5000
600 REM COLUMN MOVE
610 POKE1787,32
620 FORW=1TO100:NEXTW
630 FORI=1790TO1820 STEP3
640 POKEI,228
650 GOSUB 3000
660 IF FLG=1THEN900
690 POKEI,32
700 NEXTI
720 GOTO520
900 REM ROW MOVE
902 POKEI,32
905 RT=I+40:RB=I+200
910 FORI=RTTORBSTEP40
920 V=PEEK(I)
930 POKEI,V+128
940 GOSUB3000
950 IF FLG=1THEN1050
980 POKEI,V
990 NEXTI
1010 GOTO520
1050 POKEI,V
1060 POKE1787,228
1062 IFV=43THEN2000
1065 IFV=60THEN5200
1070 IFV=62THENV=32
1075 IFV=42THEN55
1078 IFV=45THEN4000
1080 GOSUB5100
1090 GOTO520
2000 REM NEXT MENU
2002 IFDS=23330THEN4100
2010 DS=DF+1:DF=DF+200
2020 GOSUB5500
2030 POKE1787,228
2040 GOSUB5000
2100 REM COLUMN MOVE
2110 POKE1787,32
2120 FORW=1TO100:NEXTW
2130 I=1788:GOSUB5700
2140 IFFLG=1THEN2400
2150 FORI=1791TO1815STEP8
2155 GOSUB5700
2160 IFFLG=1THEN2400
2170 NEXTI
2220 GOTO2030
2400 REM ROW MOVE
2402 POKEI,32
2405 RT=I+40:RB=I+200
2410 FORI=RTTORBSTEP40
2420 V=PEEK(I)
2430 POKEI,V+128
2440 GOSUB3000
2450 IFFLG=1THEN2550
2480 POKEI,V
2490 NEXTI
2510 GOTO2030
2550 POKEI,V
2560 POKE1787,228
2562 IFV=43THEN2000
2563 IFV=45THEN5600
2565 IFV=60THEN6100
2570 IFV=62THEN6000
2575 IFV=0THEN6400
2578 IFDS=22930ANDI=
     1991THENGOSUB6600
2580 GOSUB5800
2590 GOTO2030
3000 REM*KEY*
3010 FORJ=1TO50
3020 F=PEEK(56320)AND16
3030 IFF=0THEN3070
3040 NEXTJ
3050 FLG=0
3060 RETURN
3070 F=PEEK(56320)AND16
3080 IFF=16THEN3100
3090 GOTO3070
3100 FLG=1
3110 RETURN
4000 REM*RVS WRAP*
4010 DS=23330:DF=23529
4020 GOSUB5500
4030 GOTO2030
4100 REM*FWD WRAP*
4110 DS=22530:DF=22729
4120 GOSUB5500
4130 GOTO520
5000 REMJOY ST
5020 F=PEEK(56320)AND16
5030 IFF=0THEN5050
5040 GOTO5020
5050 F=PEEK(56320)AND16
5060 IFF=16THEN5080
5070 GOTO5050
5080 RETURN
5100 REM PRINT CHAR
5105 IFS=1743THEN5150
5110 POKES,V
5120 S=S+1
5130 POKES,228
5140 RETURN
5150 POKES,V
5160 S=1024
5170 POKES,228
5180 RETURN
5200 REM ERASE CHAR
5205 IFS=1024THEN5250
5210 POKES,32
5220 S=S-1
5230 POKES,228
5240 GOTO520
5250 POKES,32
5360 S=1743
5370 POKES,228
5380 GOTO520
5500 REM DISP MENU
5510 P=1823
5520 FORI=DSTODF
5530 P=P+1
5535 D=PEEK(I)
5540 POKEP,D
5550 NEXTI
5560 RETURN
5600 REM LAST MENU
5610 DF=DS-1:DS=DS-200
5620 GOSUB5500
5625 IFDS=22530THEN530
5630 GOTO2030
5700 REM MENU COL
5710 POKEI,228
5720 GOSUB3000
5760 POKEI,32
```

continued on next page

Listing for Visu Writer, C64 version.

