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JUNE 1979

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electronics today international

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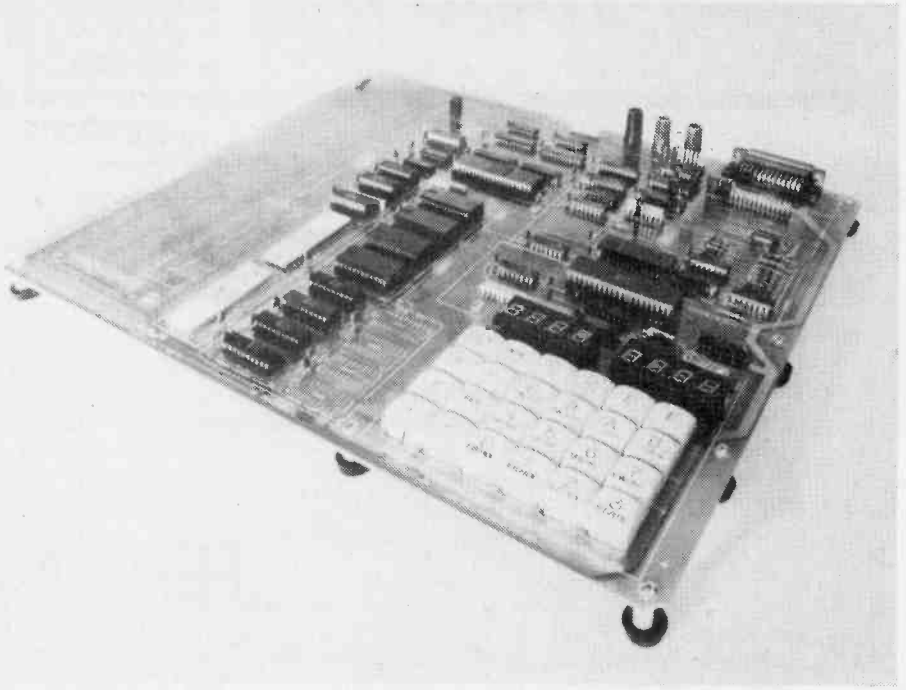


8086 Micro Kit

Intel's distributors are stocked with the SDK-86, a complete 8086 microcomputer system on a board with memory and I/O systems in kit form. This stand-alone microcomputer allows designers hands-on experience with Intel's 8086 16-bit HMOS microprocessor which offers ten times the processing power of the 8080.

The kit includes an 8-digit LED display, a 24-key keyboard, and all other necessary components from resistors and crystal to CPU. Once assembled and corrected to a power supply the SDK-86 is ready to go.

For data memory, there are 2K bytes of 2142 RAM. This can be doubled by implementing additional devices in the positions provided. There is also room for 8K bytes of program memory using either or both of the keyboard and TTY/CRT 4K ROM-resident software monitors included in the kit, or a 2716/2316E EPROM/ROM combination. There is a fully-buffered system bus and 22 square inches of the printed circuit for developing prototype circuitry.

Programs and data may be entered three ways: the keyboard with LED display, a built-in serial communications interface, or via cable (SDK-C86) to any Intellec Microcomputer Development System. The development system approach allows the user to create programs using PL/M 86 or Assembly Language, and download them for checkout in the SDK-86. The monitors provide single-step and breakpoint capability, as well as memory and register modification and control of the keyboard/display, serial port, and bus expansion interfaces.

The SDK-86 Microcomputer kit is priced in the US at $780.00 in single unit quantities.

Fast RAMs

Intel Corporation claim they have the next generation of static RAMs, the 2115H/2125H 1024-bit and 2147H 4096-bit static memories. They are fabricated using a new generation process called HMOS II to achieve maximum access times of 20 ns and 35 ns respectively. These speeds are more than twice as fast as previous MOS memories of corresponding size. They are the fastest, lowest power, 1K and 4K static RAMs currently available. Moreover, the new devices are faster than bipolar memories of equivalent storage, and they use considerably less power. The 1K devices will be used to directly replace bipolar memories in existing product designs and to enhance performance of existing and future products. The 4K devices will provide a fully-compatible performance upgrade for existing 2147 applications, as well as unprecedented 4K performance for new product designs.

Hundred-piece US prices are $9.85 each and $62.60 each.

Bell Goes More Digital

Bell Canada's DMS-200, first of a generation of new digital switching machines was officially introduced in April.

The DMS-200 has a capacity of 60,000 trunks — more than double the capacity of any analogue switching system in use. The DMS-200 does not connect directly to customers lines but rather interconnects with local switching centres which are in turn used to serve customers.

The new switcher requires only a fraction of the floor space of conventional units and the speakers mentioned that the solid state software controlled design would lead to substantial operational savings.

The DMS-200 actually went into service in Ottawa in January and has been operating smoothly since that date. Later this year the first DMS-100 machine will be opened in Ottawa's Iona switching centre at which time customers will be able to subscribe to such additional features as call waiting, call forwarding and speed calling.

A final member of the DMS family is the DMS-300, which will provide gateway switching service to countries overseas.

50 MHz Freq Counter

The Max-50 is a 50 MHz, 6-digit frequency counter, about the size of a pocket calculator. Operation is automatic with lead-zero blanking and a choice of two power sources.

Input is sampled for 0.1 second, readout updated 6 times per second.

For further information please contact: Len Finkler Limited, 25 Toro Road, Downsview, Ontario, M3J 2A6.

Concentration-Difference Engine

Tokyo Institute of Technology has developed the first vehicle to be driven by concentration-difference energy. The CDE engine uses heat given off when a solution of salts decreases in concentration, caused by vapour absorption. The fuels are pure water and the enriched aqueous solution of inorganic salts. Maximum speed of the prototype vehicle is about 20 kph, but that's a start.

Triac Drivers

Two new single-chip, optically-isolated triac drivers, with zero voltage-crossing capability, have been introduced by Motorola. Designated the MOC3030 and MOC3031, the devices are designed to drive up to 55 amp triacs in the interfacing of logic control systems to equipment powered from a 110 Vac line. The MOC3030/31s contain gallium-arsenide, infrared emitting diodes, optically coupled to a monolithic silicon chip incorporating the detector, triac driver and zero-crossing circuitry.

Zero-crossing protects the triacs and load equipment from inrush currents that are generated when triacs are triggered at near-peak voltage and greatly reduces potential RFI/EMI.

The trigger current required to on output is 30 mA (MOC3030) or 15 mA (MOC3031). US 100-up prices are $1.80 and $2.37.

Cesco Micro Cat

Cesco has published a new 48 page microcomputer catalogue describing microcomputer and microprocessor products available from manufacturers such as Texas Instruments, Motorola, Signetics, AMI, RCA, Intersil, Commodore and Apple. This catalogue includes the latest microcomputers, pms keyboards, printers, displays, disk drives and software. The Micro-computer systems range from the personal Pet and Apple to the AMPL prototyping unit. Available free by writing to Cesco Electronics Ltd, 4050 Jean Talon St. West, Montreal, Que, H4P 1W1; or to the Toronto, Ottawa or Quebec City branches.

Exporting To Japan

The Japan External Trade Organization has recently published a directory entitled "Exporting to Japan, 1979" which includes a complete list of products that Japanese companies wish to buy from foreign sources.

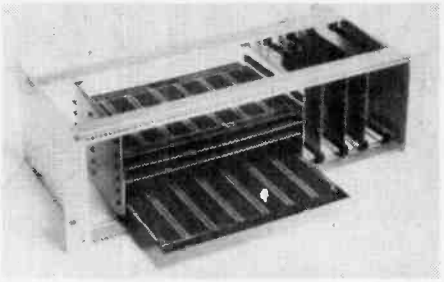
The bulk of the products listed in the directory fall into the categories of food stuffs, machinery, textile products, sundry goods, metal products, chemical products and precision machines.

For those interested in receiving personal copies, further information can be obtained by contacting Overseas Courier Service, 222 North Queen Street, Etobicoke, Ontario M9C 4Y1; telephone 416-626-2968.

Horizontal Card Mounting System

The increased popularity of large format microprocessor boards such as Intel, S100, S50, Motorola, Exorciser and Double Eurocard has meant an increase in the height of card housing required.

To facilitate the mounting of any of these boards in a standard 3U high frame, Vero Electronics have introduced a Horizontal Card Mounting Kit. Designed for use with Vero 3A, 3C and KM4C card and case frames, the kit consists of two mounting plates and eight moulded feet. These can be positioned anywhere in the frame to suit the required size of board. Clip-in



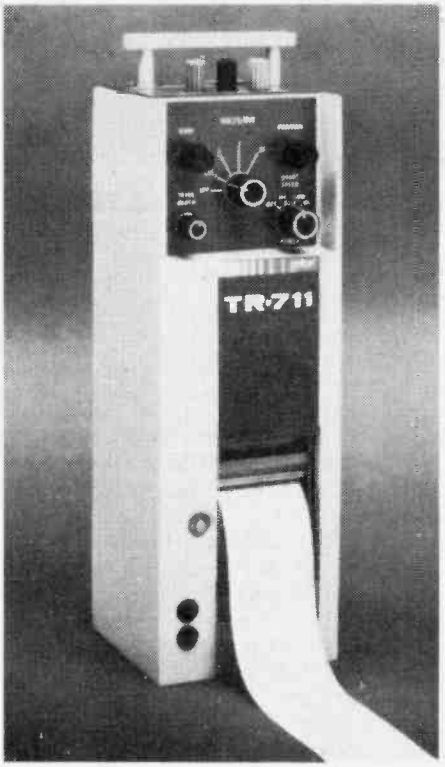
guides to fit the mounting plates are also available. Standard boards may also be mounted vertically within the same system as the horizontal mounted boards.

Electronic Packaging Systems, PO Box 481, Kingston, Ontario, K7L 4W5. Telephone 613 549 5152.

Two Chart Recorders

Webster Instruments has two new chart recorders:

The Techni-Rite Model **TR-711** single channel chart recorder provides a frequency response of dc to 125 Hz;



multiple chart speeds in 3 ranges of 1 and 2, 5 and 10, 25 and 50 mm per second; sensitivities of 10 mV/div., 100 mV/div. and 1 V/division and an input impedance of 500 k ohms.

Writing is by a thermal stylus on heat sensitive chart paper. The stylus features a ruggedized two piece coaxial construction that will withstand most physical abuse.

Calibrated chart width is 40 mm with 40 divisions. Chart length is 65'. Left and right hand event markers, actuated by external switch closure, are optionally available, as are a carrying case, plug in chart rewinder, one second timer, remote control chart drive, and aninverter for 12 VDC operation.

The TR-711 is 4" square by 12¼" long and weighs 10 lbs.

A two channel oscillographic recorder, the Gulton **TR-725**, offers seven switch selectable sensitivities from 10 to 1000 mV/div.; four pushbutton chart speeds of 1,5,25 and 50 mm/second; frequency response of dc to 100 Hz (-3dB) for each 50 mm channel. Additionally, Position, Gain and Stylus Heat controls are included on the front panel.

A single event marker is supplied that is switch controlled by either a one-second timer or by a pushbutton manual control.

Rugged coaxial thermal styli are provided that are extremely resistant to damage from improper handling. The styli are guaranteed for six months.

A plug-in chart rewinder is available, as are a variety of useful options and accessories.

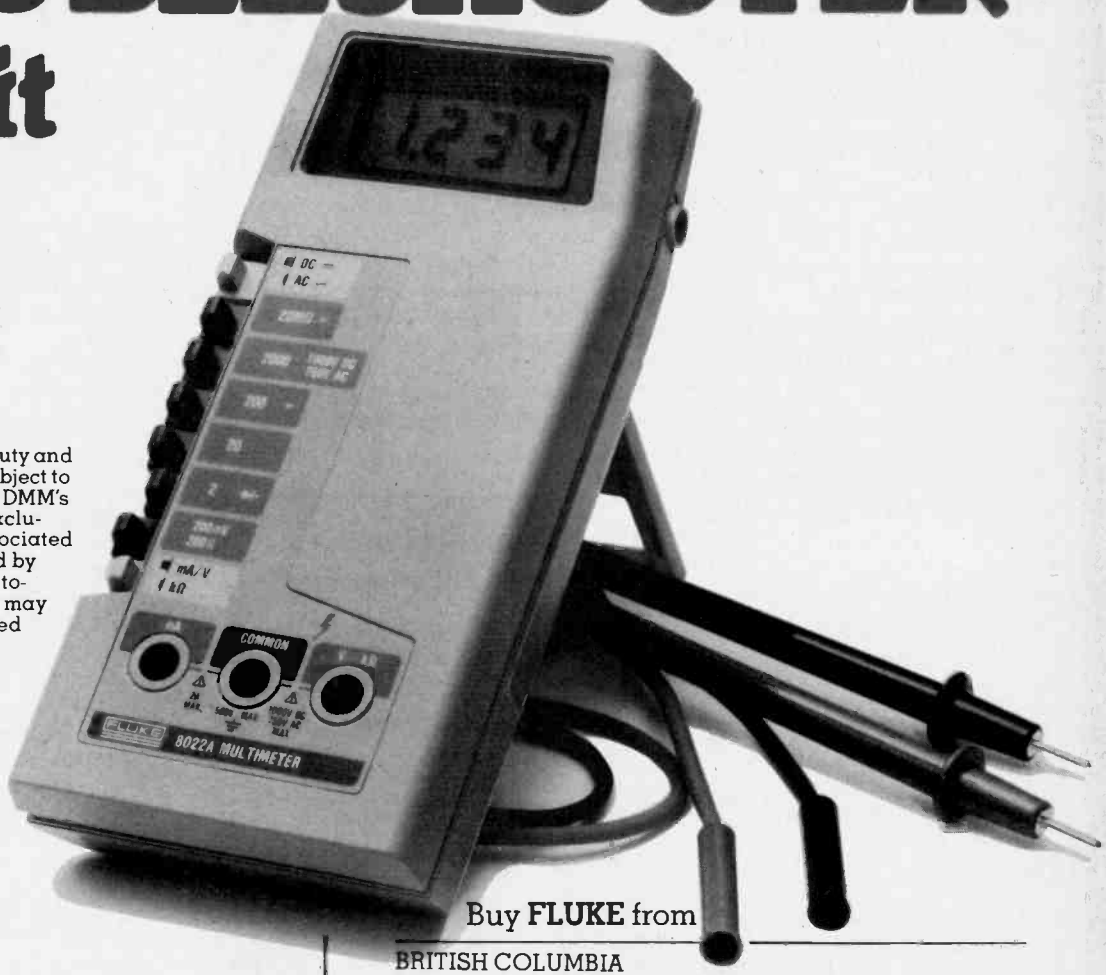
For more info contact Roger Webster, Webster Instruments Ltd, PO Box 427 Port Credit PS, Mississauga, Ontario, L5G 4M1. Phone 416-275-2270.

Introducing the TROUBLESHOOTER

3½ digit DMM

$179*

* Suggested Canadian price. Duty and federal sales tax included. Subject to change without notice. Fluke DMM's are represented in Canada exclusively by Allan Crawford Associated Ltd., and are stocked and sold by authorized distributors coast-to-coast. Individual distributors may sell at other than the suggested price.



We call our new 8022A hand-held digital multi-meter the "Troubleshooter" because it provides all the measurement functions you normally need: high ohms, low ohms, AC voltage, DC voltage, AC current, and DC current.

And it's packed in a small, light-weight impact-resistant plastic case with circuitry designed to withstand both physical shock and electrical overloads.

Even the razor sharp 3½ digit LCD readout is made to handle the extremes of humidity, temperature and vibration.

For extra convenience and safety the probes feature Fluke's exclusive finger guards and shrouded connections, discouraging accidental contact with circuit voltages.

And it's so handy to pick one up. The 8022A is in stock right now at Fluke distributors across Canada.

FLUKE®

Buy **FLUKE** from

BRITISH COLUMBIA

Vancouver:	ACA Electronic Centres
	Allan Crawford Associates Ltd. 604/294-1326
Victoria:	Queale Electronics Ltd. 604/388-6111
Nanaimo:	Queale Electronics Ltd. 604/753-1124
Vernon:	Interior Electronics Ltd. 604/545-2394
Kelowna:	Interior Electronics Ltd. 604/860-0585

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Cardinal Industrial Electronics Ltd. 403/455-4122

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Sudbury:	Sonic-Northern Ltd. 705/674-5691
Timmins:	Sonic-Northern Ltd. 705/264-1228

QUEBEC

Montreal:	ACA Electronic Centres
	Allan Crawford Associates Ltd. 514/670-1212

NOVA SCOTIA

Halifax/ Dartmouth:	Allan Crawford Associates Ltd. 902/469-7865

NEWS DIGEST

Cardon Distribute Antenna

Cardon Import Canada Ltd has been named officially the exclusive Canadian distributor for Anetnna Inc products.

For more information, write to Cardon Import Canada Ltd, 95 McNab St. North, Hamilton, Ont, L8N 3C8. Tel: 416-527-1040.

Crowbar SCRs

Motorola has announced a new series of SCRs — type numbers MCR67 through MCR71 — the first in the industry to be specifically characterized and specified for "crowbar" applications.

The new devices are accompanied by data sheets which now provide a graph detailing Peak Capacitor Discharge Current — a plot that indicates peak discharge current as a function of power supply capacitor discharge time. This permits power-supply designers to select the specific SCR whose peak current characteristics are capable of handling the characteristics of their particular supply.

Imaging Devices

A forty-eight page product guide providing tabulated data and outline configurations for RCA's standard line of Imaging Devices, designed for use in communications, industrial, consumer, and military applications, has been released by RCA Electro-Optics and Devices.

Copies of the IMD-100 product guide may be obtained by writing to RCA, Box 3200, Somerville, New Jersey 08876, or by calling 717-397-7661, ext 2712.

Tunable Filter

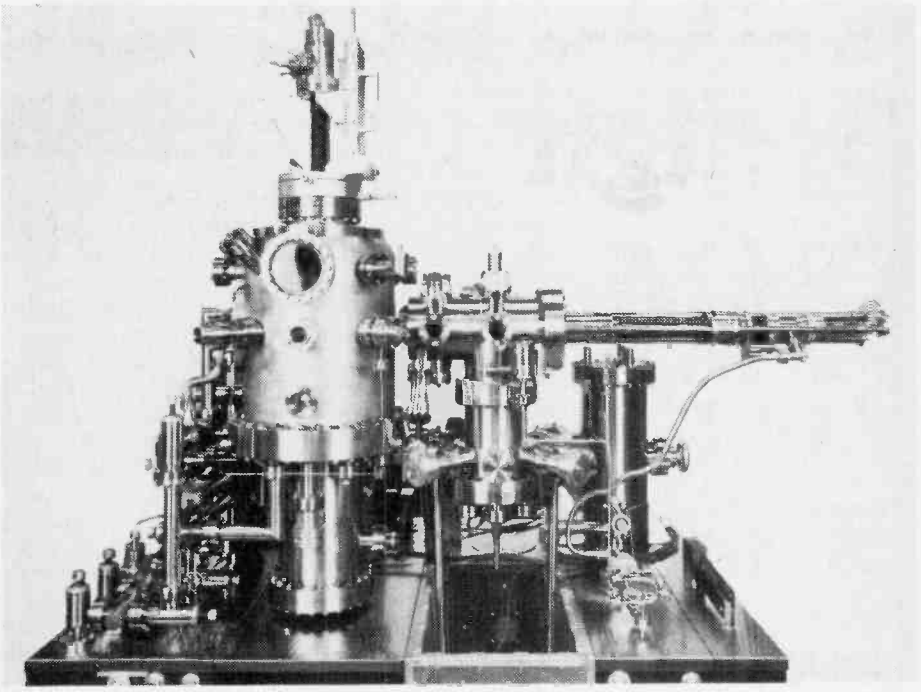
A tunable band-pass filter, for use in audio and vibration analysis or for controlling random noise, has been introduced by Krohn-Hite Corporation and is available in Canada from Webster Instruments Ltd.

The Model 3500 filter offers an unlimited selection of pass-bandwidths, plus independently adjustable high and low frequency break-points, over the range of 20 Hz to 200 kHz. Insertion loss is 0 dB within the pass-band with attenuation slopes of 24 dB/octave outside the pass-band.

The model 3500 offers a 4th-order Butterworth (maximum flatness) response for frequency domain filtering, plus a "Low Q" (damped) response, for pulse and transient filtering. Maximum attenuation is greater than 60 dB, and internally-generated hum and noise is typically less than 200 microvolts RMS.

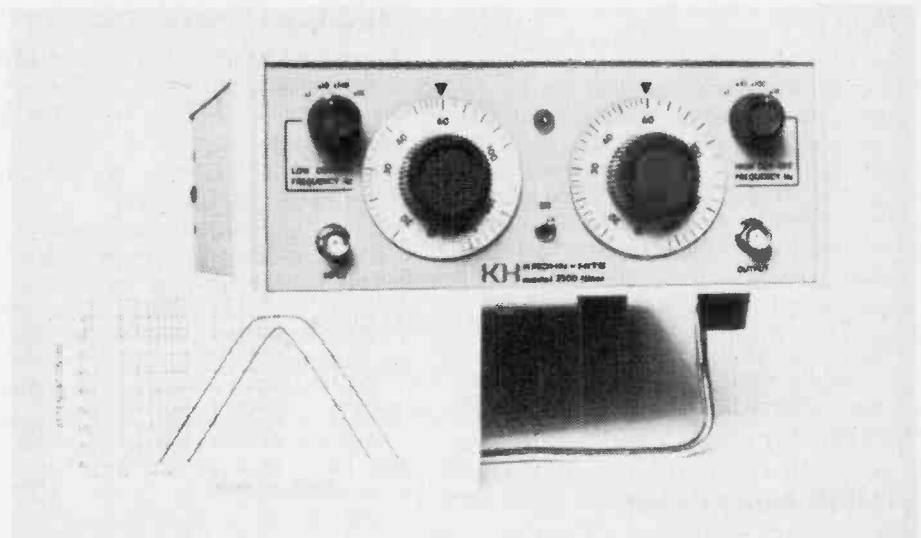
Floating (ungrounded) operation is switch selectable.

For more information, contact Roger Webster, Webster Instruments Ltd PO Box 427, Port Credit PS, Mississauga, Ontario L5G 4M1. Phone 416-275-2270.



No it's not the ETI capuccino-expresso machine! It's the VG EELS electron energy-loss spectrometer, This instrument was developed to identify extremely thin films of absorbed molecules, and is believed to be the first to direct at the surface a beam of electrons which are of low energy — typically of only 2 to 5eV — to eliminate the risk of damaging the adsorbate. Identification is by measuring the kinetic energy lost by the reflected beam.

More info from Paul Robinson of Datacomp Electronics at 416-533-2381.



NEWS DIGEST

Wire-Wrapkit

A wire-wrapping kit including a new wire wrapping tool, a roll of wire-wrapping wire, and pre-stripped wire in 4 popular lengths, is now available.

The tool model WSU-30 is a combination tool that wraps and unwraps 30 AWG (0,25mm) wire on .025 (0,63mm) square pins. It strips 30 AWG wire using handy built-in stripper. The wire is Kynar insulated silver-plated copper. Supplied in the kit are a 50 ft roll plus pre-cut and stripped wire in insulated lengths from 1-4 inches stripped 1 inch on each end. Available with blue wire as Model WK-2B, white wire as WK-2W, yellow wire as WK-2Y and red wire as WK-2R.

For further information, Len Finkler Limited, 25 Toro Road, Downsview, Ontario. M3J 2A6. Phone: 416-630-9103.

An Apple For The Teacher, Teachers PET, Etc.

The Cluster/One is a new system which interconnects up to 30 Apple II, PET, or TRS-80 computers. The computers then share the resources of the system — disk storage, quality printing, etc.

The hardware that you get for the US price of $4500 includes a dual 8in flexible disk drive, console computer (actually a PET) with expanded RAM, and controller for the interconnection bus. For each remote computer there is a board with the necessary hardware and software; this connects to the computer without modification.

The maximum distance to the farthest remote station is 250 ft.

Nestar Systems Inc, 430 Sherman Ave, Palo Alto, CA 94306; 415-327-0125.

UHF Modulator

A video modulator for use with video games or personal computers is available from M&R Enterprises, PO Box 61011, Sunnyvale, CA 94088.

The Sup'R'Mod II comes with coax output and twin-lead balun, and is pre-tuned to UHF channel 33. It needs +5 to +12 V dc power supply.

Data Logger

The Fluke 2200B data logger from Allan Crawford Associates features simplified programming and expanded alarm capabilities for voltage, current transmitter, thermocouple, and RTD inputs.

You can preset up to four limit alarms for each channel or group. A programmable internal clock provides time of day in hours, minutes, and seconds up t 24 hours with precise scan control. And a unique program list documenting the exact program parameters and limits is available from the on-board printer at the touch of a button. Alarms, clocks, and program list are all included in the standard 2200B package.

The system is ready to go in the application of your choice with a 10-channel low level scanner and high performance A-D converter, featuring low thermal offset voltages and 1 microvolt resolution. It comes with an iso-thermal input connector which can be used to connect voltage inputs and up to four types of thermocouple inputs simultaneously.

The basic 2200B is equipped for 60-channel operation or may be expanded to 100 channels using a Scanner Extender Chassis available separately.

Vancouver Dasco

Dasco Products maintains sales offices in Vancouver, Calgary, Winnipeg, Toronto, Ottawa, Montreal, Quebec City, Saint John, Halifax and St. John's. Dasco Date Products Limited have a new showroom and warehouse at 8495 Ontario Street, Unit 304, Vancouver, B.C., V5X 3E8. The telephone number is 604-324-3446 and the telex number is 04-54252.

S100 Universal Microprocessor Board

A new low-cost prototyping board compatible with the S100 Microprocessor Bus System, is now available from Electronic Packaging Systems Limited.