```
5770 RETURN
5800 REM PRINT WORD
5810 IFS=1743THEN5930
5820 POKES,V
5830 S=S+1
5840 I=I+1
5850 V=PEEK(I)
5860 IFV=32THEN5890
5870 POKES,V
5880 GOTO5810
5890 POKES,V
5900 S=S+1
5910 POKES,228
5920 RETURN
5930 POKES,V
5940 S=1024
5950 GOTO5840
6000 REM NEXT LINE
6005 POKES,32
6010 FORTST=1024TO1744STEP40
6020 N=S-TST
6030 IFN<0THEN6050
6040 NEXTTST
6050 IFTST=1744THEN6080
6060 S=TST
6065 POKES,160
6070 GOTO2030
6080 S=1024
6085 POKES,160
6090 GOTO2030
6100 REM ERASE WORD
6110 POKES,32
6120 S=S-1
6130 IFS<1024THEN6150
6140 GOTO6160
6150 S=1743
6160 POKES,32
6170 S=S-1
6180 IFS<1024THEN6200
6190 GOTO6210
6200 S=1743
6210 X=PEEK(S)
6220 IFX=32THEN6250
6230 POKES,32
6240 GOTO6170
6250 S=S+1
6260 IFS>1743THEN6280
6270 GOTO6290
6280 S=1024
6290 POKES,160
6300 GOTO2030
6400 REM SCREEN DUMP
6405 Q=0
6410 L=1063
6420 OPEN4,4
6425 PRINT#4,CHR$(15)
6430 FORX=1024TO1743
6440 Z=PEEK(X)
6450 IFZ>31THEN6470
6460 Z=Z+64
6470 PRINT#4,CHR$(Z);
6475 IFZ=32THEN7000
6478 Q=0
6480 IFX<LTHEN6510
6500 L=L+40
6510 NEXT
6520 PRINT#4
6525 CLOSE4
6530 GOTO2030
6600 REM*SOUND*
6605 Z=0
6610 FORW=54272TO54296:POKEW,0:NEXT
6620 POKE54277,136:POKE54278,130
6630 POKE54296,15
6650 POKE54273,25:POKE54272,177
6660 POKE54276,17
6670 FORX=1TO500:NEXT
6680 POKE54273,28:POKE54272,214
6690 FORL=1TO350:NEXT
6700 POKE54267,16
6710 FORL=1TO50:NEXT
6720 Z=Z+1
6730 IFZ=10THENGOTO6800
6740 GOTO6650
6800 FORW=54272TO54296:POKEW,0:NEXT
6810 RETURN
7000 REM*SPC TRACK*
7010 Q=Q+1
7020 IFQ=200THEN6520
7030 GOTO6480
9999 END
READY.
```