The S100 board layout has been optimized for flexibility, and as a memory board will hold up to fifty-two 16-pin DIPs. In more general use, thirty-six 16-pin, plus eight 24-pin, plus two 40-pin packages.

The board is produced from copper clad epoxy glass material and is fitted with 50 + 50 gold plated contacts at .125" pitch.

Display Decoder-Driver

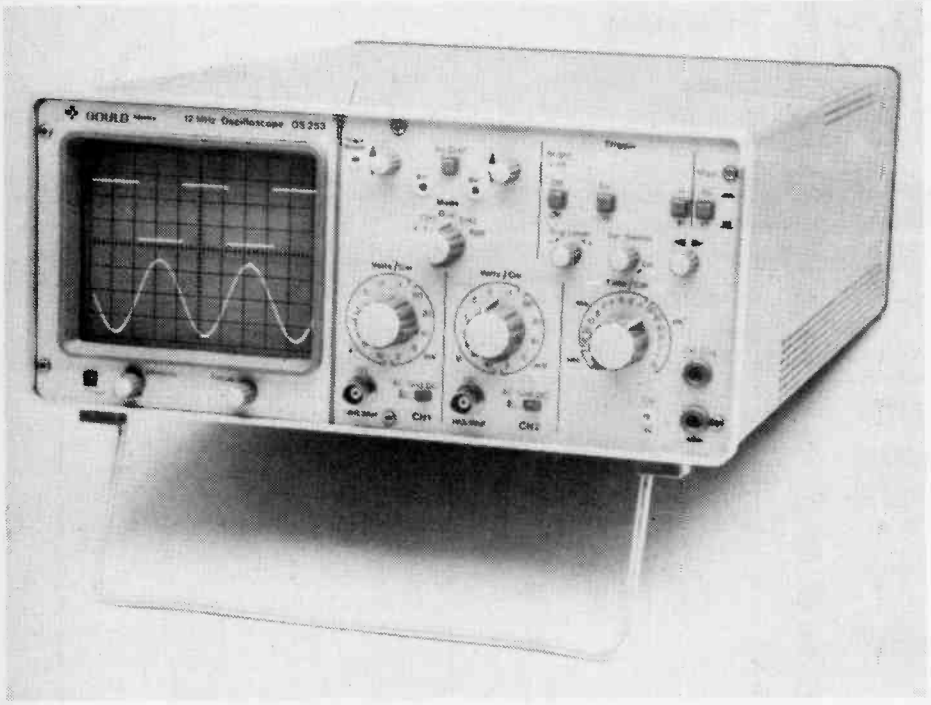
A new chip (ICM7211) from Intersil is a non-multiplexed 4-digit BCD-to-LCD display-driver for use in low-power applications, and the companion ICM7212 is intended as a driver/decoder for LED displays.

A new chip (ICM7211) from Intersil is a non-multiplexed 4-digit BCD-to-LCD display-driver for use in low-power applications, and the companion ICM7212 is intended as a driver/decoder for LED displays.

The ICM7211 device features direct drive to an LCD display and contains a complete on-board RC oscillator for the LCD backplane frequency. No external components are required. The ICM7212 LED driver directly interfaces the display without multiplexing and thus no RFI is generated. High (8mA typical) drive current contributes to display brightness. A brightness control line is available for adjustment of light intensity via a potentiometer.

CMOS construction requires only minimal power, typically 10 uA at 5 VDC. The ICM7211 is a pin-for-pin, function-for-function equivalent to the Siliconix DF411, and additionally, is capable of either CODE B or hexadecimal decoding. In either decoding mode, the devices carry a full numeric display function in addition to a limited alphabetical display (A, B, C, D, E, for the ICM7211/12 hex mode, or E, H, L, P, blank for the ICM7211/12 Code B mode). The new chips may be ganged or cascaded to allow for 8, 12 or 16-digit displays. Applications include low-cost direct interface between digital systems and microprocessors to the LCD or LED displays; 3-1/2-digit BCD readouts for A/D converters; instrumentation displays such as capacitance meters, counters, DVMs and DPMs; and battery-powered digital systems. Both the ICM7211 and ICM7212 are available in 40-pin plastic packages. Prices in 100-unit quantities are $5.60 for the ICM7211 LCD display driver and $3.45 for the ICM7212 LED device.

Intersil, Inc., 338 Queen street East, Suite 208, Brampton, Ontario L6V 1C4 Phone 416-457-1014.



Dual-Channel Scope

A new low-cost 12 MHz dual-channel general purpose oscilloscope, the Gould/Advance model OS253, has been introduced by Allan Crawford Associates Ltd.

The OS253 features ease of maintenance, portability, ruggedness, and a two-year warranty on parts and labour.

The vertical amplifiers feature 2mV/cm sensitivity with dc and ac coupling, sum and difference of the two channels with channel 2 inversion and X-Y modes. Horizontal sweep rates are fully adjustable over 18 ranges from 0.5 microsecond/cm to 2s/cm, with a X5 expansion giving a fastest sweep rate of 100ns/cm with no loss of accuracy.

Triggering is ac coupled from an internal or external source, positive or negative slope and variable manual level control. Bright-line operation is available to give a trace in the absence of signal or when the selected level is outside the range of the input signal.

Additional facilities include dc-coupled Z-modulation input, calibrator output and a front-panel trace-rotate control.

Cable Assemblies

Cable assemblies for testing or connecting circuitry within a board or for jumping from board to board, featuring rainbow color coded flat cable have been introduced by OK Machine & Tool. They use 26 AWG stranded conductors soldered and epoxy encapsulated to popular top-entry plugs. Plugs are available in 14 and 16-pin Dip configurations. Pins are gold plated phosphor bronze for performance and durability. Double ended configuration available in 2", 4" and 8" lengths. Single ended assemblies are offered in 12" and 24" sizes.

For further information contact: Len Finkler Limited, 25 Toro Road, Downsview, Ontario. M3J 2A6 Phone: 416-630-9103.

ASCII-Alphanumeric Displays

Litronix have introduced two 'Intelligent Displays', the DL2416 and DL1414. They accept ASCII information from a computer system data bus, store it, and convert it to letters on LED alphanumeric displays. Each module displays four letters and modules may be placed side-by-side to present words, phrases, or sentences.

In large quantities the manufacture expects the Intelligent Displays to cost only $1.00 to $1.50 more than the cost of LED characters alone. The US price in 1000-piece quantities for the DL2416 (0.16 inch characters, after magnification) is $26.00 each, and for the DL1414 (0.112 inch characters) $13.00 each. Both units are available from stock.

Zentronics Phone

Zentronic's new phone number is 416-676-9000.

Display Terminals

Volker-Craig Limited has introduced two new microprocessor-based asynchronous data terminals.

The Model VC4152 is compatible with Digital Equipment Corporation's VT52 display terminal and features a detachable upper/lower case typewriter keyboard, 1920 character display and data rates to 9,600 baud. Additional features not on the DEC VT52 include a 25th status line, character highlighting, and 10 special function keys. Hold screen mode and dual mode keypad are selectable from the keyboard and a transparent tape mode switch is standard to allow the operator to display all 128 ASCII characters, an aid in debugging software and solving difficult communication problems.

Other available options include graphics, split speeds, a bi-directional serial peripheral interface controlled from the CPU or keyboard, parallel input for bar code readers or peripherals, and numerous keyboard-character fonts (French, German, Swedish, etc.).

The VC4152 is manufactured in Canada by Volker-Craig Limited. Delivery is 12 weeks. Unit price is $1,850, with distributor and OEM discounts up to 45%.

The Volker-Craig model **VC415APL** offers both ASCII teletype compatibility and full APL overstrike capability switch selectable. The terminal features a buffered line edit mode for preparation of data, and selectable independant window (split screen) for host responses so existing screen data is not erased during programming operations. A transparent tape mode switch enables the display of all 128 characters and the standard detachable terminal keyboard is typewriter paired. An optional keyboard package includes a 16 key numeric pad and 12 special function keys.

Other available options include serial and parallel peripheral interfaces and coloured display screens (amber, green).

Delivery is 12 weeks. Unit price is $1,850, with distributor and OEM discounts to 45%.

Volker-Craig Limited, 266 Marsland Drive, Waterloo, Ontario, N2J 3Z9. Tel: 519 884 9330, or 416 456 2070.

Audio Today

Developments in audio reviewed by Wally Parsons

BY NOW IT should be clear that the variety of signals which actually exist in what is presumed to be a two channel stereophonic signal is considerably more than two, and that they can be recovered in a variety of ways and put to many uses.

All of the techniques we discussed in the past two columns dealt with electronic means and with applications to which these means were peculiarly suited. Now, as promised, a look at some passive circuitry and applications, that is systems which involve only the loudspeaker networks themselves.

SIMPLICITY

Passive systems have one very great advantage over active: they are simple, and therefore cheap. It is the closest thing to something for nothing that I know of. It requires no additional power amplifiers, no isolation devices, no matrixing amplifiers. It also involves fewer things to go wrong.

The first modern application of passive sum-difference matrixing was the David Haffler "Dynaquad"™ introduced in the early sixties by Dynaco as an add-on device and incorporated into their integrated amplifiers. Essentially it was used as a means of ambience retrieval. Hafflers reasoned that in the recording of concert music especially, that the recording channel picked up not only left-right information, but reflections from walls, ceiling, rear walls, etc., of the hall in which the recording was made. These reflections, bouncing around several times before being picked up by the microphone, or the ear constituted short-term delayed sounds which were responsible not only for the tonal character of the hall, but also for our perception of distance from the original sound, through the ratio of direct to reflected sound and even our awareness of size and shape of the listening environment, by subconcious analysis of the different time delays. Because of the random nature of these signals, many of them appear at the recording microphones in varying phase relationships to each other, and when reproduced through the two front speakers are either masked by the direct sound or are partially or completely cancelled acoustically depending on their phase relationship.

These out-of-phase signal components could be recovered separately by extracting the difference signal. Moreover, this difference signal is available at the speaker terminals of any stereo amplifier. If a speaker is connected from the signal output of one channel to the signal output of the other channel, any difference signal would result in a current through the speaker so connected. This is shown in Fig. 1.

It will be noted that a left channel only signal will also be reproduced. Same thing for a right channel only signal. This is because the circuit for the ambience speaker is completed through the parallel impedance of the other channel speaker and the amplifier internal impedance.

It will be further noted that a centre channel signal will appear at each speaker terminal equal in amplitude and phase. Therefore, there will be no difference, and no current will flow through the "ambience" speaker.

DOWN THE CENTRE

Fig. 2 shows the first Dyna circuit actually used. In addition to the ambience speaker, which was normally located to the rear of the listener, a centre speaker has been added, by inserting it between the left and right speakers and ground, and sharing the ground return with them. Both left and right channel signals are reproduced by this speaker since it is in a common

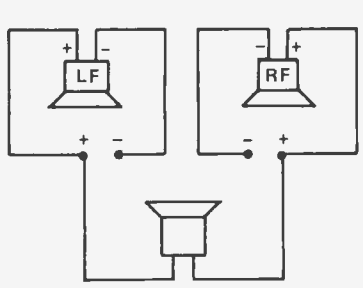


Fig. 1. Speaker connected to give difference output.

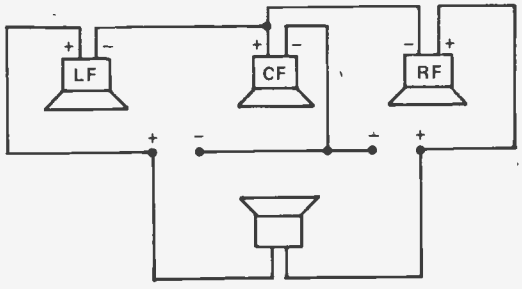


Fig. 2. Centre front and difference connections, the "Dyna" circuit.

return path. Actually, for a left channel signal, for example, current will divide at the junction of the three speakers, with part going through the centre speaker and part through the parallel combination of the other channel speaker and the amplifier's internal impedance. Moreover, since it entered the other channel from the return lead side, it is also in reverse phase from its own channel. To counter this a small amount of channel blend, usually about 6 dB is introduced at the inputs of the amplifiers. Thus a small level signal from the other channel appears in opposite phase to the signal leaked from the speaker line of the other channel.

The result of all this is a very solid stereo image particularly with regard to centre and near-centre imaging. True, stage width is reduced since with each channel being reproduced by its own speaker *and* the centre speaker, the sound source is now a point somewhere between them. But it allows the left and right speakers to be separated by a greater distance, and allows good listening over a wider area. You'll notice also that difference signal will appear at the junction of the three speakers and to the extent that their amplitudes are identical and their phases are opposite will cancel out, leaving only the rear channel to handle them. Notice too that if the rear channel is removed, the centre channel can still be synthesized with the same circuit....

PHASE ANOMALIES

. . .And a good thing too, because a close inspection will reveal a problem with the rear channel. Suppose the rear speaker is connected with the "plus" connected to the left channel "plus". This means that the "minus" will have to be connected to the right channel "plus", unless you have a balanced output and can connect to the right channel "minus", but in that case you will no longer get a difference signal, but a sum signal.

A left signal will be reproduced by the left front and the difference speaker in phase. However, a right signal will be reproduced by the right speaker and the difference speaker in reverse phase. The solution then is either to use a speaker with two voice coils or two speakers, as in fig. 3. This is the final Haffler circuit, with the centre channel removed, and with two rear channel speakers connected in series but in reverse phase to each other, but in phase with respect to their respective channels, and a resistor to ground from the junction point. This is intended to provide a ground reference, and with the blending described earlier, remove front channel signals from the rear, plus minimize out-of-phase signals from appearing in the opposite rear channels. If this seems a little obscure, it should be mentioned that at the time Dyna was also promoting a system of 4-channel encoding to be used with this system.

To use this system on today's stereo sources it is often sufficient to connect only the rear speakers as shown but without the resistor, and with or without blending. In that case some signal will leak to the other channel, and left front will appear also at the right rear out of phase, and in phase at left rear. Similarly with left front signals. By providing adjustable resistances in the series leg it is possible to vary the amount of rear channel signal, and by inserting a variable resistor in place of the fixed one, the amount of blend in the rear channels and the ratio of in-phase to out-of-phase sound can be varied. In this case a pair of ganged resistances

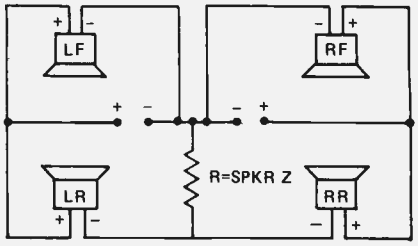


Fig. 3. Four, four, four channels from two!

will be required in each of the rear speaker lines. The effect can be quite dramatic on some programmes. Is it accurate? I don't know. But then, what is?

BACK TO CENTRE

Note, that if the resistor is replaced with a loudspeaker, we now have the centre channel arrangement shown in fig. 2. If the "minus" lead goes to ground you will get a sum signal in phase with the left and right front signals, and it can indeed be used as a centre channel. Series and shunt resistors allow not only adjusting the blend in the rear channels, but also the centre channel level. Increasing the total resistance reduces the blend, while reducing it increases the blend until, at zero ohms, each rear speaker is on parallel with its respective front channel. By increasing series resistance in the centre speaker and reducing shunt resistance you can alter centre channel level while keeping blend constant.

Finally, of course, you can reverse phase of the centre speaker and use it as a centre rear channel. It may seem hard to believe at first, but this technique can actually firm up the centre channel image even without a front centre speaker. The out of phase rear condition tends to project its image forward which, in conjunction with the two front signals, tend to bring the centre towards the listener. Ironically, the effect tends to be less dramatic with front speakers whose imaging is already outstanding, but the feeling of room expansion is still there.

TWO FOR ONE

A microphone technique called "M-S" or mid-side found some use several years ago. This involved the use of a cardioid microphone facing the performers, and a gradient, or figure 8 microphone arranged so that its plane of minimum signal faced the same direction. Matrixing the outputs of these two microphones (see April and May) yielded left and right signals. By reversing this it is possible to produce stereo sound from a single speaker box.

I don't mean one eight feet long, but a small box of usual proportions. Fig. 4 shows how. A single speaker faces front and reproduces the sum of the left and right channels. A second speaker is mounted on the axis if the first and rotated 90°, and reproduced the difference signal. Essentially, the rotation of the difference speaker results in a sound field which is perceived to come from one side, which side depending on the relative phase of the combining signals. In practice two speakers are used for the difference signals and wired in opposite polarity and mounted one above the other and facing opposite directions. This is necessary due to the different radiation impedances of each side of a conventional dynamic speaker. Also, the sum speaker may consist of two speakers wired in series or parallel, with the difference speakers mounted between them.

Jensen, who manufactured such a speaker about ten years ago used a complex network with a tapped coil, but the simplest and to my mind the best

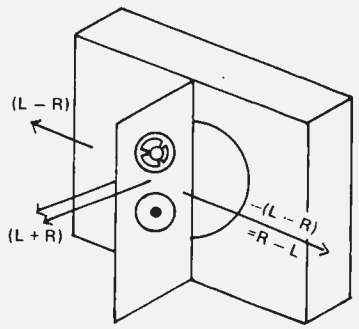


Fig. 4. You didn't want all those nasty speakers pointing at you anyway, did you?

approach is the very same matrix network we've been discussing. Connect the difference speakers as you would rear channel ambience speakers, and the sum speakers between the junction of the difference speakers and ground. By varying the relative levels of the sum and difference speakers you can alter the size of the stereo image.

It is also useable as a centre channel speaker, because it does not reduce the size of the main stereo field. The centre channel image is firm because it is a real image, while left and right are less well defined, being virtual images. The reverse is true of discrete left and right channels.

Ever notice how many good things were forgotten when audio became a consumer commodity?

Audio Today Letters

Want to express your views or report on news? Write to Audio Today, ETI Magazine, Unit Six, 25 Overlea Blvd., Toronto, Ont. M4H 1B1.

WP COMMENTS

The large number of handwritten letters which I receive is a splendid commentary on typewriter sales in this country. Possibly IBM, Underwood (Hi, guys!) Royal, et al, could use some advice on marketing from the audio industry, which has certainly made heavy inroads into the consumer market with professional and quasi-professional equipment. In view of the fact that it's hardly likely that anyone with a typewriter would choose to take quill in hand, I presume that these people do not possess typewriters, and I'm not about to suggest that they go out and purchase one just to please me.

However, it does mean that, from time to time, I receive letters which are, um, shall we say, difficult to read. The writers of such letters, I suspect, often get something of a brush-off from other publications and even some manufacturers' reps. Well, they won't get brushed off here. Many such writers appear to be of somewhat limited education, if one uses apparent literateness as a basis of judgement. The projects which such people undertake are all the more remarkable, then. Perhaps some of the more sophisticated are a little too smart for their own good, and would rather trust the Japanese to do for them.

Then, too, there are readers for whom English is not their native language, including many French speaking Canadians. Certainly their English is still usually a lot better than my French, and suggests a greater level of common sense throughout the province of Quebec than in Quebec City itself, or in Ottawa.

It occurs to me that many readers, particularly those to whom I've referred, might consider their problems to be pretty simple, and not worth my while bothering with. While it's true that many are indeed simple, from my point of view, they are not so simple from the point of view of the letter writer, or of many other readers who haven't yet written. Any reader who takes the trouble to write with a problem, especially one which he suspects is so simple that he thinks he might appear foolish (by the way, that's the main reason letter writers are indentified only by initials), particularly someone who does very little letter writing, and may be working in a non-native language, then spent seventeen cents in postage, and entrust this to the hazards of the post office, obviously has a problem or comment which is important to *him* and will certainly get this department's full attention, if not always the fastest response.

Which brings us to the first letter. I hope the writer will read the foregoing in the spirit intended, and will not take offence. It's an interesting letter (to me, anyway), but the handwriting is extremely difficult for me to read. All I know about the writer is that he lives in St. Lambert, P.Q., or just possibly St. Laubert, or St. Lambeth, although I don't know of these places, and judging by some of his references, is probably in his forties or fifties. Anyway, here it is, as best I can read it.

HISTORIC SPEAKERS

Maybe what I'm asking is a little bit too old for you, but 20 or 22 years ago a man named Karlson designed an enclosure that I built in those days with an Electrovoice triaxial speaker. Everybody was in hi fi in those days, stereo was as far as the moon. Maybe in your files or charts you have the exact measurements for it.

As I recall this was the best sound in the world with a 15" Wharfdale, 8" commercial horn horizontally arranged on top, and I don't recall the tweeter used. The twin taper pieces formed an exponential curve and were very important, like tuning an organ pipe.

Will it work properly with the new high compliance, high efficiency units? I remember the measurements were for a 15", a 12" and an 8" speaker.

I still use a 4 x KT66 output tube circuit called class AA and a transistor pre-amp. I still prefer the sound of tube type power amps. Is it obstinacy on my part or a taste developed over some twenty years?

St: Lambert (?) P.Q.

Probably a bit of both. You're not the first to observe some highly desireable qualities among some of the best tube types. Historical perspectives can be

most peculiar. In music, we should remember that Bach was practically unknown in his own time, and were it not for the efforts of Mendelssohn, we may never have known that this genius ever existed. The great revival of Baroque and Renaissance music in the fifties and early sixties brought to light an incredible amount of rubbish — "music to gather wool by" — which should have been left in the archives where it was found, but also unearthed some real gems. Today's nostalgia for the fifties and the big band era conveniently forgets the amount of trash recorded. Similarly, most of the equipment built in the "old days" was just as ordinary and undistinguished in its time as most of today's stuff is now. But there were and are some gems which are occasionally revived and given the benefits of modern technology.

I remember your Karlson speaker enclosure very well. Karlson never made speakers, only enclosures, and they were frequently mated to Wharfdale, Electro-Voice, University, and Jensen drivers, and the occasional Goodman. The design, which is reprinted here from Babani's collection of speaker design (Fig. 1) is a hybrid of the bass reflex and a very short pipe terminated in an exponential slot. Performance is very much related to speaker compliance and "Q" as in a reflex system. Detailed analysis is extremely complex, but the dimensions suggest a volume in the loading chamber of about 2.5 to 3.0 cu.ft. and a port area of 78.75 sq.in., which makes it the same area as a 12" speaker cone. Tuning frequency is probably around 50 Hz, but it's hard to figure, especially since it's not too certain whether the upper section should be considered as a duct, or a pipe. Probably it's actually a bit lower than this.

I would suggest as a starting point, a 12" driver with a resonance around 35 Hz to 45 Hz, such as one of the Goodman's Audiom series. Since it's a smallish box you don't want a high compliance driver unless it has a low Q which means big magnet. If you wish to experiment with it, I would suggest making the space behind the shelf, and the slot both adjustable, and alter them both. I would start with the shelf to achieve the classic twin peak reflex impedance curve, then adjust the slot to control the spread and height of these peaks.

I must confess that none of these speakers ever impressed me as much as such contemporaries as the Electro-Voice Patrician, a Klipsch-licensed folded horn, and the original Tannoy GRF, a sort of transmission line with a horn flare, and both designed for corner placement.

Anyway, hope this helps, and good luck.

AUTO SOUND

I'm writing to suggest that you devote one of your columns to the subject of automobile stereo. I have been searching for over a year to find an efficient way to put a higher power amplifier in place of the 2 watts that runs my AM-FM now. First, I found a fairly efficient 85%-95% voltage doubler circuit but even at 25V there wasn't enough volume for my ears. So I tried to bridge the amplifier (three of four different but fairly common circuits I dug from my magazine stack) with a simple phase inverter to theoretically quadruple my power. However, I was not ever able to arrive at a circuit that wouldn't violently break into oscillation the moment a speaker was attached.

Next I found the NE 540, an interesting device, but lack of data on its pin configuration helped me send four of these little beggars to an early grave.

I finally came across an excellent circuit for a simple amplifier (from the pages of Audio Amateur, has a fairly low parts count and can be used at any voltage from ±15V up to whatever is necessary for your particular application by only increasing component ratings and adjusting two bias pots. I'll send you this circuit if you are interested) which retains high quality, its only drawback being that for automobile use it is difficult to create a negative supply.

Digging through Wireless World and ETI Circuits #1, I found two circuits which claim to deliver a complementary negative voltage. I have not been able to get either circuit to work at more than a couple of milliamps before the negative heads down to zero. Have you any experience with generating negative voltage at amplifier type currents (33 mA to 2 A) or could you direct me to some literature on this subject?

You expressed a desire for some input a few issues ago on preamps. I am currently building one from an article in Audio magazine which just about fits my idea of what a preamp should be. That is, there are no tone controls, which I believe aren't necessary anyhow in a good quality system. It does however incorporate a rumble filter, a centre channel output, and keeps hum down to a minimum by using a second chassis to house the power supply.

Another subject that I would like to know more about is one you discussed before. Tape decks and associated circuitry. You answered one reader's letter with the comment that design was fairly dependent on the recording head itself as well as the type of recording system. Could you delve further into this some time? I haven't seen much in the way of explanations of the characteristics of the recording head or the effect of speed and tape size on the signal being recorded.

Well, this letter, believe it or not, started out to be a short series of comments. So I'll just sum up by saying your column is becoming my favourite ETI feature. Thanks for your time.

B.D., Victoria, B.C.

The trouble with cook-book engineering is that combining recipes does not result in the sum of the two, but something else entirely. Usually acrid smoke. Collections of circuits, including ETI's are intended as sources of circuit information, but cannot just be strung out one after the other and be expected to work.

Looking first at your power supply problem, I can't for the life of me figure out why you would even consider using either one. The WW circuit (Fig. 2) couldn't possibly deliver any kind of current. Or were you expecting the 555 to operate as a current source. As for the ETI circuit (Fig. 3) this is simply an inverter with a doubler output and a positive ground. What you require is a balanced supply, and on the same page (page 50) of the same ETI Circuits #1, and immediately following the circuit you used, you will find a circuit for a DC to AC inverter. It uses an astable multivibrator driving a power amplifier driving a step-up transformer with a centre-tapped secondary. Follow this with a rectifier and filter and you have a balanced DC supply.

Returning now to the source of your problem, required audio power, I should like to draw to your attention the fact that I am using a 10 Watt amplifier for speaker measurements, and have no difficulty generating enough power at 20 Hz to cause violent vibration of the floors, even with an inefficient speaker. The kind of sound levels you seem to want in the car kind of scares the hell out of me. I'm just glad you drive on BC roads, instead of Ontario. Anyway, with a 12 Volt supply, assuming an amplifier capable of a voltage output of Vcc -2v,

P-P that gives 10 V P-P, or 5 V peak, or 3.5Vrms. Into 4 Ohms this will deliver 3 Watts. Or into 8 ohms we have 1½W. Now with a bridge arrangement you will get twice the voltage across the speaker, and thus four times the power, for 12W into 4 ohms or 6W into 8 ohms. But this requires that you have truly out of phase inputs (ie: differential amp inputs), AND amp outputs rated for half the impedance driven by the bridge set-up (or less), ie, 2 or 4 ohms respectively. Otherwise you won't get twice the voltage as hoped. Note that if you want you can get out more acoustic power simply by connecting more speakers in parallel with the first, again if the amp will handle it. That is, two 8 ohm speakers look like 4 ohms, three 8 ohmers look like 2.7 ohms etc. In other words, bridging works if all considerations are taken care of, but it's not the only way to get mor volume with a fixed power supply. But this is a topic for a whole column by itself.

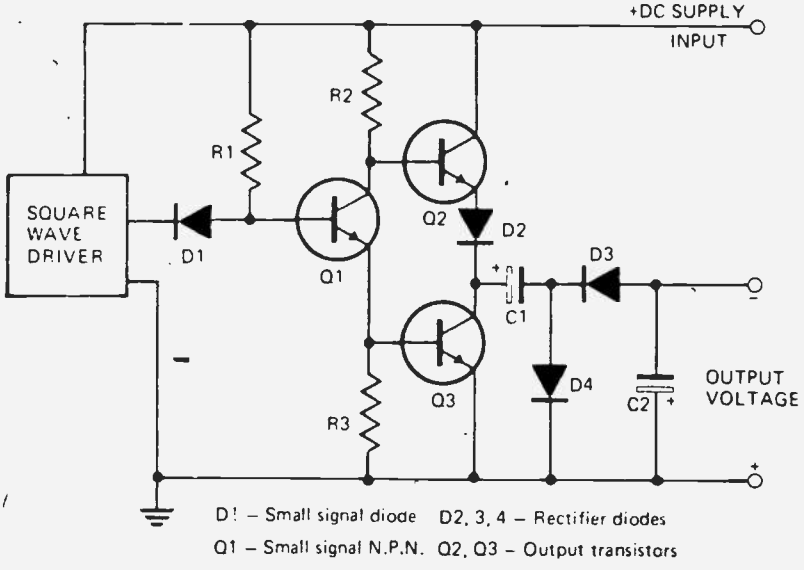
I don't agree that if a system is of high quality there is no need for tone controls. Tone controls are for correction of programme sources not equipment defects. If your reasoning were correct there would also be no need for a rumble filter, since good equipment would not contain any rumble. This sounds like either the Burwen or the Bongiorno circuits, both of which are very good.

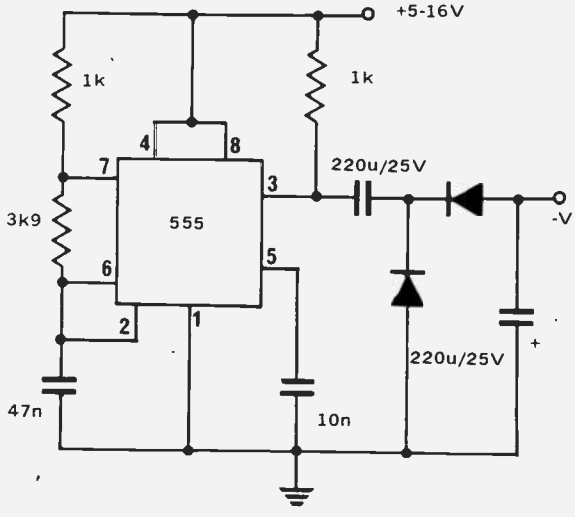
No, I will not delve further into tape electronics right now since there is no room. But it is on my list of subjects.

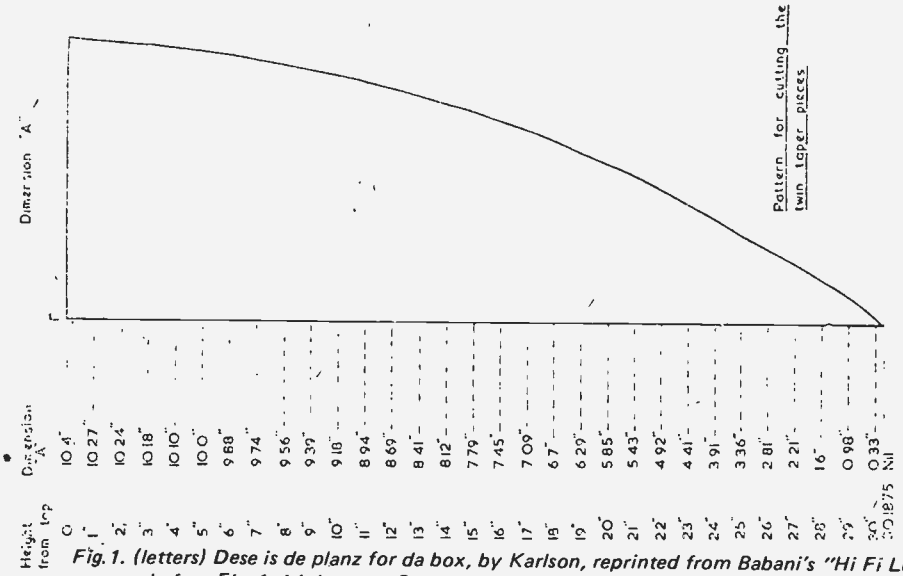
Letters like this one are particularly welcome, as long as you don't mind being shot down occasionally. After all, ETI readers are all adults, even the kids, and as such can handle a little straight talk, right?

Yes, I'd like to see the AA circuit. Thanks for the offer.

Fig. 2. A couple of inverters that won't do the trick.







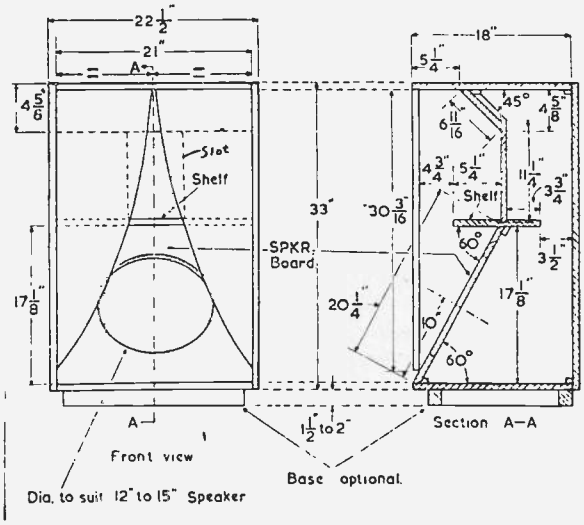


Fig. 1. (letters) Dese is de planz for da box, by Karlson, reprinted from Babani's "Hi Fi Loudspeaker Designs". If you're wondering why Fig. 2. appears before Fig. 1 it's because Gail put it in the wrong place. However, we have that problem solved for next month, she's going to our English office, and we've got a new artist, Sarah.

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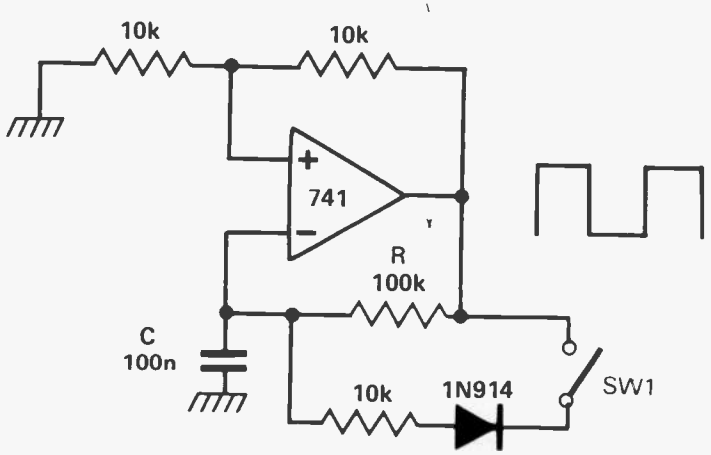
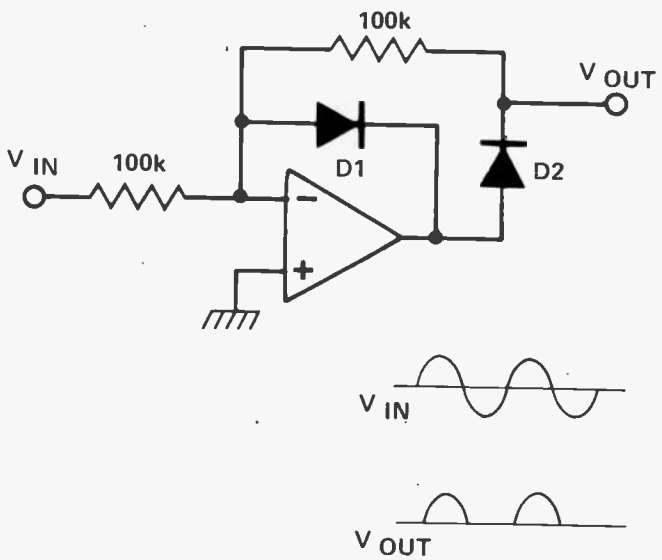
Op Amps: Part 2

In the first part of this series Tim Orr discussed the theory and operation of op-amps. This month he moves on to give some circuit applications for this ubiquitous device, and explains how and why it can do what it does!



SINGLE OP AMP OSCILLATOR

This circuit has a Schmitt trigger and a 'sort of integrator' all built around one op-amp. The positive feedback is via the 10 k resistors. The 'integration', (the timing) is controlled by the RC network. The voltage at the inverting input follows that of the RC charging exponential, except that it is confined to be within the upper and lower hysteresis levels. Thus the hysteresis levels and the RC time constant determine the frequency of operation. It is possible to make the output square wave have a large mark to space ratio. By closing the switch SW1, the discharge time of the capacitor becomes ten times as fast as the rise time. Thus a square wave with an 10:1 mark space ratio is generated.



PRECISION HALF WAVE RECTIFIER

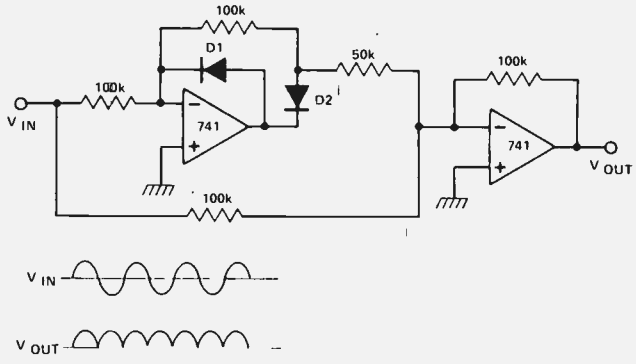
Rectifying small signals with any accuracy can be very difficult using diodes only due to their forward voltage drop of about 0.6 V. However, an op-amp can be used to reduce this voltage drop to virtually nothing. Consider the circuit shown. There is negative feedback so that 'virtual ground' circumstances exist. When Vin is positive, D1 conducts to maintain the virtual ground, D2 is reverse biased and so the output is just a 100 k resistor connected to 0 V. When Vin goes negative, the output rises positively, D2 is turned on and D1 turned off. As the virtual ground is being maintained, the output voltage is the exact inverse of the input voltage. This is true for all negative inputs. Therefore, the output is composed of positive going half sinewaves. Precision half wave rectification has occurred. In fact the diode error is very small, being equal to

$$\frac{600\ \text{mV}}{\text{(surplus voltage gain)}}$$

Op Amps: Part 2

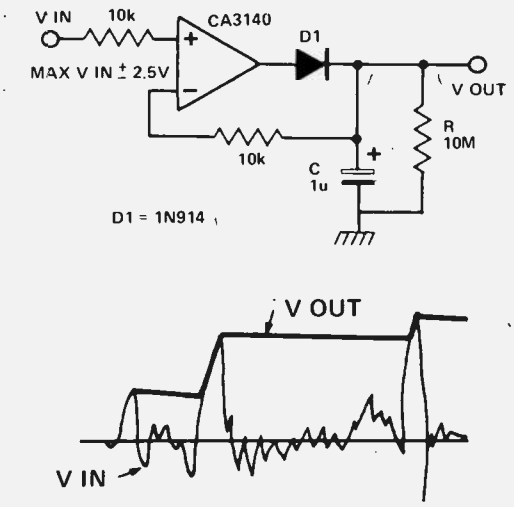
Therefore as the input frequency increases, and the surplus voltage gain decreases, precision falls.

By adding together the original and the half wave rectified signals together in the right ratio, it is possible to fill in the half cycle gaps and thus to generate precise full wave rectification. The addition of one summing op-amp and three resistors is all that is needed as shown opposite.



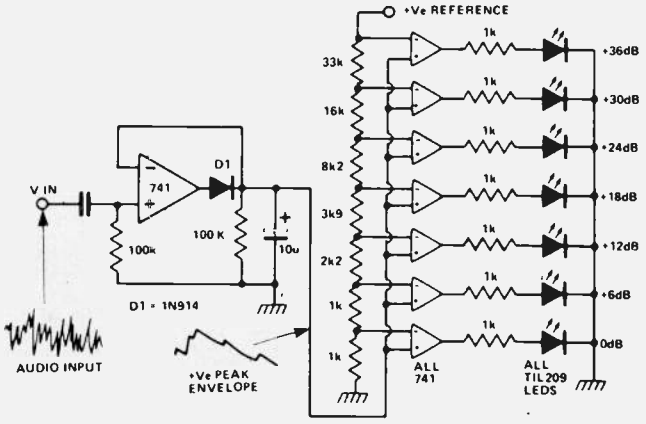
PRECISION PEAK VOLTAGE DETECTOR WITH A LONG MEMORY TIME

The circuit shown has negative feedback only for positive signals. That is, the inverting input can only get some feedback when diode D1 is forward biased and this can only occur when the input is positive. When a positive input signal is applied the output of the op-amp rises until the inverting input reaches the same potential. In so doing, the capacitor C is also charged to this potential. When the input goes negative, the diode D1 becomes reverse biased and so the voltage on the capacitor remains there, being slowly discharged by the op-amp input bias current and the resistor R (10M). The op-amp used has a MOS FET input, having an exceptionally low input bias current of 10 pico amps. Thus the discharge of the capacitor is dominantly controlled by the resistor R, giving a time constant of ten seconds. Thus the circuit detects the most positive peak voltage and remembers it.



LED BAR PPM DISPLAY FOR AUDIO

The peak voltage detector can be used to control an illuminated audio level monitor having the same characteristics as a PPM (Peak Programme Meter). A bar column of LEDs is arranged so that as the audio signal level increases, more LEDs in the column light up. The LEDs are arranged vertically in 6 dB steps. A fast response time and a one second decay time has been chosen so as to give an accurate response to transients and a low 'flicker' decay characteristic. The op-amps that drive the LEDs are used as comparators. On each of their inverting inputs they have a dc reference voltage, which increases in 6 dB steps up the chain. All of their non-inverting inputs are tied together and connected to the positive peak envelope of the audio signal. Thus as this envelope exceeds a particular voltage reference, that op-amp output goes high and the LED lights up. Also, all the LEDs below this are illuminated.



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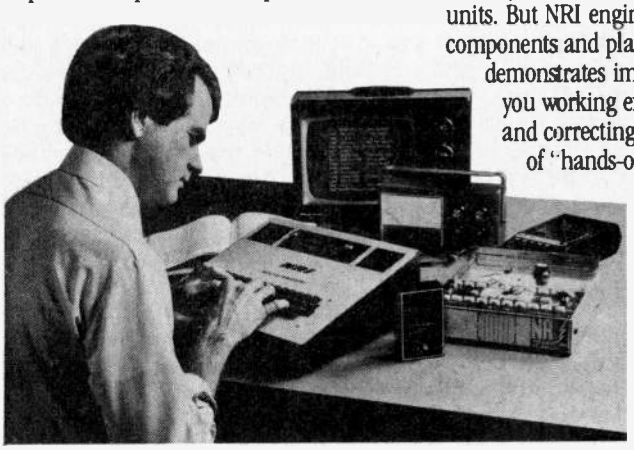

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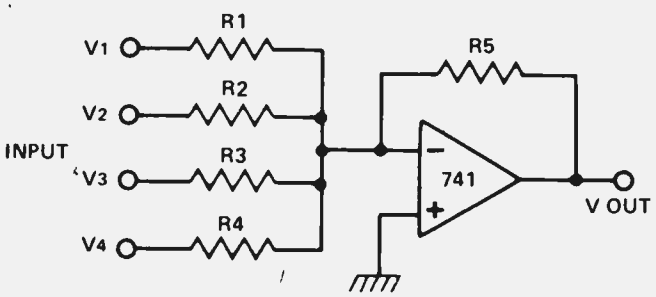
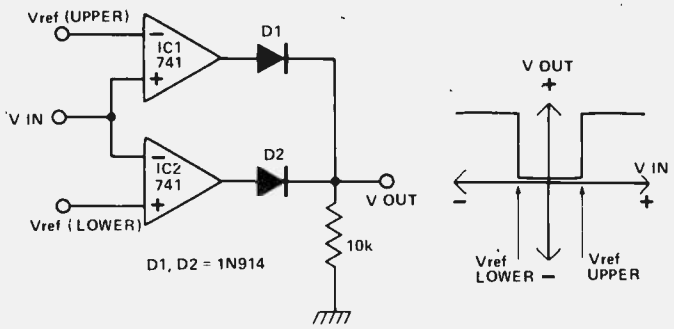
BASIC SUMMING CIRCUIT (MIXER)



$$V\ OUT = -R5\left(\frac{V1}{R1} + \frac{V2}{R2} + \frac{V3}{R3} + \frac{V4}{R4}\right)$$

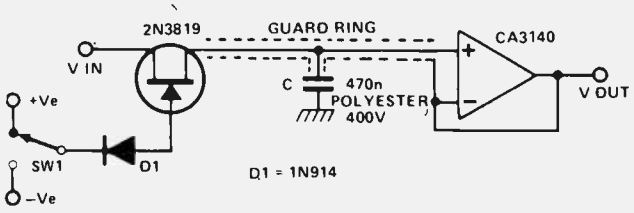
A virtual ground amplifier can be used to mix several signals together. The output voltage is a mixture of all the inputs. The amount of an input that appears at the output, inversely proportional to the input resistor. If the input voltages are fed into potentiometers before being fed to the mixer, then their individual levels can be manually adjusted. This is the basis of most audio mixers, although the cheaper units use op-amps. Most op-amp mixers will degrade the signal to noise ratio of the signals by more than a good discrete component amplifier.

WINDOW COMPARATOR

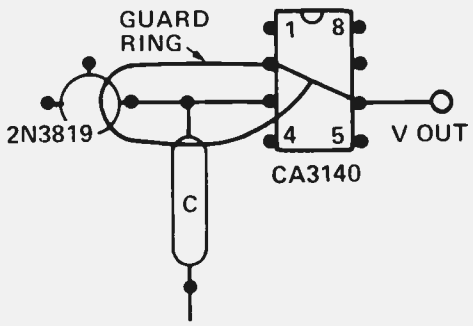


A window comparator gives an output which in this case is 0 V, when an input voltage lies in between two specified voltages. When it is outside this 'window', the output is positive. The two op-amps are used as voltage comparators. When Vin is more positive than Vref (upper) the output of IC1 is positive and D1 is forward biased. Otherwise the output is negative, D1 reverse biased and hence Vout is 0 V. Similarly, when Vin is more negative than Vref (lower) the output of IC2 is positive, D2 is forward biased and thus Vout is positive. Otherwise Vout is 0 V. Thus only when Vin lies within the window set by the reference voltages is Vout 0 V.

HIGH PERFORMANCE SAMPLE AND HOLD



PRINTED CIRCUIT BOARD LAYOUT



It is often necessary to have a circuit that will sample an analogue voltage and then remember it for a long time without any significant degradation of that voltage. This is known as a sample and hold circuit and one of its uses is to store the voltage from the keyboard connected to an electronic music synthesiser. The voltage is then used to control the pitch of a voltage controlled oscillator and so it is very important to have a high performance sample and hold. A drift of less than one semitone, (80 mV), in ten minutes is required. A sample and hold is simply an electronic switch, a storage capacitor and a high input impedance voltage follower. In the circuit shown, when switch SW1 is positive the FET is turned on, and has a resistance of about 400R. Thus the input voltage charges up the capacitor through the FET. When SW1 is negative, the FET is turned off, (pinched off), and can have a resistance of thousands of megohms. To get a long storage time the op-amp must have a very low input bias current. For the CA3140, this current is about 10 pico amps, i.e., 10^{-11} amps. Therefore the rate at which the capacitor will be discharged by this current can be worked out from the equation, $C(dv/dt) = i$
where dv/dt is the rate of change of voltage on the capacitor.

Therefore:

$$\frac{dv}{dt} = \frac{i}{C} = \frac{10^{-11}}{0.47 \times 10^{-6}} \quad 22\ uV/s$$

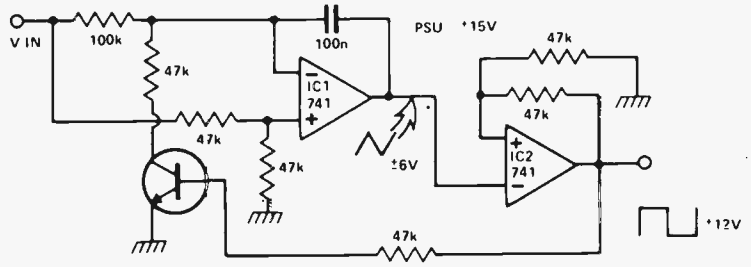
This is a very low drift rate, much better than we need. However, the actual drift rate will probably be in excess of this, due to surface leakage on the printed circuit board, leakage through the FET, and internal leakage in the capacitor. It is advisable to use a high voltage, non-polarised capacitor in this circuit to keep the leakage currents to a minimum. Also, to stop surface leakage a simple PCB trick can be used, that of making a guard ring around the sensitive components.

Normally any potential stored on the capacitor may leak to ground across the surface of the PCB, but if we make the surrounding surface a conducting track held at the same potential as that of the capacitor then the potential difference is virtually always zero, and hence the surface leakage is greatly reduced.

LINEAR VOLTAGE CONTROLLED OSCILLATOR

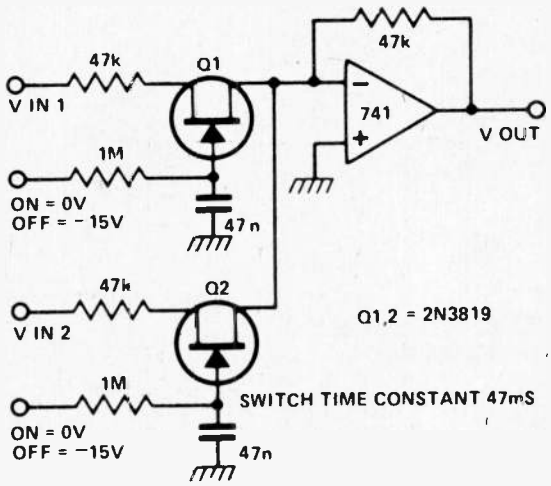
This oscillator is very similar to the triangle square wave oscillator shown on this page, except that this one is voltage controlled. The integrator and Schmitt trigger action are the same as before, but the feedback has been altered. The input voltage Vin, is applied differentially to the integrator via the resistor network. The larger the value of Vin, the faster the integrator ramps up and down. Thus the frequency of the operation is determined by an external positive control voltage. The frequency is linearly proportioned to this control voltage.

When the output of the Schmitt is low, Q1 is off and all the input voltage is applied to the inverting input. Half of the input voltage is always applied to the non-inverting input. Therefore the integrator's output ramps downward until the Schmitt flips into its positive state. Now, Q1 is switched on and the voltage at the inverting input is negative with respect to the non-inverting input. Hence the integrator now ramps upwards.



SILENT AUDIO SWITCHING

Sometimes electronic switches for audio signals are required. FETs can be used to perform the switching, but they can cause distortion, the resultant output impedance is not very low and clicks generated by the switching signal can break through. The circuit shown virtually eliminates all of these problems. By using an op-amp a very low output impedance is obtained as well as the possibility of selecting or mixing one or more of many input channels. Because of the virtual ground mixing, the voltage across any FET that is switched on is very small. If the output voltage is 1V and the FETs ON resistance is 470R, then the voltage across the FET is about 10 mV. When large voltages are applied to a turned on FET, the distortion is large, but if the voltage is small, (10 mV say), the distortion could be less than 0.1%. Thus the virtual ground mixing enables low distortion operation. Lastly, to stop the generation of switching clicks, a time constant of 47 msec has been enforced at the gate of the FETs.



The next part sees circuits for exponential voltage to current convertors, musical chime generators, triangle to square wave convertors, square wave generators with auto level adjustment and variable mark space ratio — amongst other things.