```
1 REM MENU DATA
2 REM AUD 1984
3 REM TGA
10 RESTORE
20 OPEN2,8,2,"0:MENU,S,W"
30 FORI=1TO999
40 READD
50 PRINT#2,D
60 NEXTI
70 CLOSE2
80 END
100 REM MENU #1
110 DATA32,32,32,32,32,32,43,32,32,1,32,32,6,32,32,11,32,32,16,32
115 DATA32,21,32,32,26,32,32,52,32,32,57,32,32,38,32,32,46,32,32,32
120 DATA32,32,32,32,32,32,45,32,32,2,32,32,7,32,32,12,32,32,17,32
125 DATA32,22,32,32,48,32,32,53,32,32,33,32,32,39,32,32,58,32,32,32
130 DATA32,32,32,32,32,32,62,32,32,3,32,32,8,32,32,13,32,32,18,32
135 DATA32,23,32,32,49,32,32,54,32,32,35,32,32,40,32,32,59,32,32,32
140 DATA32,32,32,32,32,32,60,32,32,4,32,32,9,32,32,14,32,32,19,32
145 DATA32,24,32,32,50,32,32,55,32,32,36,32,32,41,32,32,61,32,32,32
150 DATA177,32,32,32,32,32,42,32,32,5,32,32,10,32,32,15,32,32,20,32
155 DATA32,25,32,32,51,32,32,56,32,32,37,32,32,44,32,32,63,32,32,32
200 REM MENU #2
210 DATA32,32,32,32,43,32,32,1,7,1,9,14,32,32,32,3,8,1,9,18
215 DATA32,32,32,4,15,15,18,32,32,32,32,6,1,19,20,32,32,32,32,32
220 DATA32,32,32,32,45,32,32,1,14,4,32,32,32,32,32,3,8,1,14,7
225 DATA5,32,32,4,15,23,14,32,32,32,32,6,5,5,20,32,32,32,32,32
230 DATA32,32,32,32,62,32,32,2,1,20,8,32,32,32,32,3,8,5,3,11
235 DATA32,32,32,4,18,9,14,11,32,32,32,6,12,15,15,18,32,32,32,32
240 DATA32,32,32,32,60,32,32,2,5,4,32,32,32,32,32,3,12,15,19,5
245 DATA32,32,32,5,25,5,19,32,32,32,32,7,5,20,32,32,32,32,32,32
250 DATA178,32,32,32,0,32,32,2,12,9,14,4,32,32,32,4,1,20,5,32
255 DATA32,32,32,6,1,14,32,32,32,32,32,7,18,5,1,20,32,32,32,32
300 REM MENU #3
310 DATA32,32,32,32,43,32,32,8,1,9,18,32,32,32,32,8,9,7,8,32
315 DATA32,32,32,12,1,20,5,18,32,32,32,12,15,23,32,32,32,32,32,32
320 DATA32,32,32,32,45,32,32,8,1,22,5,32,32,32,32,8,9,7,8,5
325 DATA18,32,32,12,5,6,20,32,32,32,32,12,15,23,5,18,32,32,32,32
330 DATA32,32,32,32,62,32,32,8,5,1,20,32,32,32,32,9,14,32,32,32
335 DATA32,32,32,12,5,19,19,32,32,32,32,13,5,1,12,32,32,32,32,32
340 DATA32,32,32,32,60,32,32,8,5,12,12,15,32,32,32,9,19,32,32,32
345 DATA32,32,32,12,9,11,5,32,32,32,32,13,15,18,5,32,32,32,32,32
350 DATA179,32,32,32,0,32,32,8,5,12,16,32,32,32,32,9,20,32,32,32
355 DATA32,32,32,12,9,16,19,32,32,32,32,13,15,22,5,32,32,32,32,32
400 REM MENU #4
410 DATA32,32,32,32,43,32,32,13,25,32,32,32,32,32,32,14,21,18,19,5
415 DATA32,32,32,15,21,20,32,32,32,32,32,18,5,1,4,25,32,32,32,32
420 DATA32,32,32,32,45,32,32,14,15,32,32,32,32,32,32,15,6,6,32,32
425 DATA32,32,32,15,22,5,18,32,32,32,32,18,9,7,8,20,32,32,32,32
430 DATA32,32,32,32,62,32,32,14,15,19,5,32,32,32,32,15,11,32,32,32
435 DATA32,32,32,16,9,12,12,19,32,32,32,18,15,15,13,32,32,32,32,32
440 DATA32,32,32,32,60,32,32,14,15,23,32,32,32,32,32,15,14,32,32,32
445 DATA32,32,32,16,12,5,1,19,5,32,32,19,5,5,32,32,32,32,32,32
450 DATA180,32,32,32,0,32,32,14,21,13,2,5,18,32,32,15,16,5,14,32
455 DATA32,32,32,16,12,21,19,32,32,32,32,19,5,20,32,32,32,32,32,32
500 REM MENU #5
510 DATA32,32,32,32,43,32,32,19,9,4,5,32,32,32,32,20,8,5,32,32
515 DATA32,32,32,20,46,22,46,32,32,32,32,23,1,20,5,18,32,32,32,32
520 DATA32,32,32,32,45,32,32,19,12,15,23,32,32,32,32,20,9,13,5,32
525 DATA32,32,32,21,14,5,1,19,25,32,32,23,9,14,4,15,23,32,32,32
530 DATA32,32,32,32,62,32,32,19,20,1,18,20,32,32,32,20,9,18,5,4
535 DATA32,32,32,21,16,32,32,32,32,32,32,23,9,16,5,32,32,32,32,32
540 DATA32,32,32,32,60,32,32,19,20,15,16,32,32,32,32,20,15,32,32,32
545 DATA32,32,32,22,9,19,9,20,32,32,32,23,15,21,12,4,32,32,32,32
550 DATA181,32,32,32,0,32,32,20,8,1,14,32,32,32,32,20,18,25,32,32
555 DATA32,32,32,23,1,19,8,32,32,32,32,25,5,19,32,32,32,32,32,32
READY.
```

Listing for C64 menu data.

the words or characters, because this is where the cursor will be when it is moving across the screen. A useful aid in creating a new menu is a sheet of graph paper which can be used to represent the screen positions for each character. It should also be remembered that the position of the word HELP is also the screen position which triggers the audible alarm.

Assuming you have changed your "menu data" files and are just about to load them,don't forget that if you still have the old file on your tape or disk, you will have to use the save and replace command in order to save the new file and still use the old name (this is important, as the main program opens the data file by its name).

Hardware

The hardware portion of this project is not too complicated for the Sinclair, and simplicity itself for the Commodore.

On the Sinclair, it is necessary to open the cover which is done by turning the computer upside down. You will find 3 of the 5 screws hiding under the little rubber feet which are stuck to the bottom. Once the bottom cover is removed, the PC board is revealed in all its glory. The portion of the board you're interested in is the bottom left hand corner (see sketch). Two short pieces of 24 gauge wire should be soldered onto the pins which correspond to the input key. In the case of the program listing shown, the input key was "Z" which would require the cable pair to be soldered to 1 and D. If, however, you choose to connect to 0 and A, as they are physically close together, then this can be accommodated by changing lines 5810 and 5920 in the program to "Q" instead of "Z". The other end of each wire is connected to a subminiature jack which is attached to the casing by drilling a 1/4" hole. This arrangement permits the pressure switch to be removed or replaced as required. A suitable switch which can be operated by the disabled person is shown in the photo. Both the switch and the jack are available from Radio Shack. The switch is part number 44-610 at $5.49, and the jack is part number 274-292 at $1.99 for two.

As indicated above, the Commodore joystick port adapter is very easy to construct. The connector is available from most electronics stores, including Radio Shack, who stock it under part number 276-1537 at $2.99. The pins to be connected are 6 and 8, as shown in Figure 5. In this case, the cord from the switch can be connected directly to the connector. The program is written to accept the input on control port 2, so make sure the connector is plugged into that port.