A STEP BY STEP GUIDE TO BUILDING OUR

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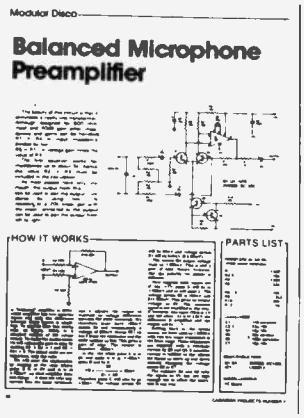

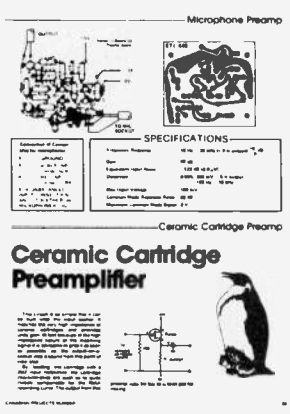

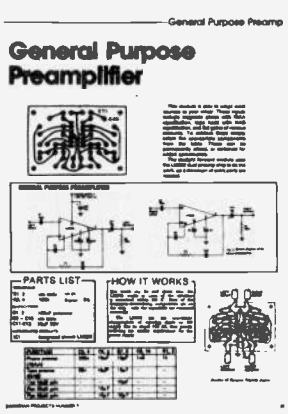

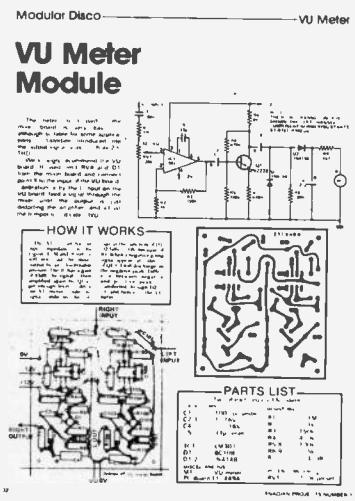

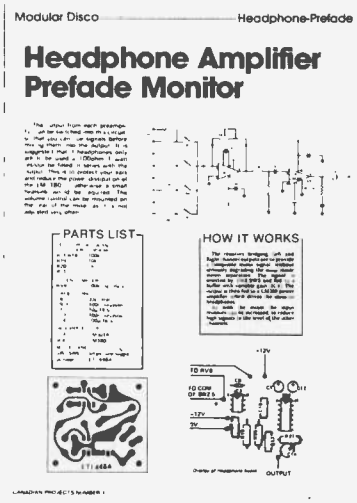

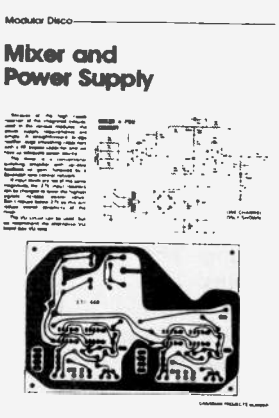

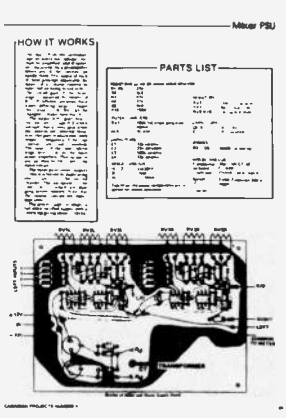

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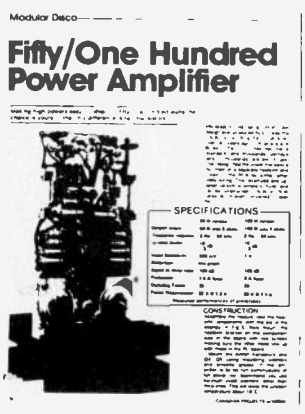
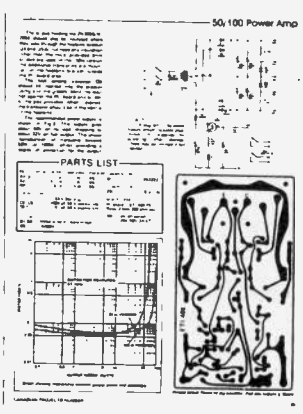




And we will send you complete full–size (ETI– size pages) instructions on these and many projects in our

CANADIAN PROJECTS BOOK #1

Inside Info From Ultrasound

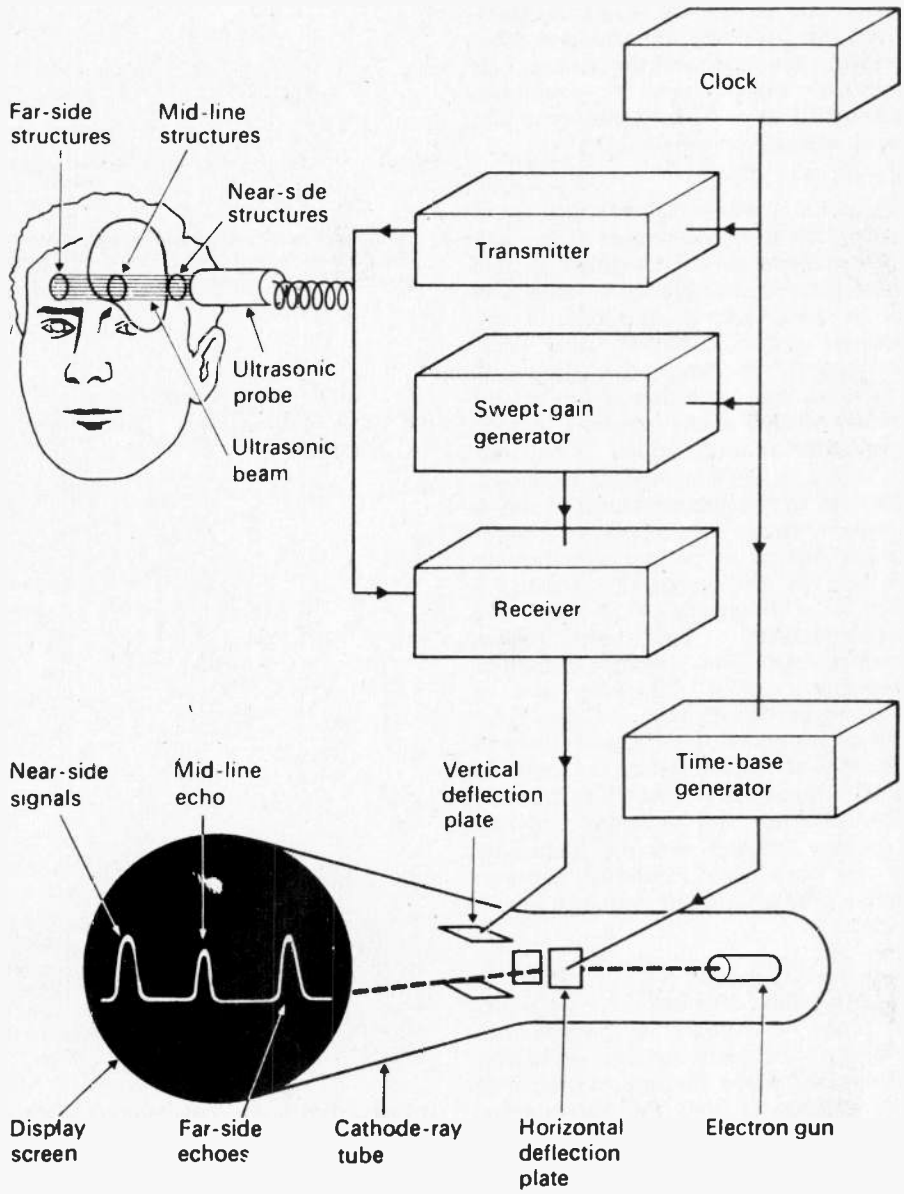
Ultrasonic sound is being used increasingly in medical diagnosis. By Dr. P.N. T. Wells.

THE importance of ultrasonic diagnostic methods lies in the fundamental differences between them and other techniques such as radiology and radioisotope scanning. The symptoms of some diseases, and of natural conditions such as pregnancy, are best investigated by ultrasound. It maps out anatomical cross-sections, measures the performance of the heart and the flow of blood, and identifies many kinds of abnormality, including several types of cancer, all without encroaching into the body in any way.

Twenty-five years ago, doctors seeking to investigate the structures of the body had no alternative to X-rays. Injections of substances to give better contrast were often necessary to obtain information about soft tissues. Nowadays, ultrasonic methods have replaced radiology in helping to solve many clinical problems: doctors depend on ultrasonic diagnosis, and patients demand this kind of investigation. The procedures are rapid and painless and nothing enters the body other than ultrasound waves. Unlike ionizing radiations, ultrasound at diagnostic exposure levels seems to be harmless.

BASIC PRINCIPLES

Most diagnostic applications of ultrasound depend on the reflection of ultrasonic waves at surfaces between tissue structures which differ in their so-called characteristic impedance. The characteristic impedance of a material is equal to the product of its density and the velocity of ultrasound within it. The densities of soft tissues, about 10^3 kg m^{-3} (kilograms per cubic metre), and the velocities of ultrasound within them, about 1500 m s^{-1} (metres per second), are similar to those for water. When an ultrasonic wave strikes the boundary between tissues that differ in characteristic impedance, a proportion of the energy in the wave is reflected in much the same way that light is reflected when it meets a change in reflectivity at a surface.



Basic arrangement of the A-scope system, in use in this instance to show the mid-line structures of the brain in their relative position half way between the sides of the skull, as indicated by symmetry of the deflections of the cathode-ray tube trace. Asymmetrical spacing of the deflections may mean that disease has brought about a physical change such as a tumour on one side of the brain. The swept-gain generator gradually increases the receiver amplification over each sweep of the time base to compensate for the attentuation of the deeper echoes by intervening tissues.

The characteristic impedances of soft tissues are similar, so the echoes from their boundaries are very small. For example, only about 0.5 per cent of the energy striking the boundary between kidney and fat is reflected. Such echoes are large enough to be detected by a sensitive receiver. But almost all the energy crosses the boundary and is available for reflection by deeper structures.

Much larger reflections occur at boundaries between soft tissues and either bone or gas, because of large differences in characteristic impedance. These large reflections restrict the use of ultrasound in medical diagnosis. Moreover, it is necessary to exclude air from between the probe and the patient. This may be done either by examining through a water bath or through a film of oil smeared on the patient's skin.

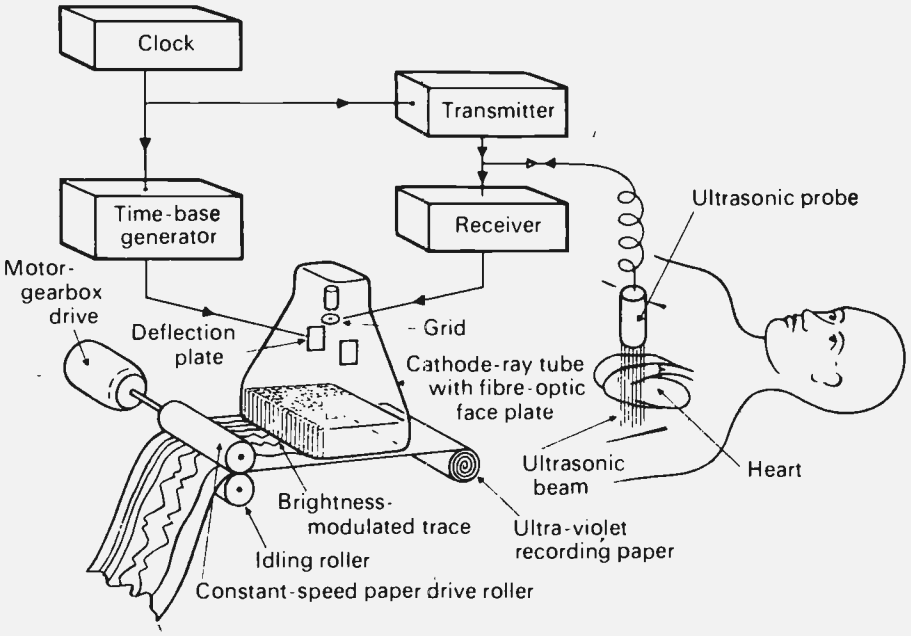
RESOLUTION

Ultrasonic echo-ranging techniques depend on the measurement of the time interval between the transmission of a brief pulse of energy and the reception of its echo, just as in radar. In any imaging system, whether using light, ultrasound or any other kind of radiation, the resolution is limited by the wavelength of the radiation. It is for this reason that ultrasound, as opposed to sound, is used in medical diagnosis. We need to visualize structures of only a few millimetres in size, so that wavelength has to be around a millimetre or less. In soft tissues, it is about 1.5 mm at a frequency of 1 MHz and proportionately less at higher frequencies. The highest audible frequency, about 20 kHz, has a wavelength of 75 mm. In principle, the performance might appear likely to improve as the frequency is increased. But ultrasound is attenuated as it travels through tissues and the rate of attentuation also increases with the frequency, so we have to comprómise between better resolution and reduced penetration.

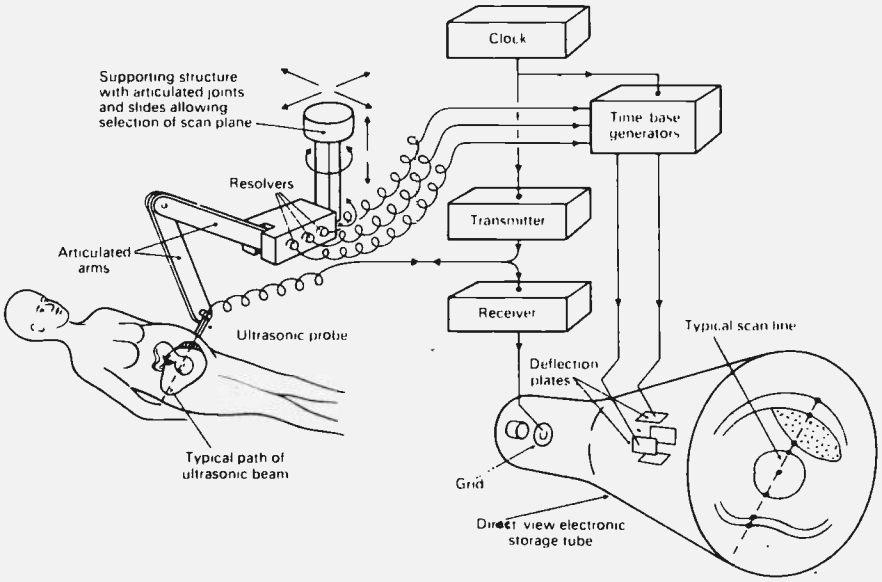
PULSE-ECHO TECHNIQUES

In an ultrasonic instrument for diagnosis, a probe containing a piezoelectric transducer converts electrical signal into ultrasound waves for transmission into the patient. It does the opposite for echoes.

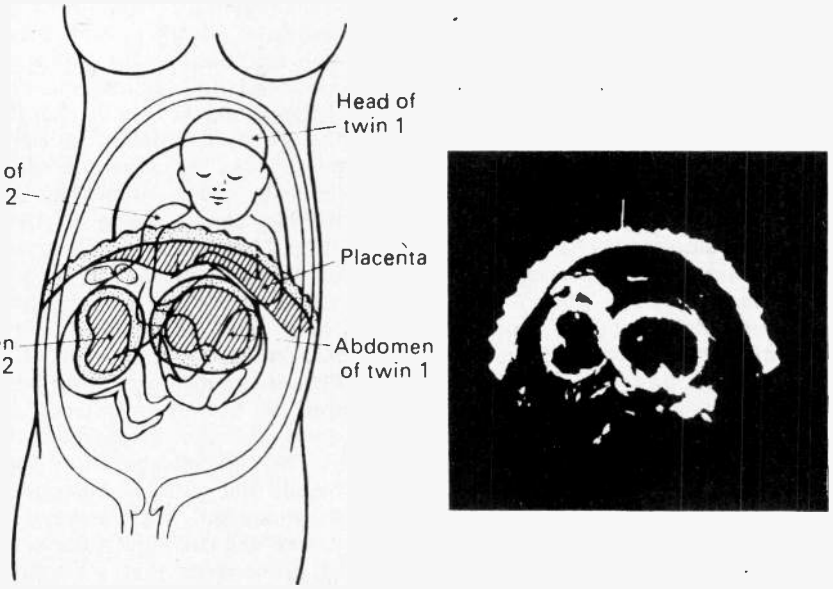
The simplest type of ultrasonic pulse-echo diagnostic system is called the A-scope. (See Fig. 1). The clock triggers the transmitter, which feeds a brief pulse with a large amplitude to the transducer. Echoes return to the probe from those reflecting surfaces inside the patient that lie along the ultrasonic beam. Electrical signals from the echoes are amplified by the receiver and applied to the vertical deflection plates of the cathode-ray tube; the time-base generator, which is triggered into operation by the clock at the instant the ultrasonic pulse is transmitted by the probe, is connected to the horizontal deflection plates to drive the spot on the display at constant speed from left to right. In this way the beam sweeping across the display is deflected vertically at intervals along the horizontal axis, corresponding, in distance from the start of the sweep, to echo-producing surfaces at various distances along the ultrasonic beam. A special circuit in the receiver increases the amplification of the deeper echoes to compensate for their attentuation by



Time-position recording system based on the B-scope display, shown in use for echocardiography. The fibre-optic face plate of the cathode-ray tube collects enough light to produce a self-developing trace on ultra-violet recording paper.



Two-dimensional scanner and B-scope display system studying a foetus. The time-base generators are driven by electrical outputs from a series of resolvers that measure the position of the ultrasonic beam as it moves across the patient. Horizontal and vertical time-bases combine to deflect the spot in such a way that its movement across the display corresponds to the movement of the beam. Echoes received as the probe moves over the patient produce a cross-sectional image in a plane corresponding to that of the scan. In this example, the image is built up on the screen of an electronic storage tube for direct viewing.



A two-dimensional scan (right) reveals twins at about 25 weeks of pregnancy. The placenta on the anterior wall of the uterus is clearly defined while the abdomens of the twins, identified in the explanatory diagram, appear in section.

intervening tissues. The clock operates at a repetition rate fast enough to give a flicker-free trace on the display.

The A-scope has clinical applications in neurology, ophthalmology and internal medicine. It allows the depths of echo-producing surfaces to be measured, and the characteristics of echoes from within structures to be studied.

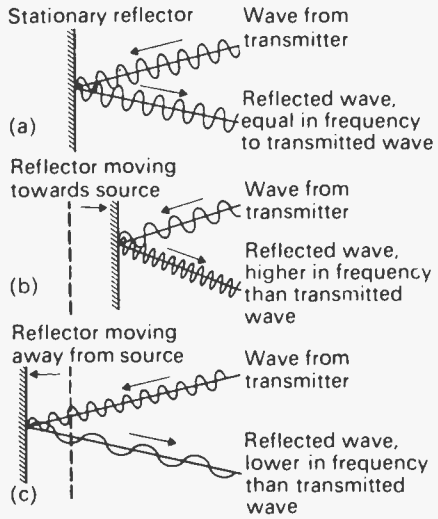
Echoes from moving structures, such as the valves of the heart, oscillate in position along the horizontal axis, or time base, of the display. In cardiology particularly, patterns of movement can give diagnostic information. They can be studied by making recordings with the aid of a B-scope display (see Fig 2). In the B-scope, the time-base sweep is normally invisible, but it is brightened by returning echoes to produce spots of light on the display in places where, on an A-scope, there would be deflections of the beam. The positions of the spots of light correspond to echo-producing structures in the patient, and the pattern of their movements can be permanently recorded.

CROSS-SECTIONAL IMAGES

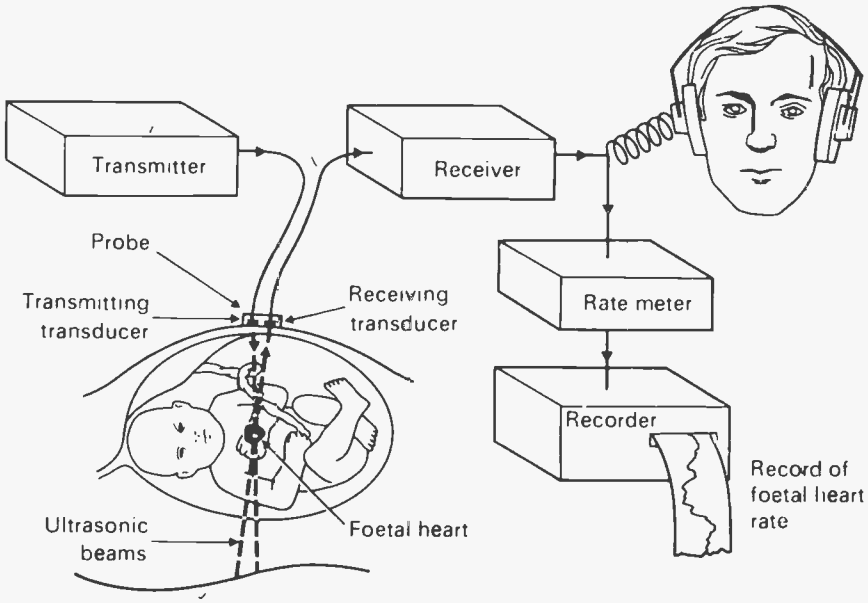
The B-scope forms the basis of another display method, the two-dimensional ultrasonic scanner (see Fig. 3). The ultrasonic probe, instead of being held in the hand, is mounted on a scanner. It can be moved to any position in a two-dimensional plane. In this way it is possible to arrange for the beam to pass through structures lying in a chosen plane within the patient, while the position of the probe and the direction of the beam are measured continuously by 'resolvers' mounted in the scanner. The electrical signals from the resolvers control two time-base generators, driving the vertical and horizontal beam deflection plates of a cathode-ray tube. The direction and position of the ultrasonic beam across the patient controls the position of the cathode-ray beam showing up on the display, related to the positions of the echo-producing surface.

A cross-sectional image of the surfaces can be built up photographically by a camera with an open shutter that records the bright spots on the display while the patient is being scanned. The echo information can also be stored electronically.

Two-dimensional scanners in which the probe is moved in contact with the patient produce individual images in scanning times of about 10 seconds. Images can be produced at a much faster rate by moving the probe mechanically. Images in rapid succession allow physiological movements to be studied; their main



The Doppler effect occurs when a wave is reflected from a moving surface, giving an upward or downward 'shift' in frequency as in (b) and (c).



One use of the Doppler 'shift' is to monitor the foetal heart. The echoes usually fall in the range of audible frequencies.

importance is in cardiological diagnosis. But although these rapid mechanical scanners produce so-called real-time images, they lack flexibility. This difficulty can be overcome by using ultrasonic probes containing many separate transducer elements, operated separately or in groups, which can produce ultrasonic scans made up of parallel lines or of lines arranged in a fan shape, at frame rates of tens per second.

As well as making it possible to study rapidly moving structures, real-time scanners can also be used to explore large volumes of anatomy in a short time. A doctor using one can examine a patient in about a quarter of the time it takes with a 'conventional' two-dimensional scanner.

The frequency of an ultrasonic wave reflected from a stationary structure is equal to that of the incident wave. If the beam is reflected by a surface which is moving towards the ultrasonic source, the reflected wave is compressed into a shorter space. This means that the wavelength is reduced. It shows as an upward 'shift' in its frequency. Reflection by a surface moving away from the source gives a downward shift. This phenomenon, the well-known Doppler effect, conveniently gives shift frequencies that fall in the audible range when ultrasound is reflected by moving structures in the body such as heart valves or flowing blood. A simple instrument based on this makes it possible to detect the movement of the foetal heart. Similar instruments to measure blood flow allow peripheral arterial disease to be assessed.

Because Doppler shifted signals are received only from structures that move, two-dimensional maps of them can be built up by using a Doppler probe to scan the patient. In this way the distribution of blood vessels close to the surface can be studied. Such information may obviate the need for X-ray angiography, which is a dangerous and expensive procedure.

It can also be combined with other information about structure position obtained by the pulse-echo method, making it possible to map out blood vessels within the body and measure the rate of blood flow at the same time.

Work being done to improve the performance of the instruments now in use includes basic studies on the interactions between ultrasound and biological materials, the development of real-time scanners and investigations of techniques for displaying the information. The ultrasonic signals from different tissues may be characteristic of the tissues themselves and in some circumstances it may be possible to identify them. Improved techniques include colour-coding to demonstrate various tissue characteristics, and storing ultrasonic data in a three-dimensional matrix so that any two-dimensional plane can be selected for display. Analysis of Doppler signals from blood flow is another promising field; it may soon be possible to assess the effect of drugs on the cardiovascular system.

The clinical value of ultrasonic techniques has already been proved, but their spread into general, everyday service will depend on the development of instruments that are simple to use. These, paradoxically, may be more complicated than the ones we already have. It will also mean training doctors and technicians to obtain and interpret results. But it is clear that ultrasonic diagnosis is, in many instances, the best and most economical way of getting the information essential to proper care of the patient.

Easy Colour Organ

Here's the electronics for a home colour organ to light up your sound system. It's less sophisticated than the lighting controller of last month, but very inexpensive.

A COLOUR ORGAN is quite simple to put together, and the circuit described here enables you to make a variety of different attractive light displays for your sound and people parties.

WHAT IT DOES

The basic idea is that three lights are controlled on or off by the three channels of our circuit. Each channel listens to a different frequency range of the audio. Thus one light will pulse in response to the bass, another illuminates with mid-range sounds, and the last lights for high notes.

Four level controls allow you to adjust overall light level, and each channel individually. Up to 200 watts per channel can be handled by this unit, or more if heatsinks are used (Be sure to insulate the SCRs from the heatsinks though!)

DISPLAY IDEAS

Various displays have been tried. Two of the most commonly seen are described here. First there's the all-in-one-box type. The box looks like a speaker box, but the front is covered with a sheet of clear or translucent plastic. The type used to cover floure-scent lighting fixtures is attractive. Inside the box are three coloured lights, and the appearance may be made more interesting by also enclosing mirrors or shapes which are then lit up.

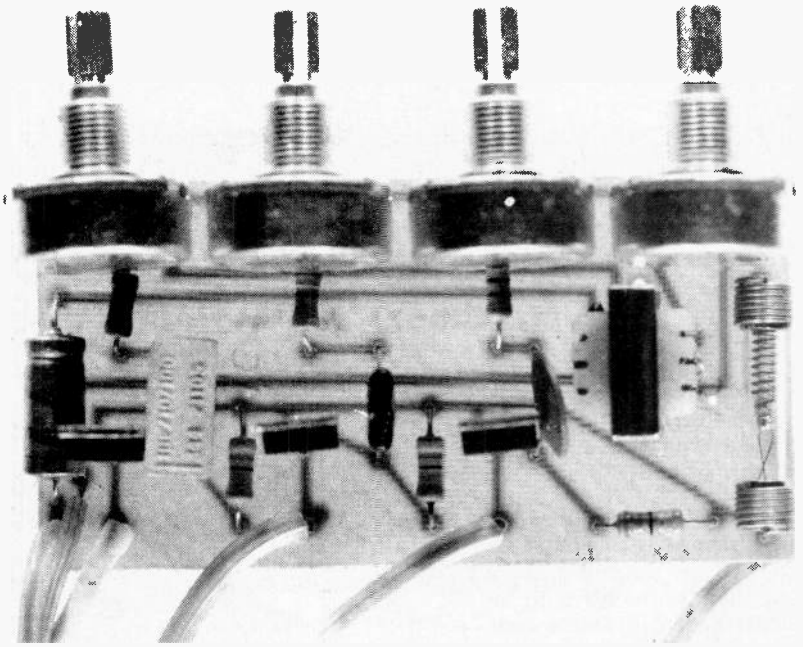
The other kind of diplay uses small flood lights of different colours to light up parts of the room in time with the music. A sophistication of this scheme is to project shapes or shadows with the lights.

CONSTRUCTION

Building this project is very quick especially using the pcb, and following the component positioning diagram. A few notes should be observed. We used a "pigtail" type holder for the fuse, the idea of which is to allow for replacement if/when the fuse blows. So attach the pigtails to the fuse, then insert the two tails into the board. Don't mount it too close to the board or you won't be able to get the fuse out if need be! About ½ inch should do. Now put in the resistors, capacitors (watch the polarity of some), and transformer. The SCRs can also be put in, but make sure not to get them too hot as this can damage them. If in doubt, grip each lead with pliers between the body and your iron as you solder, this will draw the heat away.

The potentiometers can now be mounted, their leads will need to be bent so that the pots can be oriented as shown. (See pictorial). Make sure that R4 clears the fuse and holder! You don't want the pot shaft to be live!

The last step is to wire up the sockets and line cord. Although we have shown



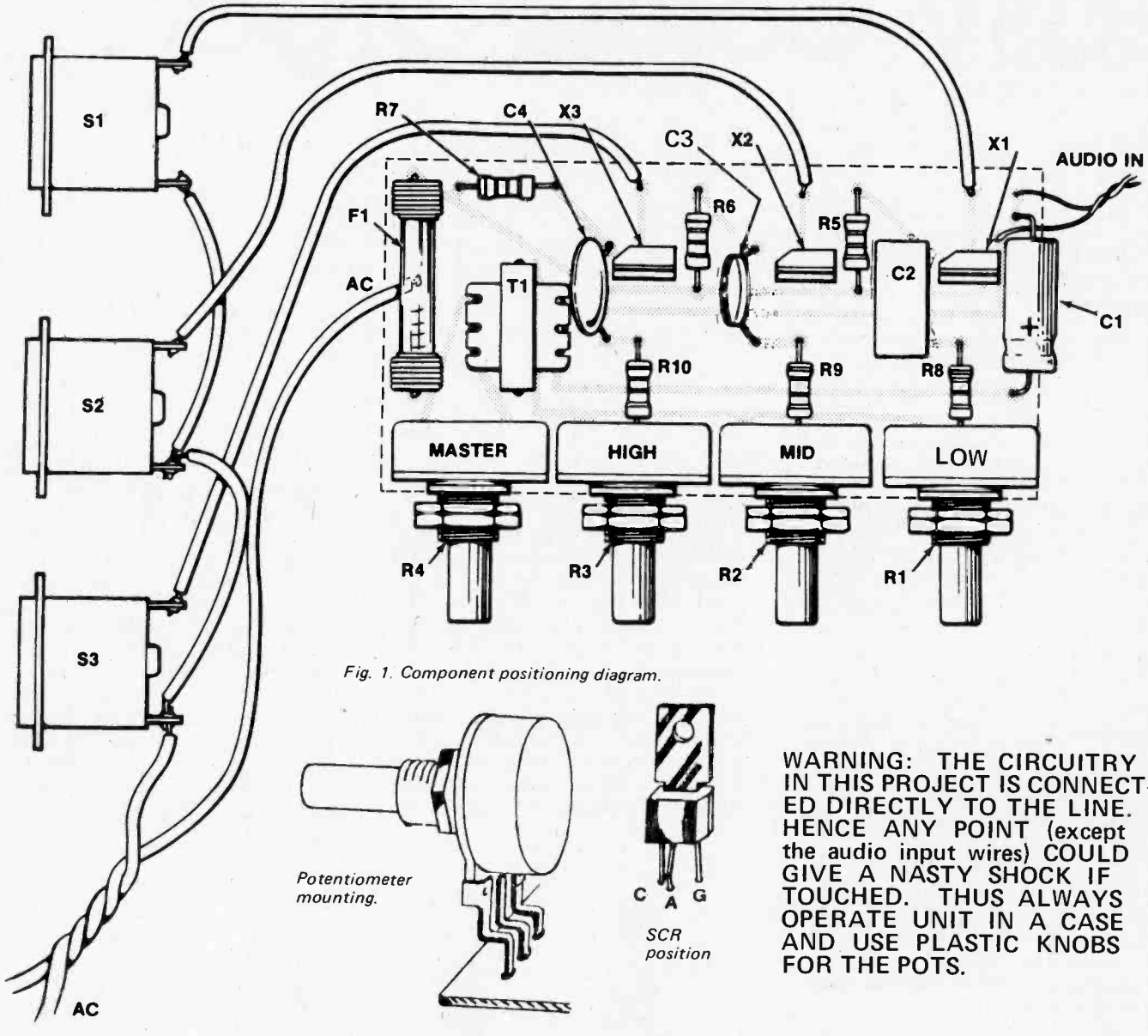


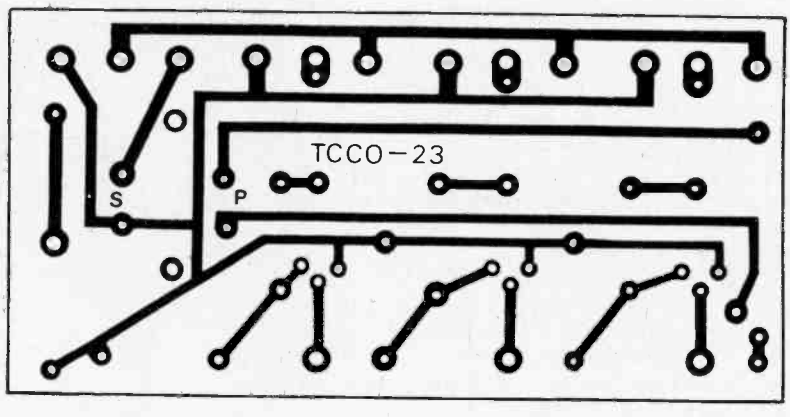
Fig. 1. Component positioning diagram.

Potentiometer mounting.

SCR position

WARNING: THE CIRCUITRY IN THIS PROJECT IS CONNECTED DIRECTLY TO THE LINE. HENCE ANY POINT (except the audio input wires) COULD GIVE A NASTY SHOCK IF TOUCHED. THUS ALWAYS OPERATE UNIT IN A CASE AND USE PLASTIC KNOBS FOR THE POTS.

Circuit board layout.



a picture of our board not in a box, we strongly advise mounting the unit in a box to keep the wires and sockets etc from floating about.

CONNECTING UP

All that remains is to attach the audio input to the speaker terminals of the amp, plug in the lights to the box, and the line cord to the wall socket.

HOW IT WORKS

Starting at the input end of the circuit, the sound signal from the speaker terminals is fed to the primary of T1, and appears at the secondary. A number of things must be said about T1. First, it is used to isolate the input (which is connected to your amp!) from the AC line. It should be noted that the transformer is used backwards from its usual orientation, that is to say the 8 ohm winding is normally the secondary and is here used as the primary.

Another purpose of the transformer is to ensure that the colour organ looks like a very small load to your amplifier, thus not affecting normal operation of the speakers which are also connected.

Let's now look at the way the rest of the circuit works. Figure 3 is a simplified picture of just one channel, with the controls R4 and R1 (or R2 or R3 depending on which channel we're looking at) set at maximum. The components R, C, R5 and the transformer secondary (as an inductor) act as a bandpass filter, so that the signal reaching the SCR gate is the filtered version of the input signal, with frequencies outside the selected band being greatly reduced. The actual frequency and "width" of the bandpass filter are set by the values of the previously mentioned components. As can be seen by looking at Fig. 2, the basic differences between channels are the values of C and R. The higher value C is, the more low frequencies are allowed through. So the channel with C2 has the lowest frequency response. Notice that R also varies from channel to channel, and the overall effect is such that each channel "listens to " about one third of the audio spectrum.

OK, now we've got the signal to the gate of the SCR. When that signal exceeds a certain amount, (about 2V) the SCR "fires" or switches on, allowing current to flow through the load, in this case light. Now, the SCR is a rather peculiar device in that it can only conduct in one direction, and once it is switched on, it stays on until the current through it falls to zero. This of course happens every 1/60 second, since it is in the AC line circuit. (See Fig. 4) However, if the sound level still exceeds 2V in the next positive ½ cycle, the SCR will be triggered again, and over an extended period of loud sound the light appears continuously on.

Control R4 sets the overall light level, while R1, 2 and 3 allow the individual adjustment of light levels of each channel.

Fig. 2. Circuit diagram for complete colour organ.

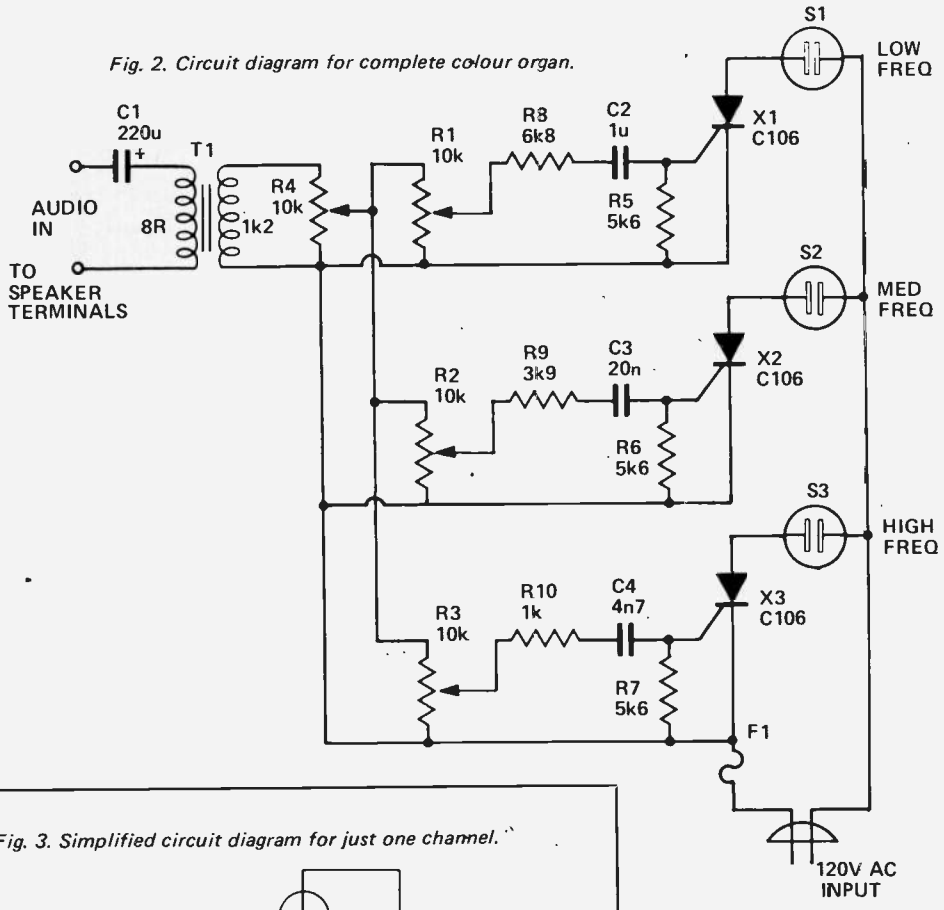


Fig. 3. Simplified circuit diagram for just one channel.

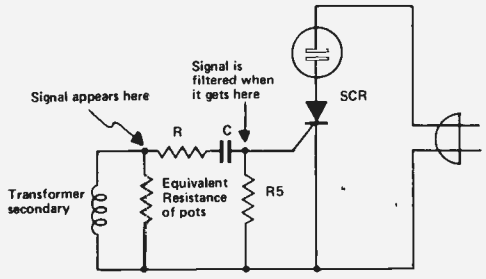
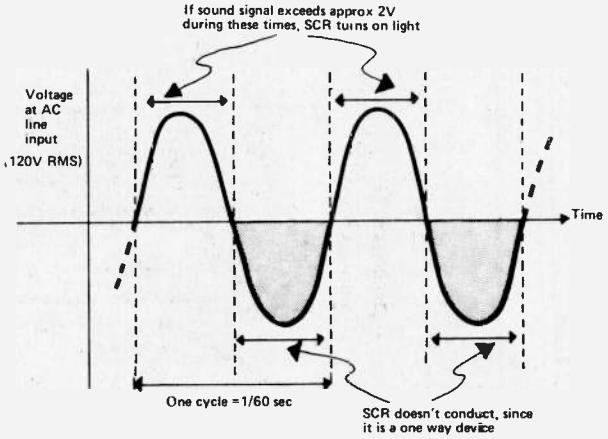


Fig. 4. What the SCR does relative to the AC supply voltage.



PARTS LIST

SCRs
X1-3 C106

POTENTIOMETERS
R1-4 10k

RESISTORS all ½W
R5-7 5k6
R8 6k8
R9 3k9
R10 1k

CAPACITORS
C1 200u/40V
C2 1u
C3 20n
C4 4n7

TRANSFORMER
T1 Speaker Driver Type 1k2 pri, 8R sec.

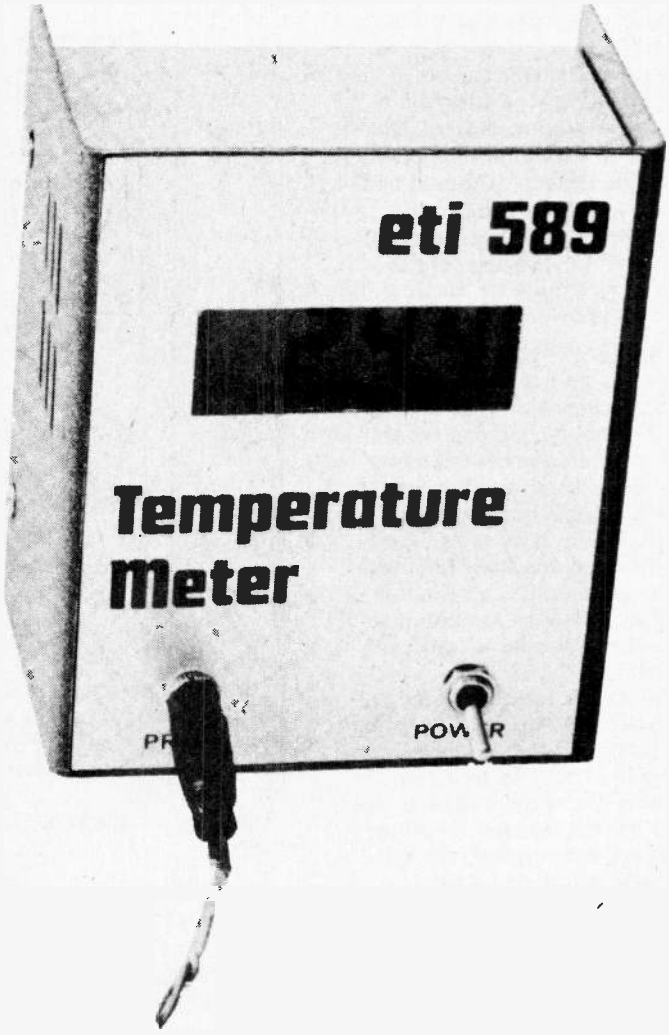
MISCELLANEOUS
3 AC Sockets, AC line cord, Fuse clips and 2A fuse, pcb.

LCD Thermometer

This simple yet accurate temperature meter will find many uses in the laboratory or home. It utilizes the digital panel described in the February 78 issue, details included here.

THE RELIABILITY OF electronic circuits in the days of tubes was, to say the least, poor by today's standards. The introduction of transistors and integrated circuits increased reliability dramatically. One of the main reasons for this is the reduction of power dissipation and the resultant lowering of temperature. Devices and circuits are now designed to minimise power dissipation as this allows a higher component density while increasing reliability. However some circuits by their nature must dissipate high power and the semiconductor devices used must be kept within their temperature limits.

This temperature meter will allow transistor temperatures to be measured and the appropriate heatsink chosen. It is just as useful outside the electronic scene measuring liquid or gas temperature especially where the readout needs to be physically separate from the sensor.



USE AND ACCURACY

The accuracy of the unit depends on the calibration; provided it has been calibrated around the temperature at which it will be used, accuracy of 0.1 degree should be possible. We could not accurately check linearity but it appeared to be within 1° from 0° to 100°C.

However other errors will affect this reading. If measuring the surface temperature i.e. a heatsink temperature, there will be a temperature gradient between the surface and the junction of

the diode. Silicon grease should be used to minimise the surface-to-surface temperature difference. Also when measuring small objects, e.g. a TO-18 transistor, the probe will actually cool the device slightly. At high temperatures these effects could give an error of up to 5% (the reading in this case is less than the true value). If the probe is in a fluid, e.g. water or air this problem does not occur.

CONSTRUCTION

Assemble the panel meter as previously described but omitting the zener diodes and R6 and R7. The value of R1 has also been changed. The decimal point drive should be connected to the right-hand decimal point. The additional components can be assembled on a tag strip as shown.

We mounted our unit on a tag strip as shown in the photo. While we have not given any details, knocking up a case should be no problem. For a power supply we used eight penlight Nicad cells giving a 10 V supply. If dry batteries are used six penlight cells are recommended although a 216-type 9 V transistor battery will give about 300 hours of operation.

The sensor should be mounted in a probe as shown in Fig. 1 if other than air temperature will be measured. This provides the electrical insulation needed for working in liquids etc. It should be noted however that the quick dry epoxies are not normally good near or above 100°C and if higher temperatures than this are expected one of the slow dry epoxies should be used.

CALIBRATION

To calibrate this unit two accurately known temperatures are required, one of which is preferably zero degrees and the second in the area where the meter will normally be used and highest accuracy is required. For a general-purpose unit 100°C is suitable. The easiest way of obtaining these references is by heating or cooling a container of distilled water. However temperature gradients can cause problems, especially at zero degrees.

One method of obtaining water at exactly zero degrees is to use a test tube of distilled water in a flask of iced water and allowing it to cool to near zero. Now by adding salt to the iced water its temperature can be lowered to below zero. If you are very careful, the test tube water will also drop below zero without freezing (you should be able to get to about -2°C). However the slightest disturbance at this temperature will instantly cause some of the water to freeze and the remaining water to rise to exactly zero, providing an ideal reference.

For a hot reference the boiling point of distilled water is very close to 100°C especially if the container has a solid base and is evenly heated e.g. on an electric hotplate.

The actual calibration is done as follows:

1. In the 0°C reference adjust RV2 and RV3 until the unit reads zero.
2. In the hot reference adjust RV1 to give the correct reading.

This should be all the adjustment required.

If zero degrees is not available, e.g. if setting up for °F, the following method can be used:

1. In the cold reference use RV2 and RV3 to adjust reading to zero.
2. In the hot reference use RV1 to adjust the reading to indicate the temperature difference between the two standards. If freezing and boiling points are used, this will be 180°F.
3. Now, back in the cold bath, adjust RV2 and RV3 to give the correct reading.

No further adjustment should be required.

SPECIFICATIONS

Temperature range	– 50°C to +150°C – 60°F to +199.9°F
Resolution	0.1°C or F
Sensor	silicon diode
Power consumption	1.5mA @ 9 V dc

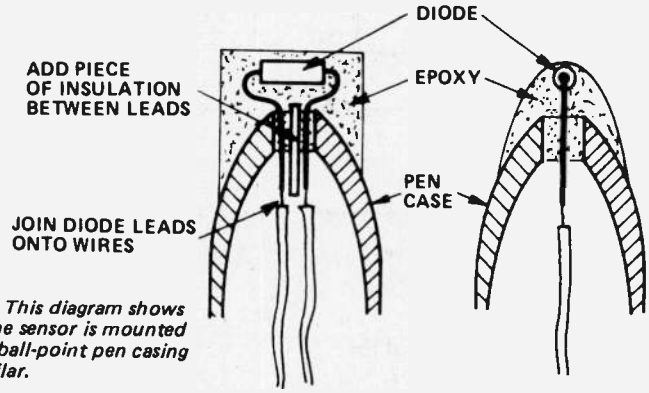
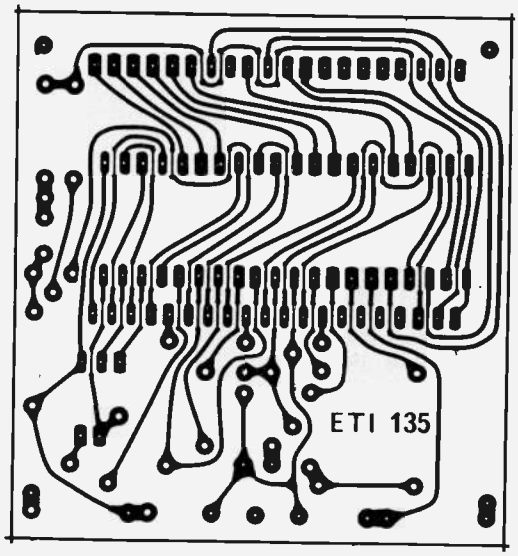


Fig. 1. This diagram shows how the sensor is mounted into a ball-point pen casing or similar.



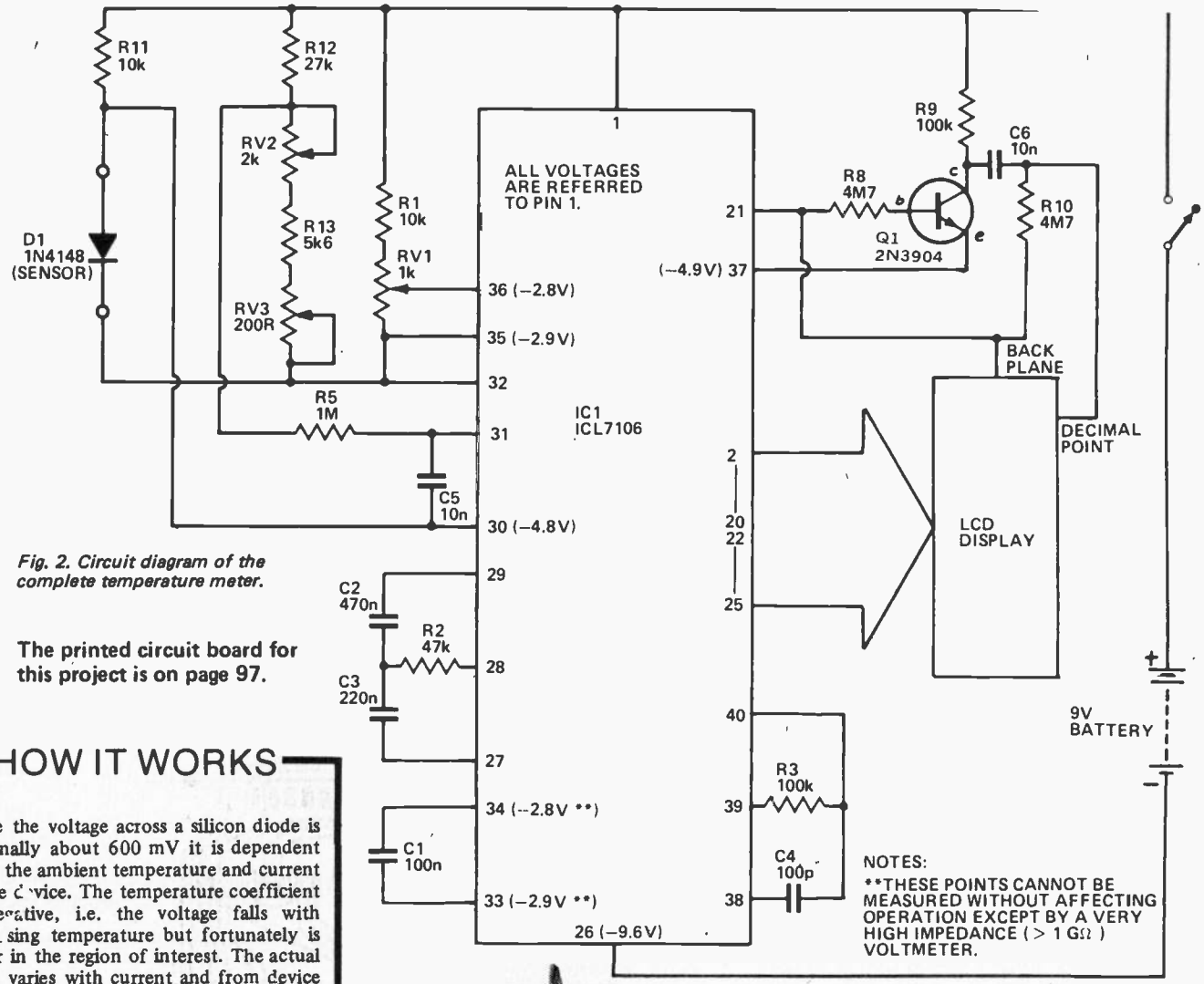


Fig. 2. Circuit diagram of the complete temperature meter.