Because the input condition required is only a simple contact closure and release, many variations of the switch are possible. In some cases, a mouth operated switch might be more appropriate for a severely disabled person to control. The possibilities are numerous. Let's hope some person who is less fortunate than most of us will be able to benefit from this project. Who knows, maybe this will provide the opportunity for someone out there to harness their pent up literary skills. If you need some help to avoid getting eye strain and computer finger typing in all those 32s, then drop a line to Ron Coles, RR#2, Tantallon, N.S. B0J 3J0. Trevor and I would be pleased to make the programs available on disk or tape for a modest charge.

As a final comment, Trevor indicated that he will re-write the program for the TI 99 if there is any interest. Also, we are looking into adding another menu to the Commodore programs which can be used with a relatively simple hardware add-on in order to switch various electrical appliances such as lights, TV, etc. on and off. ■

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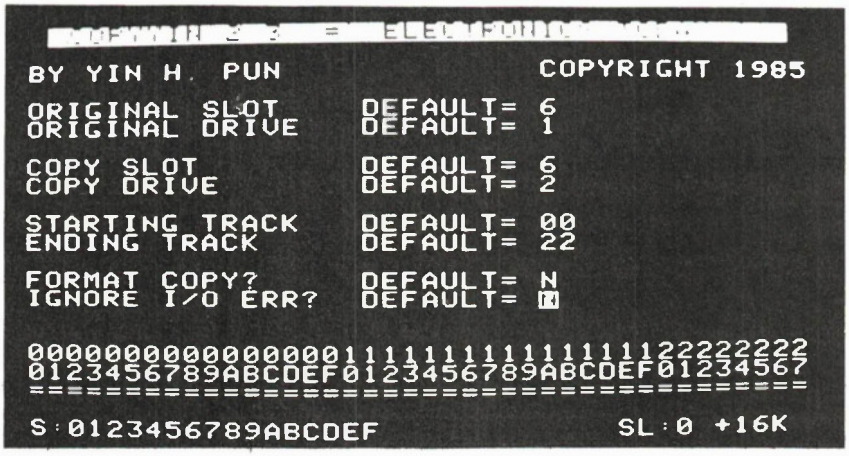
By Yin H. Pun



Computing Today

Apple Copy Program

The Apple DOS copying utility is a bit awkward to use. Here's a useful program for working with various files.

COPYYIN is a 16 sector disk copy utility program. It duplicates unprotected 16 sector disks such as DOS 3.3, PASCAL, CP/M and ProDOS disks. It operates under the same principle as COPYA on the DOS 3.3 system master because it uses the DOS 3.3 RWTS (Read/Write Track and Sector) routine. The user has the option of copying only a range of tracks rather than a whole disk or the user may chose to ignore 'I/O ERRORs' caused by bad sectors and proceed copying the rest of the disk.

COPYYIN runs under the DOS 3.3 operating system on an Apple II, II plus, IIe or IIc with a minimum of 48K. Maximum memory supported is 172K. To enter the program, boot a DOS 3.3 disk and invoke the monitor by a CALL-151. Enter the values into the memory in the following manner:

800:EA EA EA 4C 12 08 4C D9 ... etc...

BSAVE it every so often in case if someone trips on the power cord and erases your hours of typing. When you have finished and your head is full of hexadecimal numbers, type:

BSAVE COPYYIN 2.3,A$800, L$C00

To execute it, type 800G from the monitor or BRUN COPYYIN 2.3 from Applesoft.

COPYYIN asks you to enter the slot and drive number of the original and duplicate disks, and the range of tracks to be copied. Furthermore, there are some unusual parameters. When it asks you to format a disk, enter 'Y' for 'yes' and 'N' for 'no'.

If you want to ignore 'I/O ERRORs' that will normally abort a copy if the disk drive encounters an error, press 'Y'. Press the 'RETURN' to skip the entering of the 'RWTS ADDRESS' parameter since this value indicates the address of the RWTS used for reading and writing the disk. It should not be changed. If you do not want to change a value in ANY of the parameters, simply press the 'RETURN' key.

When you have entered the parameters of the first screen, you may press 'M' for more parameters or any other key to begin copying.

More Parameters

When it asks SECTORS PER TRACKS, enter $F for 16 sector disks (DOS 3.3, PASCAL, CP/M and ProDOS) or $C for 13 sector disks (DOS 3.2).

When it asks FORMAT NUMBER OF TRACKS, enter $23 for 35 track disks or $28 for 40 track disks. Most disks are 35 tracks.

Only newer disk drives have 40 track capability. Older Apple DISK II's prior to July 1982 cannot read or write 40 track disks and an I/O error will result if one tries to access track numbers over 35. Drives with the name, 'MITAC', may not work as well.

However, all drives have a maximum of 36 tracks.

Abort Feature

To abort at any time in COPYYIN, press the 'ESC' key. This restarts COPYYIN to the beginning. If you make a mistake in entering a parameter, press 'ESC'. Pressing 'RESET' does the same thing but it is not recommended while the disk drive is on.

Press control-Q to quit out of the program into Applesoft BASIC.

('RESET' only restarts the program and you won't escape!)

Copying DOS

To copy a DOS to another disk whose DOS has been damaged, select the original and copy drives. Set START TRACK to 00 and ENDING TRACK to 02. Make sure that the volume numbers of both the disks are the same. Proceed copying. If the copy disk has a bad sector in these tracks, set FORMAT to 'Y' and the NUMBER OF TRACKS to format to 03 (this is on the second parameter screen).

128K RAMcard Support

COPYYIN 2.3 supports the use of a SATURN 128K RAMcard in slots 0 to 5 or an ordinary 16K RAMcard in slots 0-5 (built-in an Apple IIe or IIc). Thus, extra memory is available for retaining the original disk contents before it is written out to a new disk. It does not support the

64K auxiliary memory of a 128K Apple IIe/IIc.

The Phantom Disk Drive

If you enter '0' for the disk drive number, the RAM is assumed as a 'disk drive'. This value is useful if you want to load a whole disk into the RAM and then make as many copies as you want from the RAM instead of reading the original disk unnecessarily many times. Only use this parameter if you have a enough memory to hold all the tracks of the disk you want to copy. A 128K expansion card can hold a whole 35 track disk.

The '0' value is also defined as an alternate input/output device other than a disk drive. With an appropriate I/O routine and hardware, a user could define it as a high-speed direct serial data-link between two computers. Replace the 'RTS' (60) with a vector to a user routine (with a 'JMP' instruction).

Copyright Notice

I give COPYYIN away as a public domain program for now. It may be distributed without charge. *It may not be sold.* Any portion of the program used in any other programs must come to the attention of the author