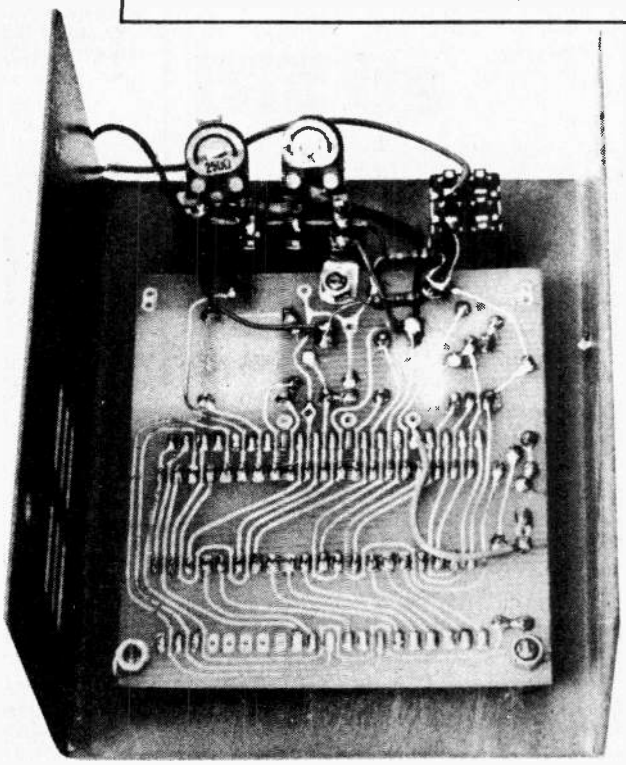
The printed circuit board for this project is on page 97.

HOW IT WORKS

While the voltage across a silicon diode is nominally about 600 mV it is dependent upon the ambient temperature and current in the device. The temperature coefficient is negative, i.e. the voltage falls with increasing temperature but fortunately is linear in the region of interest. The actual value varies with current and from device to device, but is typically −2.2 mV/°C at 250 μA.

By measuring the voltage across the diode with a suitable offset voltage to balance the voltage at zero degrees an accurate temperature meter results. The digital panel meter described in Feb. 78 has a stable reference voltage available (between pins 1 and 32) of about 2.9 V; with the 10k resistor R11 this provides a constant current for D1 (the sensor). The offset voltage is also derived from this reference voltage by R12, RV2 and RV3. The panel meter is used as a differential voltmeter and measures the potential difference between the offset voltage and the diode. We have used two trimpots in series in the offset adjustment to give better resolution. If desired a 10-turn trimpot can be used (2k2). Adjustment of the three potentiometers allows the meter to be calibrated in either °C or °F with the upper limit of 199.9°F due to the panel meter over-ranging.

The power supply is simply a 9 V battery, and so the zener diodes and dropping resistors described in the panel meter article should be omitted.



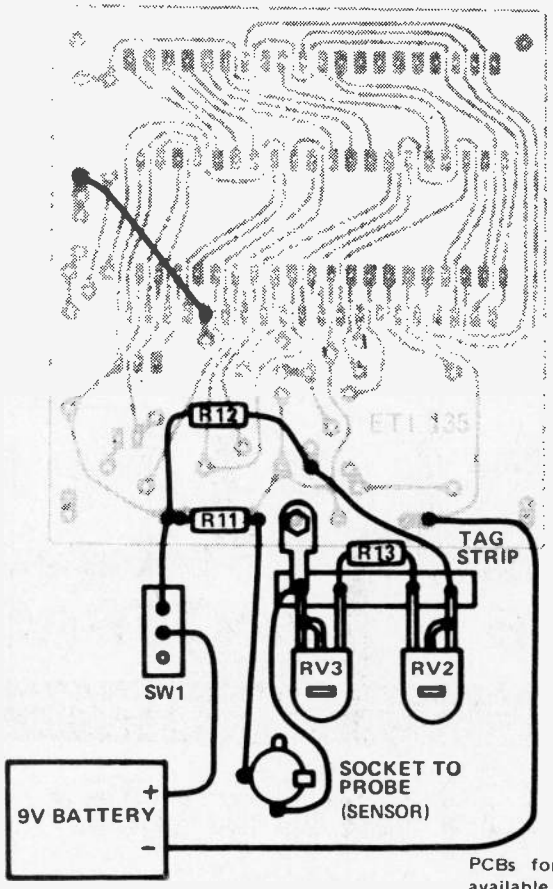


Fig. 3. The external components associated with the panel meter. For more details of the panel meter see February 78 ETI.

PARTS LIST

RESISTORS all ½ W, 5%
† R1 . . . . . 10k
* R2 . . . . . 47k
* R3 . . . . . 100k
R4 . . . . . not used
* R5 . . . . . 1M
R6 . . . . . not used
R7 . . . . . not used
R8 . . . . . 4M7
R9 . . . . . 100k
R10. . . . . 4M7
R11. . . . . 10k
R12. . . . . 27k
R13. . . . . 5k6

POTENTIOMETERS
* RV1 . . . . . 1k 10 turn trim
RV2 . . . . . 2k trim
RV3 . . . . . 200 trim

CAPACITORS
* C1. . . . . 100n polyester
* C2. . . . . 470n "
* C3. . . . . 220n "
* C4. . . . . 100p ceramic
C5. . . . . 10n polyester
C6. . . . . 10n "

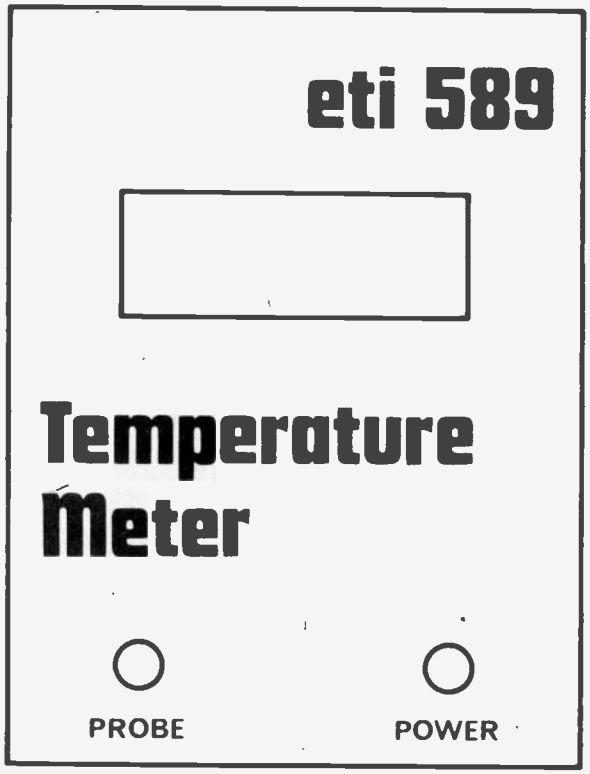
SEMICONDUCTORS
* IC1 . . . . . ICL7106
Q1 . . . . . 2N3904
D1 . . . . . 1N4148

MISCELLANEOUS
PC board ETI 135
Tag strip
* LCD Display
* Socket for LCD display
Box
Switch
9V battery

* These components are supplied with the Intersil ICL7106 EV evaluation kit.

† This value has been changed from the original panel meter.

PCBs for this project are available from: B & R Electronics, P. O. Box 6326F, Hamilton Ont., L9C 6L9, and Spectrum Electronics, 38, Audubon St. S., Hamilton, Ont., L8J 1J7. Kits of parts and boards are available from Northern Bear Electronics, P. O. Box 7260, Saskatoon Sask., S7K 4J2.



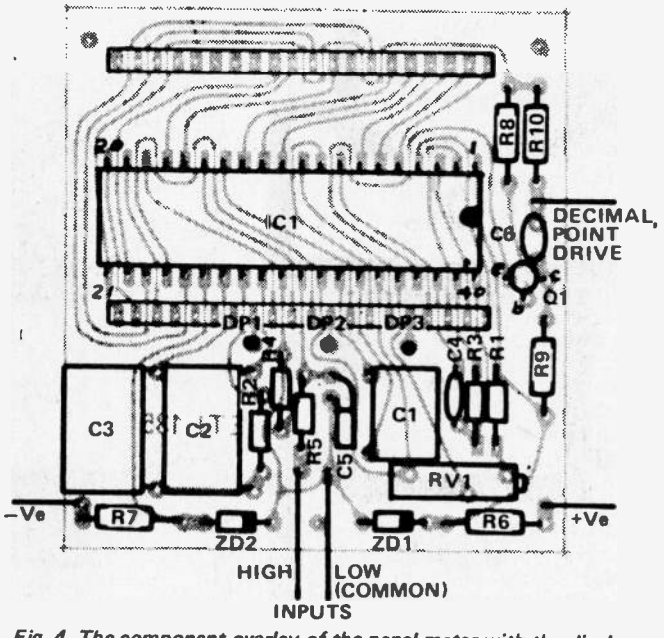
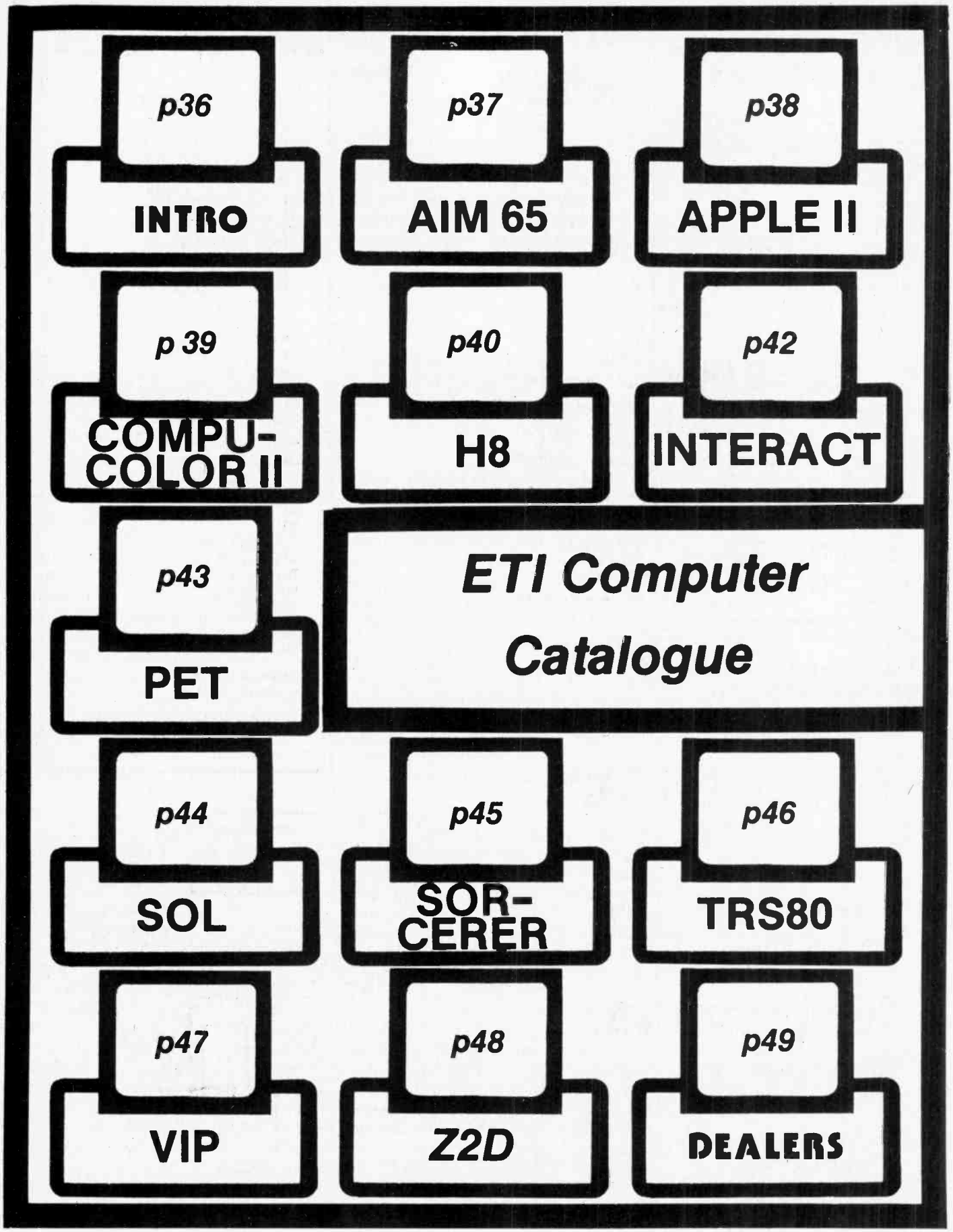


Fig. 4. The component overlay of the panel meter with the display removed. Note that for this project R4, 6, 7, ZD1, 2 and the external leads are not used.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DEALERS

ETI Computer Catalogue

INTRO

This sixteen-page supplement to ETI June 1979 gives you a picture of eleven personal computers. See the previous page for a list of contents and page numbers.

This supplement gives brief details of some 8-bit microcomputers available in Canada. We have edited the manufacturers' literature to give you a single-glance view of the important specs.

There are some famous names not included – this is because we limited our coverage to those products visibly being sold here, by manufacturers, representatives, or dealers who were easily accessible and co-operative. (Our theory was that if we have to go to some effort to get information, our readers might have to go to a lot of effort to get the product.) Even so you might have trouble getting information out of some of the companies mentioned. So we have included the phone numbers of US manufacturers for some products.

This 'catalogue' is a simple overview to give you a quick picture of what's available. More details of all these products are available from manufacturers' literature. Make sure you look deeper into the specs and try out a few machines before buying.

So here you can see what's available; the other half of your buyer-research is to define what your needs are. Ask if the computer you have in mind can be expanded into a more sophisticated system than you need today.

Take a look at the computer magazines and ask if you will one day want to add-on to your computer the products you see advertised there. The most common standard for add-on boards is S100, but the big manufacturers with non-standard buses make available a range of boards wide enough to cater for most people.

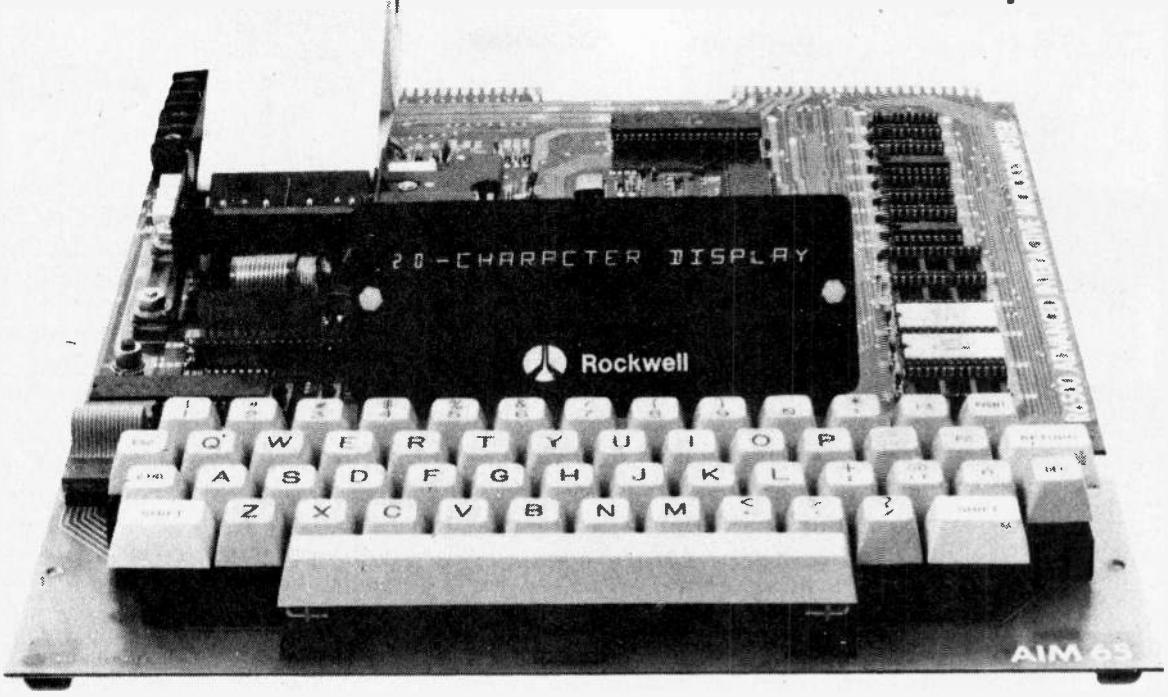
To save money look at buying the minimum system and expanding it yourself with cheap boards and peripherals. For instance, S100 RAM cards are available at prices below those shown in these pages. Rather than buying your disk drive from the company who made your computer, check out other companies (one of them will be supplying your computer company, anyway).

Note that boards have to have slots to plug into, with buffered interfacing and power supply. Note that disk systems, printers, etc, need software.

Not all the computers come with the beginner's language, BASIC. Not all have 'assembler' programs available, or the facility of machine-language programming (these are used by people who are developing programs for dedicated computers).

To learn more about computers read the series Bits, Bytes and Bauds in these back-issues of ETI: Sep, Nov, Dec 77, Jan, Feb, Mar 78. Learn more about microprocessors by reading the Microbiography series in these back issues: Oct 77 (4004. 8008), Nov 77 (8085, Z-80), Dec 77 (6800, 6805), Jan 78 (1802), and Mar 78 (2650).

AIM65



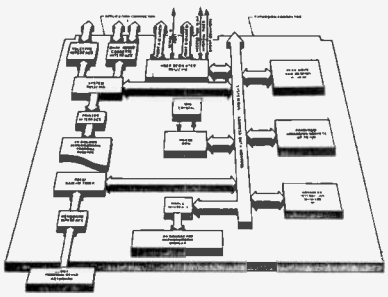
Sample System

Made by Rockwell Intl, Microelectronic Devices, (D/727-ETI), PO Box 3699, Anaheim, CA 92803. Phone 714-632-3729.

Available from Hamilton-Avnet in Toronto, Montreal, and Ottawa.

SAMPLE SYSTEM.

Computer with 4K RAM — AIM 65-400	$599
Assembler ROM	$127.50
BASIC ROM	$150
Power Supply — (Not Rockwell)	$100
Total for this system — approx	$980



The AIM 65 is the only computer in this supplement which comes without case or power-supply. But this is a pretty unusual product in other ways, too. Unlike the typical microprocessor evaluation boards this one has a full terminal-style keyboard, better than you get on many fully-packaged computers. And there's an on-board printer. And the full 64 ASCII font can be displayed on the 20-character 16-segment alphanumeric display.

The keyboard has 54 keys to provide 70 functions (26 alpha, 10 numeric, 22 special characters, 9 control and 3 user-defined functions).

The thermal printer prints the 64 character ASCII set in a 5x7 dot matrix at the rate of 120 lines per minute with 20 characters on each line.

Two 4K ROMs are installed, and three spare sockets are available for another 12K. The monitor program gives the computer its name (Advanced Interactive Monitor), and allows the user to: enter and edit programs directly, no opcodes to memorise; list programs on the printer or TTY; display/alter registers or memory; set breakpoints, trace and debug program execution; control the printer; transfer info to/from cassette or TTY; execute programs in on-board or external RAM, ROM, or PROM; interface the assembler and BASIC interpreter.

The spare ROM sockets are filled if you buy the optional assembler (4K) and optional Microsoft BASIC interpreter (8K).

The processor is Rockwell's R6502, which has 65K addressability and a 56-command instruction set. The AIM 65 comes in two sizes — with 4K RAM or 1K RAM ($100 cheaper).

The board has two R6522 Versatile Interface Adapter chips (one handles the printer, TTY and cassette interfaces, the other is all for you). Each has two parallel and one serial 8-bit bidirectional I/O ports, two 2-bit peripheral handshake control lines, and two 16-bit interval-timer/event-counters. Also on-board is an R6532 RAM-I/O-Timer — a multipurpose chip.

Interfacing is provided for TTY (20 mA current loop) and two cassette machines (with choice of two formats). These interfaces are available at a 44-pin application connector along with connections to the user's VIA ports (see block diagram). Another 44-pin connector brings out the address, data, and control lines for any expansion you might dream up.

It's hard to see in the photograph but there are actually two boards — the keyboard module is 12x4in, the circuit module is 12x10in, and detachable.

All this is yours if you can rig up a power supply to provide +5V at 2A (max), regulated to +/-5%, and +24V at 2½A (peak, 0.5A average), unregulated (+/-15%).

Upgrades

The only AIM 65 upgrades are the two ROMs we have included in our Sample System. The user can expand the system using the I/O ports or bus expansion.

ETI Computer Catalogue

APPLE II

SAMPLE SYSTEM Cat.No.	Price
Apple II with 16K RAM — A2S0016	$2200
RF Modulator — (Not Apple)	$50
Cassette Recorder — (Not Apple)	$100
Colour TV — (Not Apple)	$600
System Price (if you do not buy a new TV)	about $2350

Made by Apple Computer, 10260 Bandley Drive, Cupertino, CA 95014. Phone 408-996-1010.

Available from Compucentre, Compumart, Cesco, and various others.

— Sample System

Apart from the monitor (or TV plus modulator) and cassette recorder, the Apple II is a complete computer. The 8K ROM holds BASIC (6K) as well as the system monitor. The single board can hold up to 48K of RAM (using 16K ICs). The processor is the 6502. Power supply, keyboard, cassette interface and game I/O come in the standard package. Also included are two game controls, manual, BASIC manual, and video display circuitry.

The display can be text, high resolution graphics or colour graphics. Two pages of graphics memory are selectable, and the bottom four lines of the display can be used for text. Graphics resolution (four-colour: black, white, violet, green) is 280x192 (or 280x160 with text at the bottom of the screen). 8K bytes of RAM are displayed.

Resolution in the 15-colour mode is 40x48 or 40x40 with four lines of text.

Upper-case text is shown as 24 lines of 40 characters (normal, reversed or flashing).

Standard I/O is cassette interface, game interface, and buffered connectors for 8 expansion boards. Cassette interface is at 1500 bps. Game I/O handles four paddle inputs, three TTL inputs, and four TTL outputs.

Apple BASIC is a translated integer BASIC which includes: any-length variable names; immediate indication of syntax or range errors; multiple statements on one line; integers from + to - 32767; string arrays to 255 characters; single-dimention integer arrays; graphics commands to draw points, horizontal or vertical lines, to assign or read colours; game paddle read function; set display to text/graphics; memory boundary adjust; break execution & continue; line number and variable tracing for debugging; PEEK, POKE, and CALL; cassette SAVE and LOAD; automatic line number mode; RND, SGN, ASC, LEN, and ABS; return stack POP; GOTO and GOSUB; fully interruptable.

The 16K version (and 32K & 48K versions) include Applesoft BASIC on tape, with documentation.

With 32K of RAM add $200, with 48K add $400.

— Upgrades

Expansion Boards:

Apple makes a range of plug-in boards to fill the 8 slots available on the main board. Note that S100 boards do not plug into the Apple II.

For $265 you can get a parallel interface board designed for use with a printer (board A2B0002).

The A2B0007 is a printer interface card for use with Centronics matrix printers; it costs about $300.

The A2B0003 is an RS-232C serial interface card for interfacing with other computers either directly or via a modem. It costs $265.

A2B0005 is a high-speed serial interface card (RS-232C) for $290.

A2B0001 is a double-sided 2¾x7in prototyping card for $35.

A2B0009 is an expanded version of Microsoft's BASIC; this plug-in ROM card costs $300.

A new addition to the range is the A2M0024 one-year calendar-clock with 1/1000th second accuracy.

Peripherals:

Apple sells a range of products to expand your system — disk drives, printers, etc. Coming soon is a graphics input tablet with a linear resolution of 200 pts per inch over an 11x11in area.

Software:

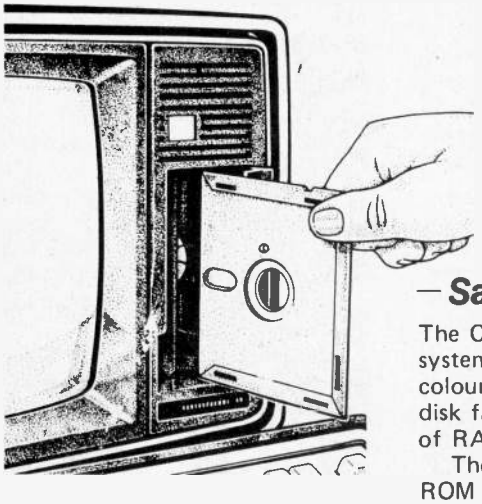
The $37 A2M0022 cassette contains the Dow Jones stock quote reporter package. Also available is the usual range of game and checkbook programs.

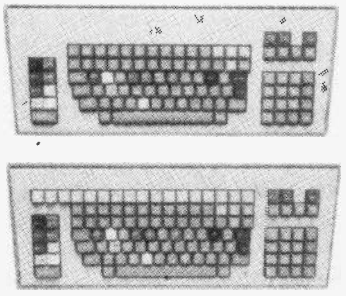
COMPUCOLOR II

Made by Compucolor Corp., PO Box 569, Norcross, GA 30071. Phone 404-449-5996.

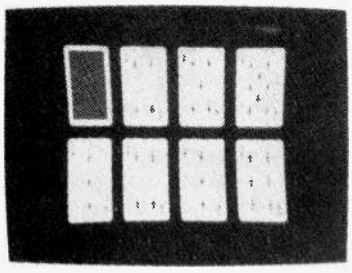
Available from House Of Computers and Datamex in Toronto, Computer Shop in Winnipeg, and Kerridale Compute-Micro in Vancouver

SAMPLE SYSTEM
Complete System — Model 5 $2995





Above: Compucolor realise that to sell lots of computers they have to provide you with a strategy for getting the wife's approval. What better than telling her you bought it for her to help her remember recipes. Left: The disk slot doesn't show in the photo so here's a drawing. Below that are a couple of screen shots — but the colour displays don't show up well in ETI. Right: These are the two upgraded keyboards.



— Sample System

The Compucolor II is a complete computer system with 72-key keyboard, built-in colour video monitor, and built-in floppy disk facility. The Model 5 comes with 32K of RAM. The model 4 has 16K for $2550.

The processor is the 8080A. 16K of ROM holds Disk BASIC, CRT control firmware, and the File Control System. Sockets are included for an additional 8K of ROM.

There is one RS-232 serial interface available. Expansion is possible using the 50-pin bus.

The CRT displays 64 characters on 32 lines in 8 colours and 2 character sizes. The graphics display resolution is 128x128, with vector-generating software. The full font contains 64 ASCII characters and 64 graphics characters. In the Terminal mode the computer can be used for time-sharing via a RS232C interface.

The terminal commands control Page/Roll Mode, Erase Line, Erase Page, Tab, Character Size, Blink, Cursor Home, C-Left, C-Right, C-Up, C-Down, X-Y addressing for cursor, Caps Lock, CPU Reset, Colour Selection, 15 plot modes Blind Cursor, Local- Full- and Half-Duplex, Write Vertical Mode, and Transmit Cursor and Page Modes.

Stored in ROM is the 'Disk BASIC 8001' interpreter which uses 29 statements, 3 commands, 19 mathematical functions, 9 string functions, and 12 disk file commands.

The disk storage system puts 51.2K bytes on each side of a 5¼in diskette. Average access time is 200ms; transfer rate is 76.8 kilobits/second.

Optional extras include two deluxe keyboards: the CCN keyboard has colour cluster and number pad (101keys) for $225. The CCNF keyboard adds another 16 function keys for $335.

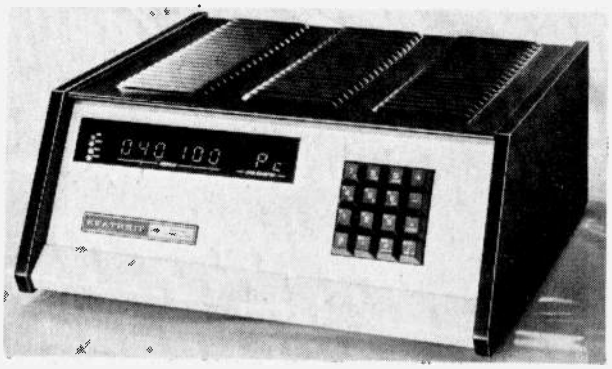
Another disk drive will cost you $599. If you buy Model 3 or 4 you can add 16K of RAM for $570.

The following diskettes are available for $30, many of the game diskettes have several programs on them: Hangman, Othello, Math Tutor, Chess, Star Trek, Blackjack, Cubic Tic-Tac-Toe, Personal Finance Vol 1, Personal Finance Vol 2, Bonds and Securities, and Equity.

Also available on diskette are an Assembler ($37.50), a Text Editor ($37.50), and Personal Data Base ($45).

The computer comes with a Sampler diskette.

H8



The H8 computer.

Made by Heath Company, 1478 Dundas St E, Mississauga, Ontario, L4X2R7. Phone 416-277-3191.

Available from Heathkit Electronic Centres in Mississauga, Montreal, Edmonton, Winnipeg, Ottawa and Vancouver.

Sample System

The H8 chassis holds the Heath 50-line bus with slots for nine cards. It comes with a ready-wired 8080A CPU card with seven vectored interrupts available. Also supplied is the Front Panel memory card which interfaces to a 16-key pad and nine-digit LED display for octal programming. The keypad gives direct access to registers and memory, one-button program load and dump, and input/output keys for direct communication with any port. The display shows contents and location of memory, registers or I/O ports — and updates continuously even when the program is running.

WH8-16

These 16K RAM cards come ready wired to enable you to expand the memory up to the 8080's addressing limit of 65K.

H8-5:

This card provides serial I/O for video terminals, printers, etc. Provides 20 mA current loop and RS-232 levels. Also has a cassette interface which can control two machines. Available in assembed form for $250.

H9:

This video terminal uses a 12in CRT to display twelve lines of 80 characters. Input is via the 67-key keyboard. Display is uppercase only, and can be organised as four columns (each 12 lines of 20 characters). Serial interfacing is via 20 mA current loop, RS232C, or standard TTL levels. Parallel interfacing uses TTL levels on 8 bits input and 8 bits output, with handshaking lines for connection to paper tape reader/punch. Simplified kit has wired and tested control board and wiring harness fitted with connectors.

H17:

This package includes a disk controller card for the H8, and disk drive with power supply. One drive is included — a second one costs another $580. Storage is on hard-sectored 40-track 5¼in diskettes, each holding 102K bytes. Typical random sector access times are less than 250 ms; track-step time is 30 ms maximum. The price includes a blank diskette. At least 16K of RAM should be fitted to the H8.

Fully assembled the H17 costs $1000.

H8-17:

To use the disk system you need this operating software. It includes Benton Harbor BASIC (if you want Microsoft BASIC you have to spend another $125 on the H8-21 diskette), a two-pass absolute assembler, a text editor and console debugger, and the disk utility programs.

Extended Benton Harbor BASIC handles strings and files, and supports the WH-14 line printer and WH8-4 interface board.

5% Discount:

If you buy the H8, a major peripheral, and the memory, software and accessories you need, Heathkit will give you 5% discount.

SAMPLE SYSTEM

Cat.No.	Price
Chassis, PSU, CPU Board, & Front Panel —	
H8(Kit)	$530
Two 16K RAM Cards —	
WH8-16(Wired)	$700
WH8-16(Wired)	$700
Serial Interface Board —	
H8-5(Kit)	$190
Video Terminal —	
H9(Kit)	$1000
Disk Drive & Controller —	
H17(Kit)	$900
DOS Software on Disk —	
H8-17	$125
All The Above With 5% Discount	$3938

Upgrades

Plug-in Boards:

The WH8-16 and H8-5 are described in the sample system. Other boards are:

H8-1 is an 8K memory card supplied with 4K of 4K-bit static static chips for $200 (kit). The chips for the other 4K cost $140.

The WH8-8 is a an assembled 8K board for $420.

The H8-2 is a parallel interface card with three independent ports and handshaking. Price for kit is $230.

WH8-4 is an assembled serial I/O card for $420.

The H8-7 is a breadboard card for $$150, with bus interface and address decode.

Cables are needed to connect peripherals to the H8-4 and the H8-5. These are $30 each.

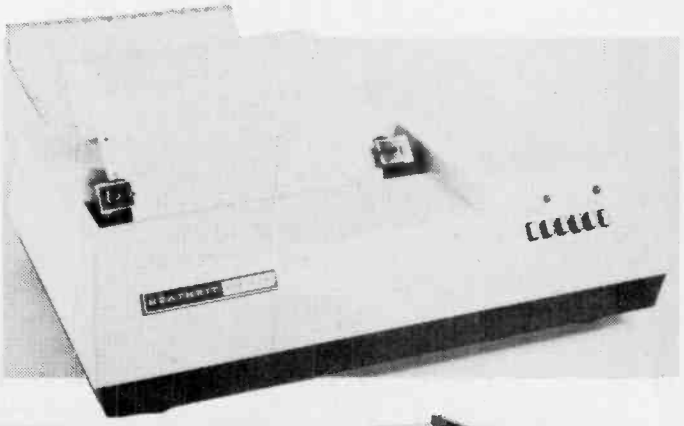
Other Accessories:

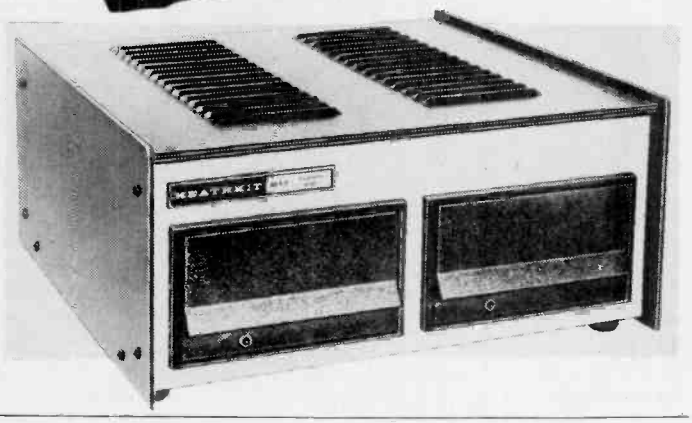
The H14 is a new line printer for $800 in kit form ($1300 assembled). The H36 is an LA36 DEC Writer II for $2195. The H10 is a paper-tape reader/punch for $580 (kit).

Heath offer a self-instruction programme for learning BASIC. You get a workbook with a Blackjack program listing, and reference cards. Price $60.

If you have 40K of memory and floppy disk you can spend $150 on a Microsoft FORTRAN interpreter.

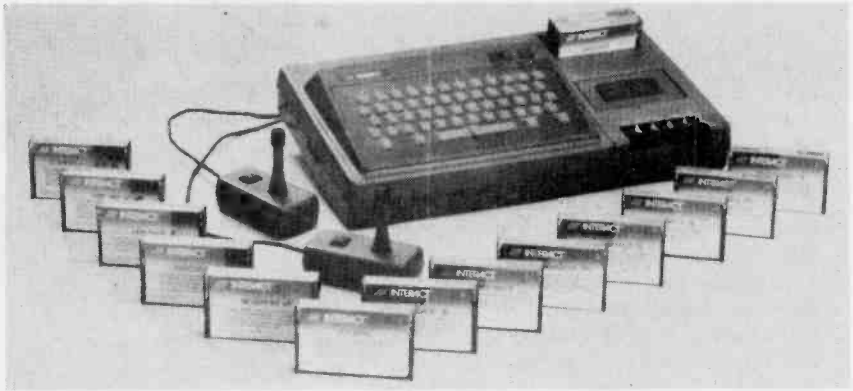
Below: The H9 video terminal. Top Right: The new H14 line printer. Bottom Right: The H8-17 mini disk drive.





LOW COST • INTERACT • MICROCOMPUTER

Now available in Canada a powerful microcomputer, costing several hundred dollars less than other similar microcomputers currently on the market. The Interact is a full function microcomputer with "Advanced BASIC" programming capability. Simply attach to your home television and you are on your way to becoming a computer programmer. Write your own programs or take advantage of the many Interact programs available from us on cassette. Future options will include floppy disk and printer attachments.



Features include: full colour; sound; full size keyboard; built-in cassette drive; 16K RAM - 2K ROM; includes RF connector and two joysticks. Weighs only 12 pounds.

ONLY $795.00

BONUS OFFER

For a limited time only receive 13 program tapes ($300 value) including EDU-BASIC, for only $50.00. Optional Level II BASIC $39.95, Micro Chess $29.95; plus many more programs available — complete list available upon request. Available at our store or by mail order.

Mail to:

MARKETRON CORP. LTD.
1240 Bay Street Mall
Toronto, Ont. M5R 2A7
Phone 416/923-1917

Dealer inquiries invited! Dealership information available to qualified retailers. Please request on company letterhead.

Pls send: Cheque ☐ Money Order ☐ Chargex ☐ Master Charge ☐ American Express ☐

ORDER INFORMATION

Interact Microcomputer	$795.00
Bonus Programs($300 value)	50.00
	$845.00
Ontario Res. add 7% sales tax	59.15
Shipping charges	$5.00
Total enclosed	$909.15

Card No. _____ Expires _____
Signature _____
Name _____
Street _____
Town _____ Province _____
Postal Code _____ Phone _____

Other programs, add appropriate amount and 7% sales tax (Ont. Res.)

INTERACT

Made by Interact Electronics,
PO Box 8140, Ann Arbor,
Michigan 48107.
Phone 313-973-0120.

Available from Computer Workshops in Toronto, and Focus Scientific in Ottawa.

SAMPLE SYSTEM
Interact Family Computer
with 16K RAM $795
Level II BASIC on cassette —
US price $50
(Colour TV also needed)

Sample System

The Interact Family Computer is designed as a computer-based compendium of video games that doubles as an inexpensive personal computer. Program cassette player is built-in, alongside a full 53-key keyboard, and the output is TV RF modulated with sound and 8-colour video. Also included are two game controls — x-y joysticks with hit buttons — and antenna switcher.

The model 1 Interact used 8K of RAM; the 16K version is new and can handle the enhanced cassette BASIC. This allows logs and trig and handles string variables.

The processor is an 8080A running at 2MHz, with the monitor in 2K of ROM.

Currently there are five series of program tapes available. The 'Strategy' series comprises Blackjack, Star Track, Concentration, Chess Master, Video Chess, and Interact Micro Chess.

The 'Educational' series comprises Add Em Up, Compute-A-Color, Hangman, Knockdown, Edu-BASIC (Level I), and Music Maestro. Music Maestro comes with a keyboard overlay to give you a three-octave keyboard of black and white notes, plus vibrato. The computer will transpose key, allow you to edit your tune, and it displays a staff on the TV screen with key signature and time at the beginning.

The 'Action' series is made up of Regatta, Trailblazers, Dogfight, Showdown, Computer Maze, and Breakthrough.

The only program so far in the 'Lifestyle' series is Biorhythm.

The programs in the 'Management' series are Checkbook, Data Base Manager, and Financial Calculator.

Programs promised are Backgammon, Computer Football, Bridge Bidding, Scientific Calculator, and Computer Flashcards.

Interact Electronics promise also to make an RS-232 interface, ROM BASIC, and disk storage available soon.

The PET 2001-16/32 with new keyboard. The inset shows the 2021 electrostatic printer.

PET

Made by Commodore Business Machines, 3370 Pharmacy Avenue, Agincourt, Ontario, M1W 2K4. Phone 416-499-4292.

Available from the dealers marked in the Dealer List on page 49.

SAMPLE SYSTEM

Cat.No	Price
Computer with 16K RAM — 2001-16K	$1495
Single cassette recorder — C2N	$120
Electrostatic Printer — 2021	$695
Single Disk Drive — 2041	around $775
Total For All Above —	around $3085

PET Models:
There still PETs available with the built-in cassette: this is the 8K PET which sells for $1095. The high-quality keyboard PETs are the 16K and 32K versions for $1495 and $1795.

— Sample System

2001-16K:
This model is similar to the PET we reviewed in our February 1978 issue, but has more RAM and in place of the old keyboard and built-in cassette you get a professional keyboard (and number pad). The 14K bytes of ROM hold the BASIC interpreter (8K+), the operating system (4K), and the monitor (1K). The video display is built-in: you get 40x25 characters on a 9in CRT. In addition to the 64 ASCII characters there are 64 graphics characters available.

The BASIC handles strings, integers, and multiple-dimention arrays, uses nine-digit precision, and PEEK and POKE for direct memory access. Sockets are available for another 8K of ROM; ROMs for the assembler or disk controller plug into the main board.

Input/output is provided via the IEEE 488 instrument interface, or via the memory-mapped user port.

C2N:
This external cassette recorder/player has been modified by Commodore for high reliability. The PET can interface twin cassettes to handle and update files.

2021:
This electrostatic printer uses only four moving parts to print all the 128 PET characters (upper and lower case letters, numbers and graphics) onto aluminium-coated paper. It connects to the PET user port (parallel data at TTL levels) or the IEEE port. Speed is 150 lines per minute.

2041:
The PET single mini disk drive uses a Shugart SA390 (for 5¼in diskettes). The disk operating system comes in two ROMs which plug directly into the main PET board, plus a ROM which replaces one on the board. The interface is made directly to the memory bus of the PET.

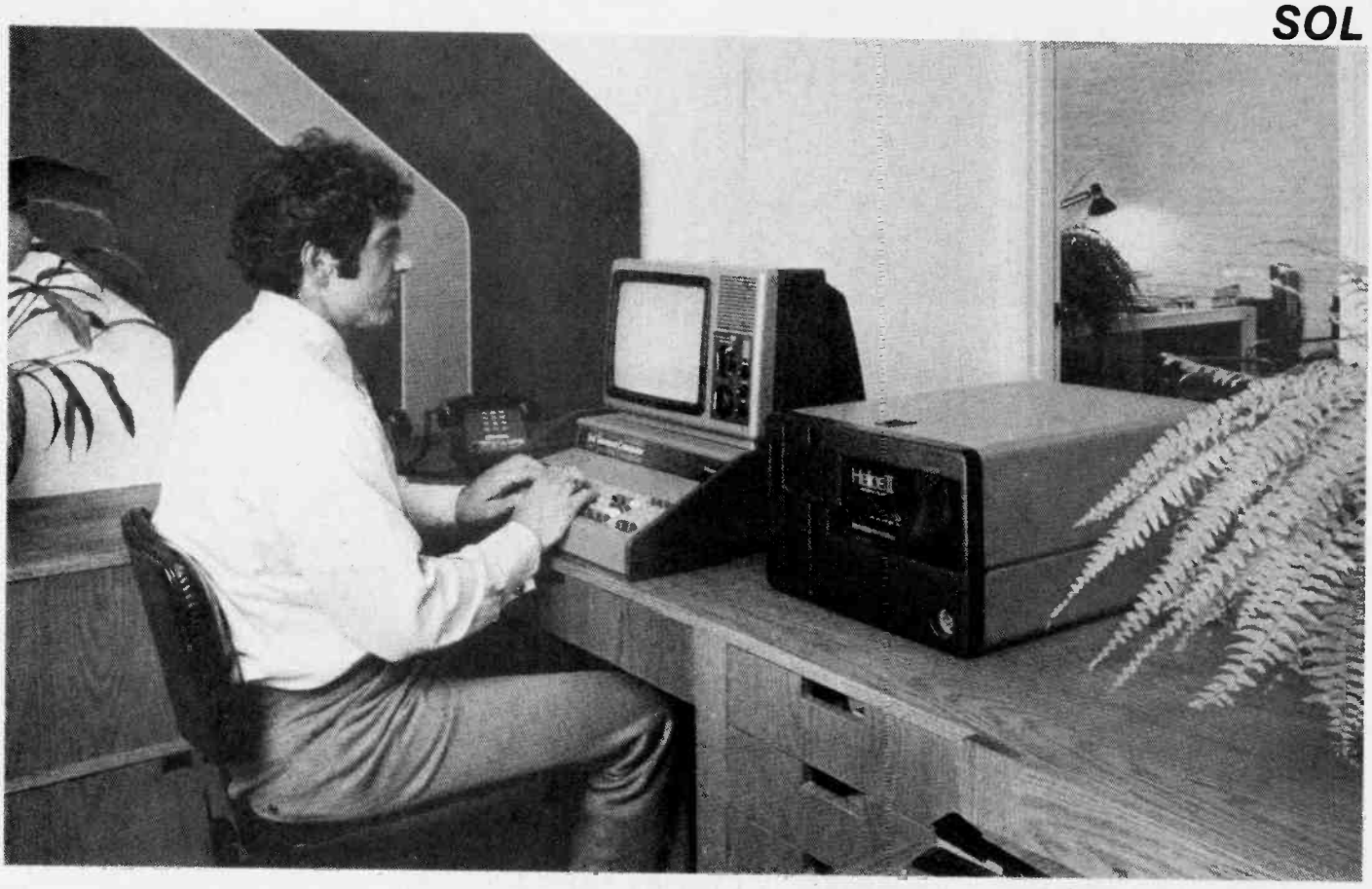
— Upgrades

Peripherals:
The best way to find out what is happening with PET peripherals is to see what you local dealer has in stock. These are rumoured to be appearing soon under the PET label: 2022, a tractor-feed printer for $1295; 2023, a dot-matrix printer for $1095; and maybe some of the products advertised now in the US computer magazines.

Boards:
Sorry, we can't help you much here. Companies do make boards for interfacing with the PET, including an S100 expansion board. But as far as what's happening in Canada try contacting your local dealer — or go direct to a US company when you see their ads.

STOP PRESS
Latest news is that this product will not be available. We also have heard that the 2020 dot-matrix printer is also unavailable.

SOL



Sample System

Sol-20/32:

The Sol comes in two simple versions – the Sol-20/16 (16K RAM and 5 free slots in the S100 backplane) for $3115, and the Sol-20/32 which is carries an extra 16K RAM card.

The Sol uses the 8080A and an operating system called Solus which comes in a 'personality module' – for use with the disk system the Solus ' personality module' is replaced by the Bootload module. This replaces the terminal functions of Solus with the Disk Operating System.

You can connect an audio cassette recorder directly to the Sol, and use the BASIC/5 cassette which is included. The Sol is capable of controlling two cassette machines.

There is an extended BASIC available on cassette or disk. Other languages available are FOCAL, FORTRAN, and PILOT. (PILOT has been developed for PT for educational applications.)

Built into the Sol is an 85-key capacitive keyboard with cursor keys and arithmetic keypad.

Video is provided to display 16 lines of 64 characters on a monitor (or TV plus modulator). The character set comprises 96 ASCII upper and lower case characters plus 32 optionally-displayable control characters. The cursor features switch-selectable blinking.

I/O is via an RS-232/20mA loop serial interface, or an 8-bits input + 8-bits output TTL-level parallel interface.

Video Monitor:

Processor Technology feature in their literature a modified Panasonic TV set for use as a video monitor. This wasn't available when we checked in Toronto, but the store did have a monitor of another make. As video levels are pretty standard it should be no problem to make the Sol work with any monitor (or any TV set, with a bit of work).

Helios II:

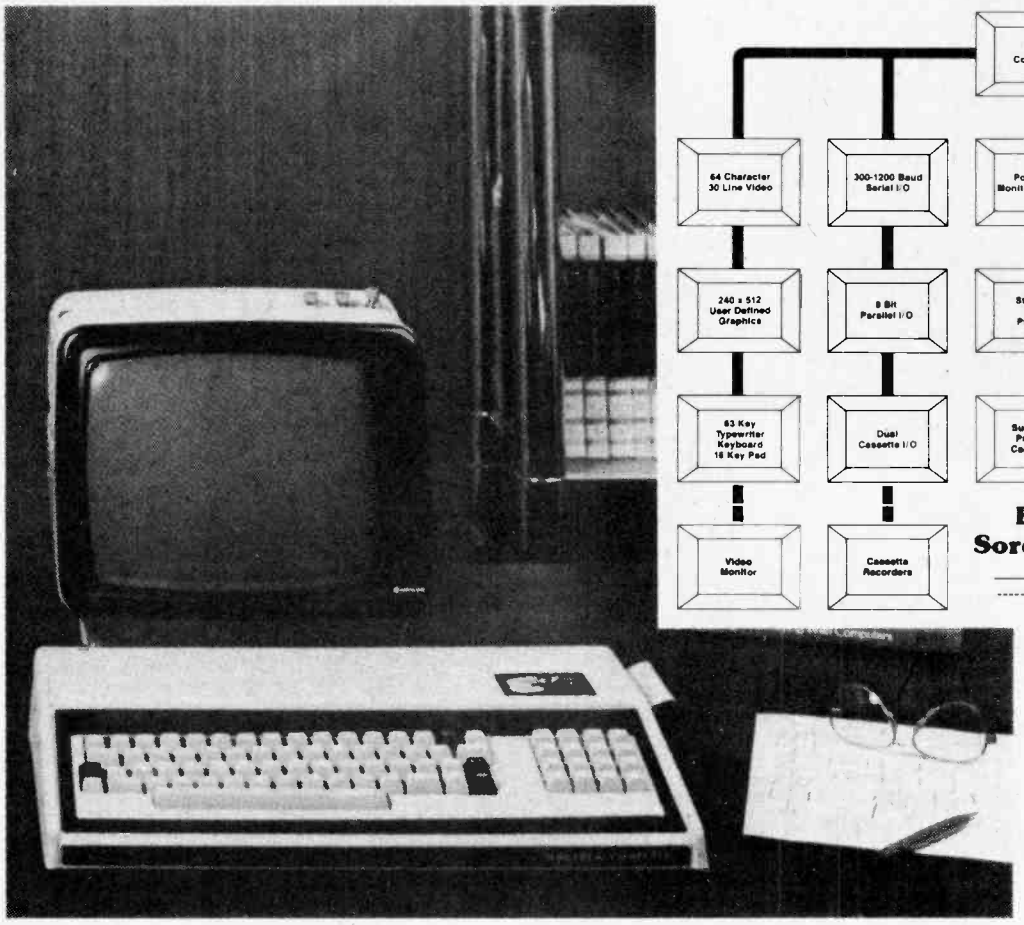
The Helios II Model 2 is a dual-drive machine; the Model 4 has two dual-drives. These make available 750K and 1500K bytes of disk memory.