```
*800.1400

0800- EA EA EA 4C 12 08 4C D9
0808- 03 60 EA EA EA 6C F2 03
0810- 40 96 A2 02 BD F2 03 9D
0818- 38 08 BD 06 08 9D 35 08
0820- CA 10 F1 A9 26 8D F2 03
0828- A9 0E 8D F3 03 49 A5 8D
0830- F4 03 4C 3B 08 4C D9 03
0838- 59 FF 5A 20 B5 08 20 7A
0840- 0E 20 EB 0D C4 CF CE C5
0848- A1 A0 D0 D2 C5 D3 D3 A0
0850- C3 D4 D2 CC AD D1 A0 D4
0858- CF A0 D1 D5 C9 D4 A0 D0
0860- D2 CF C7 D2 C1 CD BA 80
0868- 2C 10 C0 20 65 0E 4C 3B
0870- 08 AD 91 08 D0 03 4C 09
0878- 08 A9 08 A0 8F 48 AD 9B
0880- 08 C9 01 F0 05 68 20 D9
0888- 03 60 68 20 35 08 60 01
0890- 60 01 00 00 00 A0 08 00
0898- 40 00 00 00 00 00 60 01
08A0- 00 01 EF D8 60 01 60 02
08A8- 00 00 00 00 00 00 00 23
08B0- 0F 00 00 00 CE 20 2F FB
08B8- 8D 58 C0 8D 10 C0 20 93
08C0- FE 20 89 FE 20 58 FC A9
08C8- 03 85 22 A9 13 85 23 A2
08D0- 00 8A 20 55 11 20 45 11
08D8- 9D D0 05 8A 20 45 11 9D
08E0- 50 06 A9 BD 9D D0 06 E8
08E8- E0 28 D0 E5 A2 00 8A 20
08F0- 45 11 9D D2 07 E8 E0 10
08F8- D0 F4 A9 D3 8D D0 07 A9
0900- BA 8D D1 07 A9 17 20 24
0908- FC A9 1E 85 24 20 EB 0D
0910- D3 CC BA 80 20 BF 11 A9
0918- 00 20 24 FC A9 01 85 24
0920- 20 EB 0D 20 03 0F 10 19
0928- 19 09 0E 20 32 2E 33 20
0930- 20 3D 3E 20 05 0C 05 03
0938- 14 12 0F 0E 09 03 13 20
0940- 14 0F 04 01 19 20 3C 3D
0948- 20 8D 20 EB 0D C2 D9 A0
0950- D9 C9 CE A0 C8 AE A0 D0
0958- D5 CE A0 A0 A0 A0 A0 A0
0960- A0 A0 A0 A0 A0 A0 A0 C3
0968- CF D0 D9 D2 C9 C7 C8 D4
0970- A0 B1 B9 B8 B5 80 20 8E
0978- FD 20 EB 0D CF D2 C9 C7
0980- C9 CE C1 CC A0 D3 CC CF
0988- D4 A0 A0 A0 A0 C4 C5 C6
0990- C1 D5 CC D4 BD A0 80 AD
0998- A4 08 20 55 11 20 E3 FD
09A0- 20 45 11 8D B3 08 A9 88
09A8- 20 13 0E 20 20 0D 8D A4
09B0- 08 20 8E FD 20 EB 0D CF
09B8- D2 C9 C7 C9 CE C1 CC A0
09C0- C4 D2 C9 D6 C5 A0 A0 A0
09C8- C4 C5 C6 C1 D5 CC D4 BD
09D0- A0 80 AD A5 08 20 E3 FD
09D8- 20 45 11 8D B3 08 A9 88
09E0- 20 13 0E 20 88 0D 8D A5
09E8- 08 20 8E FD 20 8E FD 20
09F0- EB 0D C3 CF D0 D9 A0 D3
09F8- CC CF D4 A0 A0 A0 A0 A0
0A00- A0 A0 A0 C4 C5 C6 C1 D5
0A08- CC D4 BD A0 80 AD A6 08
0A10- 20 55 11 20 E3 FD 20 45
0A18- 11 8D B3 08 A9 88 20 13
0A20- 0E 20 20 0D 8D A6 08 20
0A28- 8E FD 20 EB 0D C3 CF D0
0A30- D9 A0 C4 D2 C9 D6 C5 A0
0A38- A0 A0 A0 A0 A0 A0 C4 C5
0A40- C6 C1 D5 CC D4 BD A0 80
0A48- AD A7 08 20 E3 FD 20 45
0A50- 11 8D B3 08 A9 88 20 13
0A58- 0E 20 88 0D 8D A7 08 20
0A60- 8E FD 20 8E FD 20 EB 0D
0A68- D3 D4 C1 D2 D4 C9 CE C7
0A70- A0 D4 D2 C1 C3 CB A0 A0
0A78- A0 C4 C5 C6 C1 D5 CC D4
0A80- BD A0 80 AD AE 08 20 DA
0A88- FD 20 EB 0D 88 88 80 20
0A90- A5 0D C9 8D F0 03 8D AE
0A98- 08 20 8E FD 20 EB 0D C5
0AA0- CE C4 C9 CE C7 A0 D4 D2
0AA8- C1 C3 CB A0 A0 A0 A0 A0
0AB0- C4 C5 C6 C1 D5 CC D4 BD
0AB8- A0 80 AD AF 08 38 E9 01
0AC0- 20 DA FD 20 EB 0D 88 88
0AC8- 80 20 A5 0D C9 8D F0 09
0AD0- 8D AF 08 EE AF 08 4C DF
0AD8- 0A A6 24 E8 E8 86 24 AD
0AE0- AE 08 CD AF 08 B0 DC 20
0AE8- 8E FD 20 8E FD 20 EB 0D
0AF0- C6 CF D2 CD C1 D4 A0 C3
0AF8- CF D0 D9 BF A0 A0 A0 A0
0B00- A0 C4 C5 C6 C1 D5 CC D4
0B08- BD A0 80 AD A8 08 C9 01
0B10- D0 02 A9 D9 C9 00 D0 02
0B18- A9 CE 20 13 0E A9 88 20
0B20- 13 0E 20 65 0E C9 8D F0
0B28- 1E C9 D9 D0 07 A0 01 8C
0B30- A8 08 D0 0D C9 CE D0 07
0B38- A0 00 8C A8 08 F0 02 D0
0B40- E1 20 13 0E 20 8E FD 20
0B48- EB 0D C9 C7 CE CF D2 C5
0B50- A0 C9 AF CF A0 C5 D2 D2
0B58- BF A0 A0 C4 C5 C6 C1 D5
0B60- CC D4 BD A0 80 AD B4 08
0B68- 20 13 0E A9 88 20 13 0E
0B70- 20 65 0E C9 8D F0 10 C9
0B78- D9 F0 06 C9 CE F0 02 D0
0B80- EF 8D B4 08 20 13 0E 20
0B88- 8E FD 20 EB 0D D2 D7 D4
0B90- D3 A0 C1 C4 C4 D2 C5 D3
0B98- D3 A0 A0 A0 A0 A0 C4 C5
0BA0- C6 C1 D5 CC D4 BD A0 80
0BA8- AE 36 08 AD 37 08 20 41
0BB0- F9 20 EB 0D 88 88 88 88
0BB8- 80 A2 02 20 65 0E C9 8D
0BC0- F0 1C 20 CA 0D 18 90 03
0BC8- 20 C7 0D 20 50 11 9D 35
0BD0- 08 20 C7 0D 18 7D 35 08
0BD8- 9D 35 08 CA D0 EA 20 8E
0BE0- FD 20 8E FD 20 EB 0D A7
0BE8- CD A7 A0 C6 CF D2 A0 CD
0BF0- CF D2 C5 A0 CF D2 A0 CF
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How to create an overlay for the popular MDM software.

The Curse of All The BBS Numbers In The World.

Keep in touch with all those obscure BBSs with this latest updated list.

Hewlett Packard Laser Printer

Beam us up Scotty, it's the attack of the high-tech printers!

Technical Drawing on the MAC

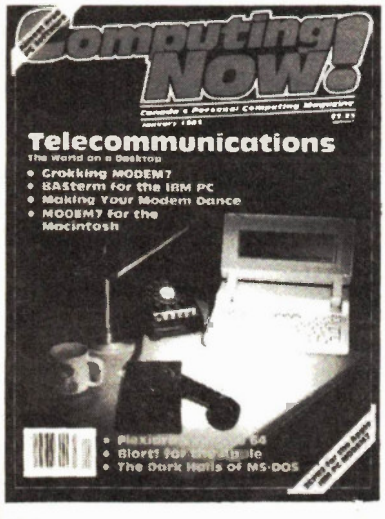
Doing complex technical drawings can cause severe eye-strain not to mention near-nervous breakdowns. Relief at last.

Tandy 1200 Review

Radio Shack's entry into the world of hard and soft drivevn MS-DOS.

The Mortgage Program

These days you just about have to mortgage everything including the dog to get that particular software package, but fear not, this program will at least give you an idea of how much you'll need.



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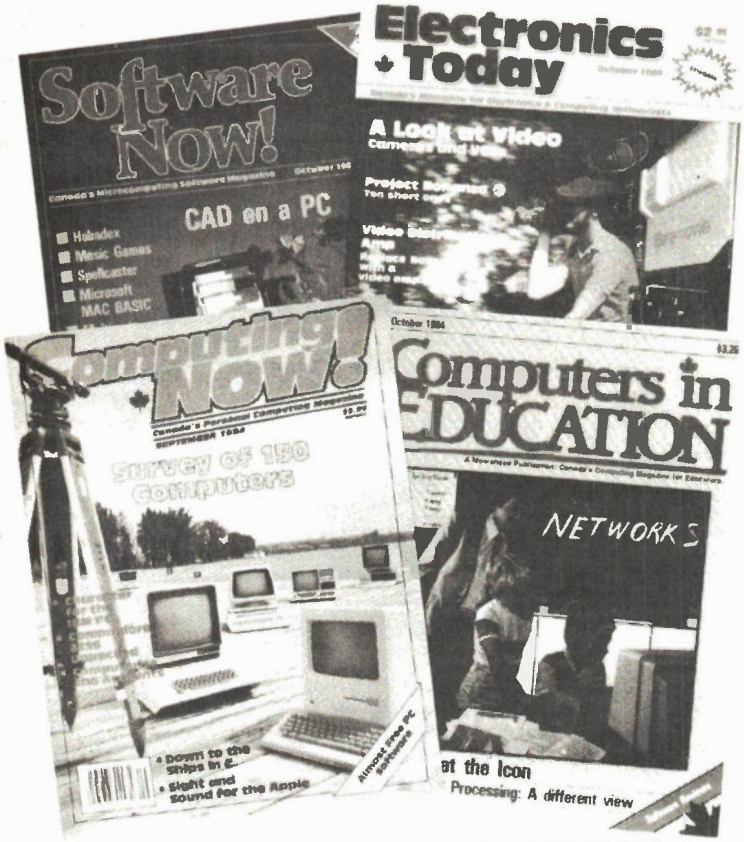

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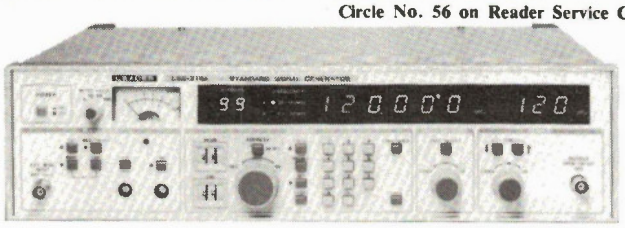

Dipole Construction Handbook

The Dandy Dipole is a new 24 page handbook for constructing over 180 variations of the oldest, most reliable and simplest amateur radio antenna known. It shows where and how to place it, how to quickly design a multiband dipole — using traps — without guessing at the wire lengths. Best height for good SWR and radiation and dozens of practical details are collected under one cover.

Among the contents are computing the wire length and pruning to resonant frequency; proper height for best SWR and radiation; the multiband trapped dipole, 183 band combinations (complete wiring tables); inverted "V" and dipole components as insulators, baluns, traps and wire.

Cost is $3.95 plus $1.00 for shipping. For more information contact Emily Bostick, Microwave Filter Company, Inc., 6743 Kinne St., East Syracuse, N.Y. 13057. Call collect from Canada (315) 437-3953.

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As software is required to run a light pen, it was inevitable that some company would expand the current versions of available software into the home educational market. And this has been done by the same company, not surprisingly.

They have a number of home software packages available, only two of which will be covered here. The first is called *Lite#Sprite*. It turns a normal household television set into a specialized 'electronic easel' for creating, editing and storing animated characters, all drawing and menu selection being done by the light pen directly onto the TV screen.

Using the light pen software, sprites are first drawn in an eight-power magnification mode, allowing for clear design. For animating a sequence of individual frames, the device provides an electronic editing station for modifying a character's position, storing poses in frames, transferring images between frames, inserting and deleting frames, flipping an image, and centering. It also includes buffers in which to store sprites temporarily until they are ready for insertion into a frame.

The second element, and potentially the most widely usable, concerns the light-pen in combination with some home educational software. As yet, only one package has been marketed, called *Kinderware*, which includes five elementary programs such as *Shapes and Colours* which focus on developing basic verbal, numeric and memory skills. The teaching mechanism involves attempting to heighten the child's desire to learn by using the light-pen to 'see and do' (actually pointing out the right answer), which is obviously not the case with keyboard usage.

Tech-Sketch Inc.,
26 Just Road,
Fairfield, NJ,
07006, USA

Valiant Turtle

As light-pens are inevitably linked with educational software, so also robots, which can be run by computers, would inevitably meld their technologies with the catch language of the eighties: LOGO. And so, as the saying goes, it has come to pass.

Designed in Britain and sold in Canada by way of Nova Scotia (entry point for all good things from Europe), the Valiant Turtle is a mechanism by which the power of LOGO may be physically generated. Essentially, one loads LOGO (either English or French) into a C-64, Apple, BBC Acorn, DEC Rainbow, IBM or Spectrum, loads some supplementary software for control purposes, and this robot (not surprisingly in the shape of a turtle; after all, we are dealing with LOGO) merrily does whatever it is commanded to do in executing all LOGO commands. The control link from computer to turtle is be infra-red transmitter/receiver.

It is powered by ten nickel-cadmium rechargeable batteries (one merely plugs the turtle into a wall socket), and uses as its main source of mechanical power two independent stepper motors. It has two illuminated eyes which serve as power indicators, failing before any other functions fail. To trace LOGO (turtle) graphics, it carries a pen which can be raised or lowered to either trace its movements or to make graphics. While it normally moves in units of 1 cm, it may also be programmed to move in units of 1 mm, 1 inch or 1 meter. Its stepper motors are sufficiently accurate to draw smooth circles and arcs.

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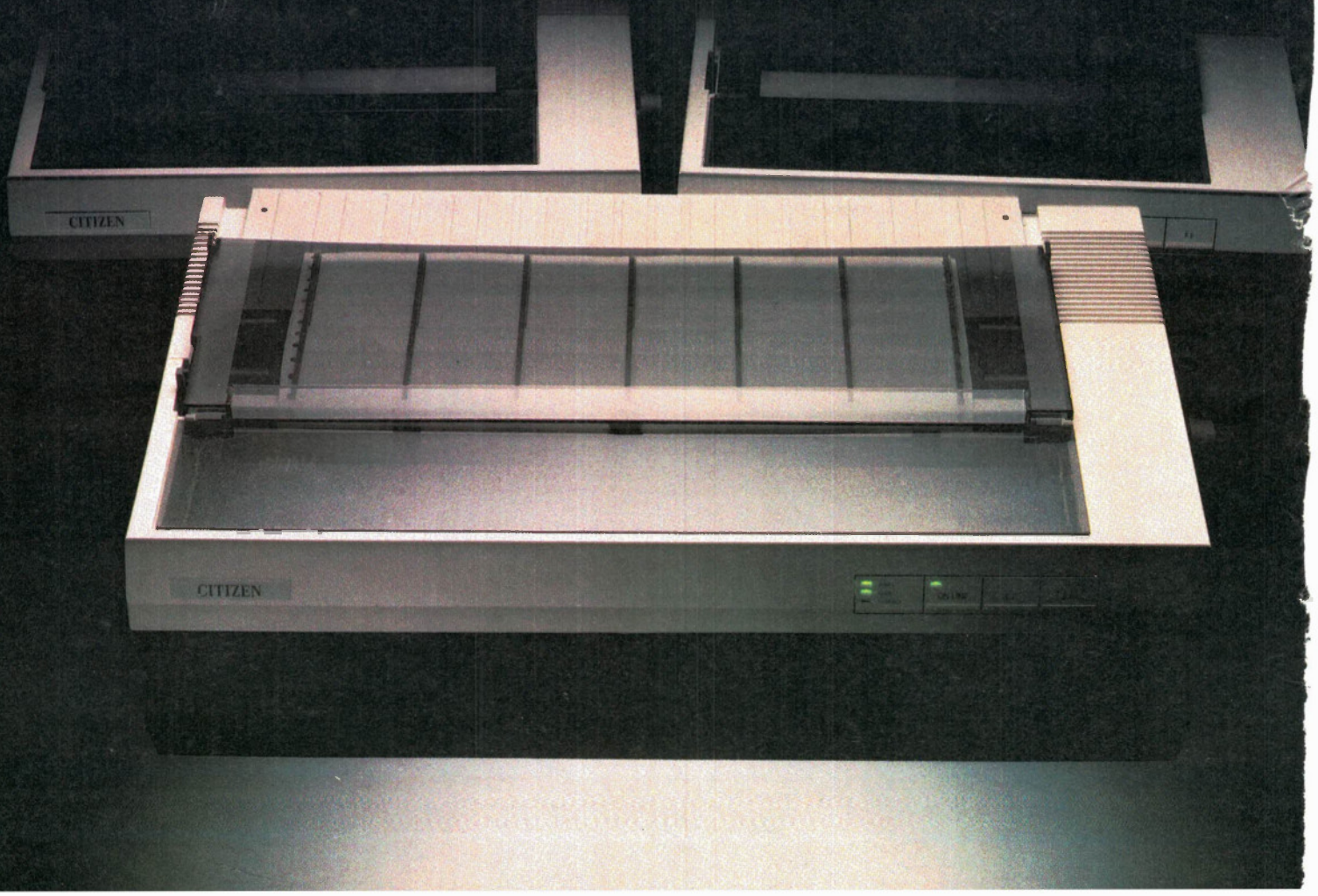

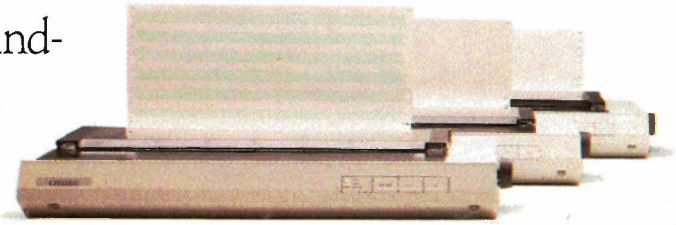

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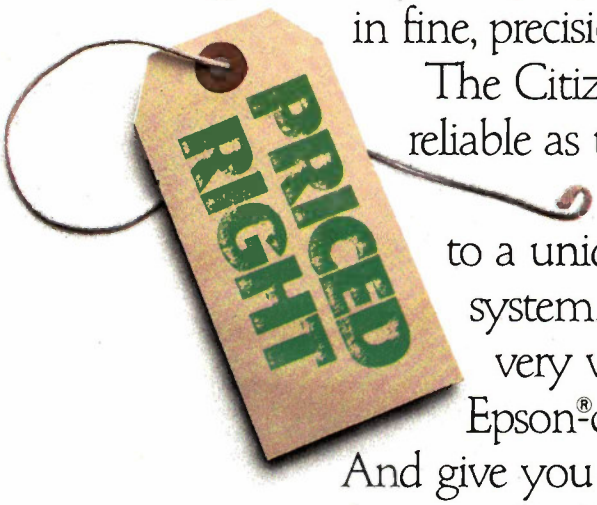

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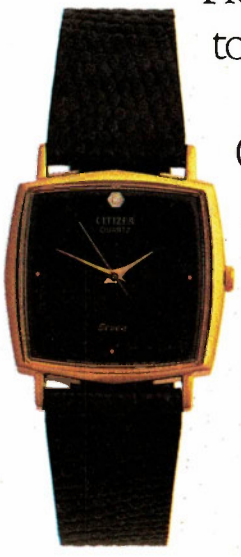

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