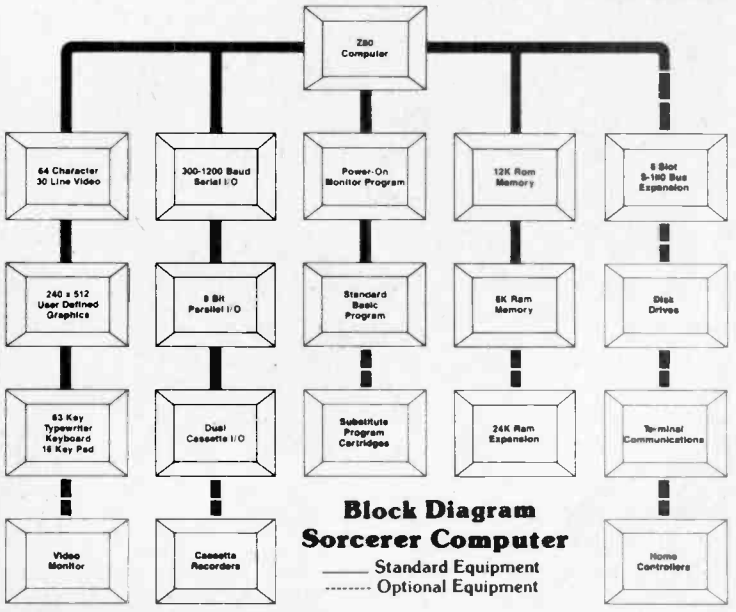
Made by Processor Technology Corp., 7100 Johnson Industrial Drive, Pleasanton, CA 94566.
Phone 415-829-2600

Available from Computer Mart in Toronto, Computer Ciruit in London, and Basic Computer Group in Vancouver.

SAMPLE SYSTEM Cat.No.	Price
Sol 20 with 32K RAM – Sol20/32	$3560
Video Monitor – (anybody's)	$400
Disk System – Helios II Model 2	$4960
Total for above	$8920

SORCERER





Made by Exidy Inc, 969 W Maude Ave, Sunnyvale, CA 94086. Phone 408-736-2110.

Available from Computer Place and Comspec in Toronto, Computer Innovations in Ottawa, and Orthon in Edmonton.

Sample System

Sorcerer:
The Sorcerer is a Z-80 based computer that comes with 8K or more RAM and has a 79 key keyboard built-in. The keyboard includes separate number/cursor pad. Video output displays 30 lines of 64 upper- or lower-case characters using the full ASCII set (128). Additionally 128 graphics characters are displayable (either 64 standard plus 64 user-defined, or all user-defined).

The 4K ROM monitor program hands control over to a plug-in ROM-PAC. This ROM card comes housed in a case identical to that of an 8-track audio cartridge – for quick language changing. Included in the basic price of the Sorcerer is a ROM-PAC cartridge containing an 8K Microsoft BASIC interpreter. Coming soon are ROM-PACs for APL, PILOT, DOS (Fortran, Cobol), and assembly language.

The standard BASIC allows multiple statements per line, string manipulation, and multiple dimention arrays. In one second you can execute approx 700 floating-point additions with seven decimal digits of accuracy.

Dual cassette interface is provided with optional high/low speed to suit the quality of your machine. Parallel (8-bit) and serial (RS-232, 300 or 1200 baud) interfaces are also provided.

Programs available on cassette include the following titles:Casino, Personal Physician (?!), Personal Data Management, Mangement Aids, Computer Aided Instruction, Advanced Engineering.

Memory:
On the main board are sockets for 32K of RAM. You can buy a 32K Sorcerer for $1945 but you will probably save by buying a cheaper model and fitting the extra RAM yourself.

Expansion Box:
A six-slot S100 expansion box is available. Although we don't make use of it in our 'sample system' this accessory will be necessary for anyone wanting to add lots more memory, disk storage, or the fun S100 boards advertised in the computer magazines.

SAMPLE SYSTEM

Sorcerer with 16K RAM –	$1645
Another 16K of RAM chips –	$250
Expansion Box –	$425
Single cassette recorder – (anybody's)	$100
Video Monitor – (anybody's)	$400
Price of this system – approx	$2820

Upgrades

Thanks to the S100 bus expansion box there is a large range of plug-in boards available for the Sorcerer. Using the interfaces provided there is no problem connecting any standard peripherals to this computer.

TRS-80

Made by Radio Shack,
Bayview Drive, Barrie,
Ontario, L4M 4W5.
Phone 705-728-6242.

Available from any of the 700+ Radio Shack outlets across Canada.

The TRS-80 CPU, the expansion interface (under the monitor), and the 'Quick Printer'. Plus cassette recorder and Radio Shack video monitor.
Also in our Sample System is the mini disk system.

SAMPLE SYSTEM

Cat.No.	Price
16K CPU with Level II — 26-1006	($1247)
Video Monitor — 26-1201	($299)
Cassette Recorder — 14-841	($69.95)
Package Price On Above Three	$1547
Expansion interface — 26-1140	$4[illegible]9
Disk Drive & Cable — 26-1160	$829
Quick Printer & Cable — 26-8160&26-1401	$868.95
Package Price On All The Above	$3692

Upgrades

Standard peripheral interfaces are available at the expansion unit. This means it is easy to add printers, disk systems, modems, etc. Four diskette drives can be added, the last three costing $799 each.

Radio Shack have a line printer for $1899/$1999, tractor feed optional. Top speed is 21 lines of 132 characters in one minute. Note Level II or disk BASIC is needed to control these printers.

To communicate with terminals and other computers the TRS-80 Expansion Interface has an optional Serial Interface board. This provides RS-232C signals.

There is a TRS-80 telephone interface which plugs into the RS-232 board and cradles a telephone handset. It operates in the 'originate and receive' mode and can provide two-way communication with another computer with 'originate and answer' capabilities.

The RS-232 board costs $170 and the telephone interface is $339.

New items in the TRS-80 range are: retrofit 12-key numeric pad, $130; voice synthesiser, $589; business desk and printer stand, $299 and $150; and a technical reference manual for $15,95.

Software:

A $55 Microsoft editor/assembler is available on cassette for anyone with 16K of RAM. It creates both source and object files. It does not support macros and conditional assembly.

A T-bug program allows you to program in machine language on a Level I machine for $30.

Other cassettes come with the usual range of programs from $8 to $50.

Sample System

26-1006:

In ETI April 1978 we reviewed the simplest TRS-80 system, with 4K of RAM and Level I BASIC (this system costs $899 with monitor and cassette recorder). Spending an extra $648 furnishes the CPU board with 16K of RAM and the vastly-improved Level II BASIC (using 12K of ROM, rather than 4K).

26-1201 & 14-841:

The CPU board can interface directly with any standard video monitor (note: it does not work directly into a TV set; if you want to use your set you have to buy a video modulator or modify the TV for video input). Similarly any quality audio cassette recorder with remote control can be used to store programs or data. The two products in our Sample System are the ones recommended by the manufacturer.

26-1140:

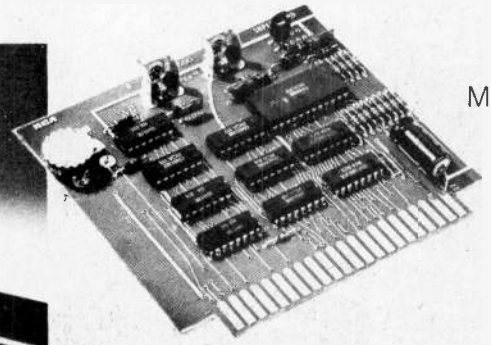
The CPU board cannot interface directly with disks, printers, and other peripherals, and the board is limited to 16K of RAM. By adding the Expansion Interface you can control up to four mini disk drives, a printer (via a standard Centronics parallel port), and a dual cassette recorder. An extra 16K or 32K of RAM can be fitted, and an RS-232-C interface board is available. The Expansion Interface is a separate module with its own separate power supply.

26-1160:

The TRS-80 mini disk system uses 5¼-inch diskettes to provide 55,000 to 310,000 bytes of on-line storage. With just one disk drive you get about 55K of storage — the first diskette holds TRSDOS (Disk Operating System) and Disk BASIC (which use about 4.2K and 5.8K of RAM). The format is 35 tracks of 10 sectors with ¼K bytes in each sector. Average track access time is 200 ms; it takes 600 ms to cross all tracks.

26-8160:

The Quick Printer gives 150 lines/minute on a roll of 4¾ inch wide aluminum-finish paper. The printer gives upper and lower-case letters and all keyboard characters except arrows. All Level II printer commands are used. Three character sizes are available, giving 20, 40 or 80 characters per line, software selectable. Level II and the Expansion Interface are necessary, so is the $69.95 cable (26-1401).



Above : The VP-550 two-channel sound board. Left: The VIP hooked up to monitor and cassette.

VIP

Made by RCA, New Holland Avenue, Lancaster, PA 17604. Phone 717-397-7661.

Western Canada: RCA, 6303 30St SE, Calgary, T2C 1R4. Phone 403-273-1815. Dealers are just being set up in the West, but try these: Byte Shop in Vancouver, Computer Shop in Calgary, Orthon in Edmonton, and Advance Indstl Electronics in Winnipeg.

Eastern Canada: RCA, 1 Vulcan St, Rexdale, Ont, M9W 1L3. Phone 416-274-5491. Available from Home Computer Centre in Toronto, Wackid in Ottawa, and Orion in Kichener.

SAMPLE SYSTEM
(Note all prices are US prices in US dollars)

Cat.No.	Price
COSMAC VIP Computer — VIP	$249
Colour Board — VP-590	$69
Second Keyboard — VP-580	$15
Total Cost Of Above System (excluding colour TV) — In USA	$333

— Sample System

VIP

The VIP is a hobbyist computer designed specifically for progamming graphics. The COSMAC 1802 processor is used with a 512-byte monitor program in ROM and 2K of RAM. Sockets enable the RAM to be doubled.

The 1802 has 16 16-bit general purpose registers, an 8-bit D register and three 4-bit registers (that can be set under program control), and features easy DMA operations.

The CHIP-8 interpretive language is said to be very easy to use (we haven't tried out the VIP at ETI, yet). CHIP-8 allows 16 one-byte variables and is limited to the operations +, -, AND, and OR. In all there are 31 4-digit-hex instructions. Single instructions generate a random byte, read in a keypad digit, display a pattern, sound a tone or increment a variable. Subroutine nesting and machine language inserts are permitted.

The firmware bit-maps a 256-byte page of memory onto the screen of the monitor (which you provide). A '1' in memory makes a patch appear on the screen, in any of 64 positions in any of 32 rows. Alternate interrupt routines can display up to 128 rows.

Software allows patterns (letters, numerals, cowboys, etc) to be formed and moved around the screen.

The keyboard is a 16-key pad marked in hex with the bottom four keys doubling as function keys — for the only four functions available, memory write, memory read, tape write, and tape read.

Interfacing is available via two connectors. One provides 8-bits parallel input and 8-bits parallel output, plus control lines, with 2 TTL load drive capability. The other connector brings out address, data, and control lines, for expansion. Also provided are separate sync and video signals. There is no buffering, though. The cassette audio and motor control leads, and the video lead, are attached to the board and fitted with plugs.

The power supply gives only 600 mA at 5V — but there are pc board pads available for fitting a 7805-type regulator and filter capacitor (so you can add your own unregulated power-supply).

The VIP comes with a cassette interface. A fixed-frequency tone sounds while a tape is written, and also when keys are depressed. An LED lights up to show when a tape has been read.

An instruction and maintenance manual is included. Featured in the manual are 20 video game programs to get you started.

VP-590 & VP580:

The first of these is a board which plugs into the VIP and allows program control of 8 colours. Any of four background colours can be selected. The board has sockets for two auxiliary 16-key keypads (VP-580) for two-player or three-player interaction.

— Upgrades

The VP-590 and VP-580 are mentioned in the Sample System.

The VP-595 is a sound board which gives one of 256 tones for US$24.

The VP-550 is a music board which gives two channels and control of frequency, time and amplitude, for US$49.

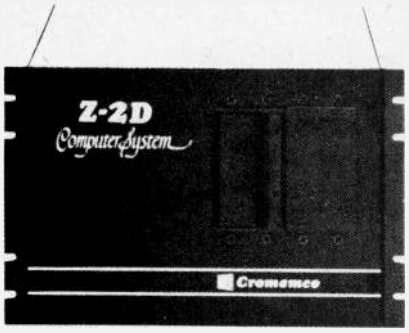
VP-570 is a 4K RAM board for US$95.

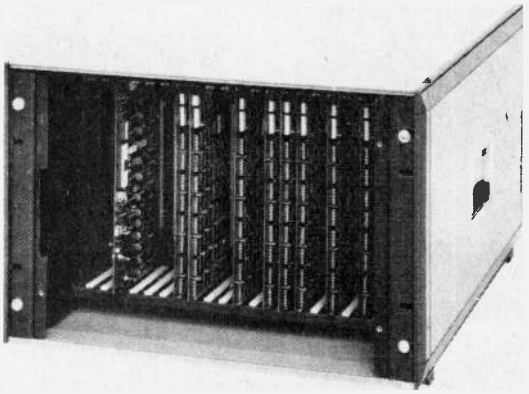
VP-700 is 4K of ROM 'Tiny BASIC', which needs ASCII-encoded keyboard, for US$39.

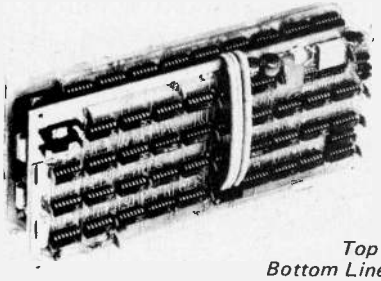
A suitable keyboard is promised for under US$50.

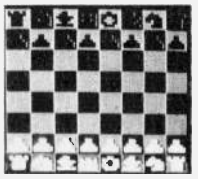
VP-560 is a board to locate two 2716 EPROMs (2K each) anywhere in 32K of memory, for US$34.

VP-565 is a US$99 EPROM programmer which generates its own high voltage, designed for 2716 2K EPROMs.









Top Left: The Z-2D with single disk drive fitted.
Top Right: Inside the Z-2, showing the S100 card frame.
Bottom Line: The two plug-in boards of the TV Dazzler. Instead of the terminal listed in our Sample System you could use the Dazzle Writer (middle picture) plus TV and suitable keyboard. The chess display shows the Dazzler at its best (well, it would be better on a colour TV!).

Z2D

Made by Cromemco Inc, 280 Bernado Ave, Mountain View, CA 94040. Phone 415-964-7400.

Available from Computer Mart & Trintronics in Toronto, Futur Byte in Montreal, and Robo-Tronics & The Computer Shop in Calgary.

SAMPLE SYSTEM

Cat.No.	Price
Chassis, PSU & CPU Board — Z-2-W	$1435
Disk Controller Board — 4FDC-W	$860
5 inch Disk Drive — WFD	$655
Two 16K RAM Cards — 16KZ-W	$860
16KZ-W	$860
16K Disk Extended BASIC — FDB-S	$130
Terminal — (anybody's)	$2000
Total For Above System —	about $5200

Sample System

Z-2W:

The Cromemco system is based on the S100 bus. The Z-2 gives you a full-length shielded motherboard with 21 card slots. It includes a heavy-duty power supply (+8V @ 30A, +/-18V @ 15A) which will power a full set of cards plus floppy disk drive. It comes with a CPU card — the $395 Z80-based 4MHz 'ZPU-W'. The Z-2 prices shown are for an assembled unit.

4FDC-W:

The Disk Controller card is capable of simultaneously interfacing three 5in or four 8in disk drives. It includes an RS-232 interface with a software-selectable range up to 76,800 baud. A 1K byte PROM holds the bootstrap monitor.

WFD:

The 5in disk drive stores 92K on each diskette side in a soft-sectored IBM format.

Z-2D-W:

The Z-2D is a Z-2 computer with Disk Controller and Disk Drive fitted.

16KZ-W:

This 16K RAM card will operate at 4MHz with no wait states. Access time is 200 ns. The card is 'Bank Selectable' — an 8-position DIP switch on the board locates the memory in one of eight banks, which are selected under software control via one of the output ports. This way the computer can access up to half a megabyte of memory; and in a time-sharing application the bank select feature can be used to handle up to 8 users with a minimum of software overhead.

FDB-S:

The Cromemco 16K Disk-Extended BASIC comes on a 5in diskette. It features 14-digit precision, extended string and sub-string handling, PRINT USING for Cobol-like formatted output, TRACEing of program execution, dynamic error trapping, random and sequential disk file access, program chaining and overlays, multiple statements per line, renumbering of lines, and direct machine-language interactions using INP, OUT, PEEK, POKE, and USR commands.

3100:

This CRT terminal has capacitive keyboard and numeric and cursor pads. It communicates to the computer via the RS-232 interface. Upper and lower-case letters are displayed eighty-to-the-line on a 24 line display. The price includes a 10ft cable with DB-25P connector.

Upgrades

The S100 system used in the Z-2 makes it very versatile, very expandable. Standard cards make up the computer described as our sample system.

The TV Dazzler is a couple of cards that map memory onto a TV screen in colour. Definition is 128x128 (ie 2K bytes of memory for simple mapping). Eight colours are available and 16 grey-scale levels. Output is video.

The D+7A is an I/O card which couples two game consoles to the computer. The consoles each have an x-y joystick, an audio amplifier and speaker, and four push-button switches.

Cromemco also have a wide range of cards for everything from memory, through I/O, to CPU.

DEALERS

The list below is made up from the lists given to us by the maufacturers of the computers in this catalogue. Some of the names we were given were not easily traceable and are not in this list.

Because of the large number we did not list PET dealers on page 43. Here they are marked with a (●).

BRITISH COLUMBIA

Conti Electronics Ltd.●
5656 Fraser Street
Vancouver, B.C.
604-324-050.

V.F.A. Systems Ltd.●
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604-736-7474.

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V6M 1Y7.
604-263-0934.

The Byte Shop,
2151 Burrard St,
Vancouver, B.C.
V6J 3H7.
604-736-0511.

ALBERTA

The Computer Shop,●
3515-18th Street W.
Calgary, Alta.
403-455-5298,
403-243-0301.

TJB Microsystems Ltd.●
Box 4844,
Edmonton, Alta.
403-455-5298.

Orthon Holdings Ltd,
12411 Stony Plain Rd,
Edmonton, Alta.
T5N 3N3

Compu-Shop
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Calgary, Alta.
403-243-3846

The Computer Shop of Alberta,
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Calgary, Alta.
403-283-0751

Heathkit Electronic Centre,
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Edmonton, Alta.
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403-475-9331.

Robo-Tronics,
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Calgary, Alta.
403-282-9496.

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Regina, Saskatchewan
306-543-4079.

Digital Service,●
1310 East Centre,
Saskatoon, Sask.
306-374-8908.

Sask. Sound City Ltd.●
1007-20th Street W.
Saskatoon, Sask.
306-653-2641.

Custom Computing Systems,
3-204 2nd Ave. North,
Saskatoon, Sask.
306-242-7808.

MANITOBA

Alberts Controls Ltd.●
504 Logan Avenue,
Winnipeg, Man.
204-947-6929.

Percomptron Inc.●
c/o The Byte Shop,
665 Century Street,
Winnipeg, Man.
204-453-6544.

Computerland of Winnipeg,●
715 Portage Ave.
Winnipeg, Man.
204-772-9519.

Heathkit Electronic Centre,
1315 Portage Ave.
Winnipeg, Man.
R3G 0V3,
204-783-3334.

Advance Industrial Electronics,
1400 Portage Ave. W,
Winnipeg, Man.

ONTARIO

TORONTO

Computer Workshops Ltd.●
1240 Bay Street Mall,
Toronto, Ont.
416-923-1917.

The Home Computer Centre,●
6101 Yonge Street,
Willowdale, Ont.
416-222-1165.

Computermart,●
1543 Bayview Avenue,
Toronto, Ont.
416-484-9708.

Hamtraders,●
45 Brisbane Road, Unit 18,
Downsview, Ont.
416-661-8800.

Richvale Telecommunications,●
Unit 18, 10610 Bayview Avenue,
Richmond Hill, Ont.
416-884-4165.

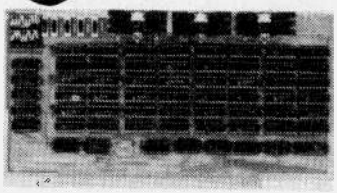
T. Eaton Stores●

The Bay Stores●

The Robert Simpson Co.●

The Computer Place,
186 Queen St. W.,
Toronto, Ont.
M5V 1Z1.
416-598-0262.

GODBOUT



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Compucentre,
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Hamilton-Avnet,
3688 Nashua Drive,
Units G & H,
Mississauga, Ont.
416-677-7432.

Computer Methods Ltd.●
Suite 205, 2249 Yonge Street,
Tornto, Ont.
416-482-5100-2.

Micro Ware,●
2334 Danforth Avenue,
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416-424-1413.

Comspec Communications,●
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M3K 1E7.
416-633-2871.

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416-596-1405.

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House of Computers Inc.●
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Toronto, Ont.
416-482-4336.

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416-459-7616.

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Computer Innovations,●
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Wackid Radio,
312 Parkdale Ave.,
Ottawa, Ont.
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Hamilton Avnet,
1735 Courtwood Crescent,
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Heathkit Electronic Centre,
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Cesco Electronics Ltd.
4050 Jean Talon Street W.,
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514-735-5511.

Heathkit Electronic Centre,
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H2M 1H1,
514-384-9160.

Compucentre,
9200 Claveau St.,
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(Stores In Place Ville Marie
and Place Bonaventure)

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Interactive Computer Systems, Ltd.●
105 Fir Court,
Fredericton, N.B.
506-455-8994.

NOVA SCOTIA

MiniComp Systems,●
5666 Stanley Street,
Halifax, N.S.
902-455-5123.

Kobetek Systems Ltd.●
RR #1,
Wolfville, N.S.
902-542-2500.

Lantz Electronics Ltd.●
15 Clifford Street,
North Sydney, N.S.
902-794-3102.

Light Show Colour Sequencer

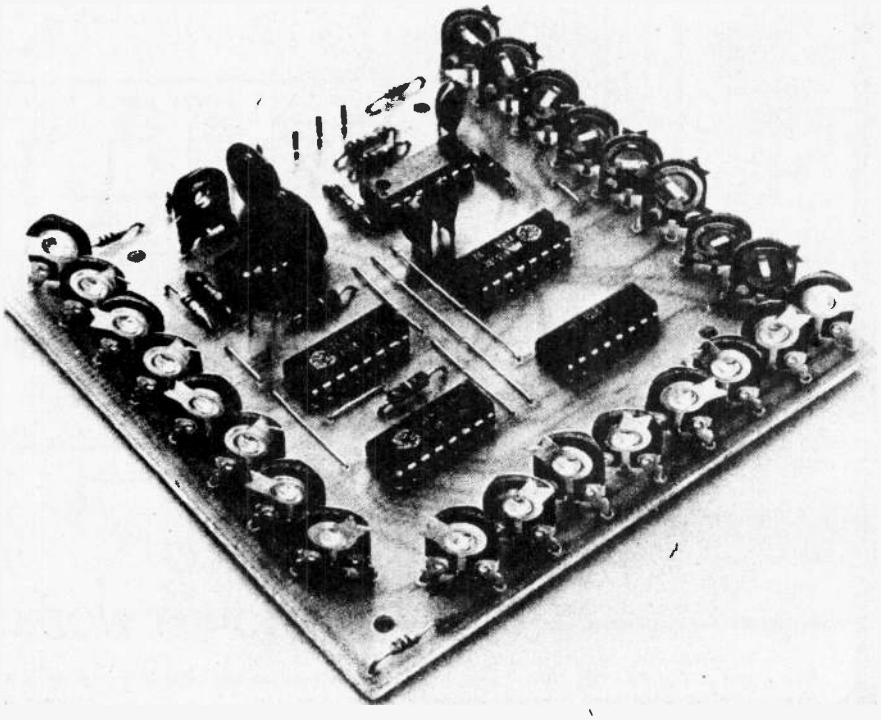
This unit interfaces with the ETI 592 Light Show Controller to give a rainbow sequence of colours.

BY MIXING THE THREE primary colours in the right proportions any colour of the rainbow, including white, can be made. A good example of this is a colour TV set, which uses only red, green and blue phosphors. When creating special effects with lights it is often desirable to have a colour which changes with time be it for a spot on a disco wall or lighting up a fountain.

This unit allows three light dimmers (the ETI 592 is ideal) to be controlled in a preset sequence giving eight different colour mixes. The rate of change from one sequence to the next is also variable.

SPECIFICATIONS

Number of channels	3
Speed	3 – 30 seconds per step
Output Voltage	0 – +7V
Power Supply	∓ 12V @ 10mA



DESIGN FEATURES

When we first examined the different ways of designing this project we had the choice of a simple system using a multitude of potentiometers or one which uses digital techniques with a RAM and D-A converters. Due to the complexity of the digital approach we chose the simple analogue system.

CONSTRUCTION

This is simply a matter of following the component overlay in fig. 2. Note that the trimpots are staggered to allow adjustment or to allow the larger type to be used without interfering with the adjacent pot.

Check the orientation of the ICs before soldering and solder the power supply rails first (especially for the CMOS ICs).

The power for the unit comes from an external supply. If it is to be used with the ETI 592 dimmer power can be taken from that unit. Otherwise a supply giving a positive voltage of between 10V and 15V (regulated) and a negative voltage of −2V to −15V is needed. Supply current on the positive supply is about 10mA while it is only about 3mA on the negative side.

SETTING UP

Connect the unit up and switch on. On switching SW1 on the unit should sequence through its cycle. Stop the unit and check to see which potentiometer in each bank controls the light. Adjust the level of the three dimmers to give the desired colour and intensity.

Close the switch until the next stage is selected, open the switch, and adjust the next colour. Proceed until all eight stages of the sequence have been programmed

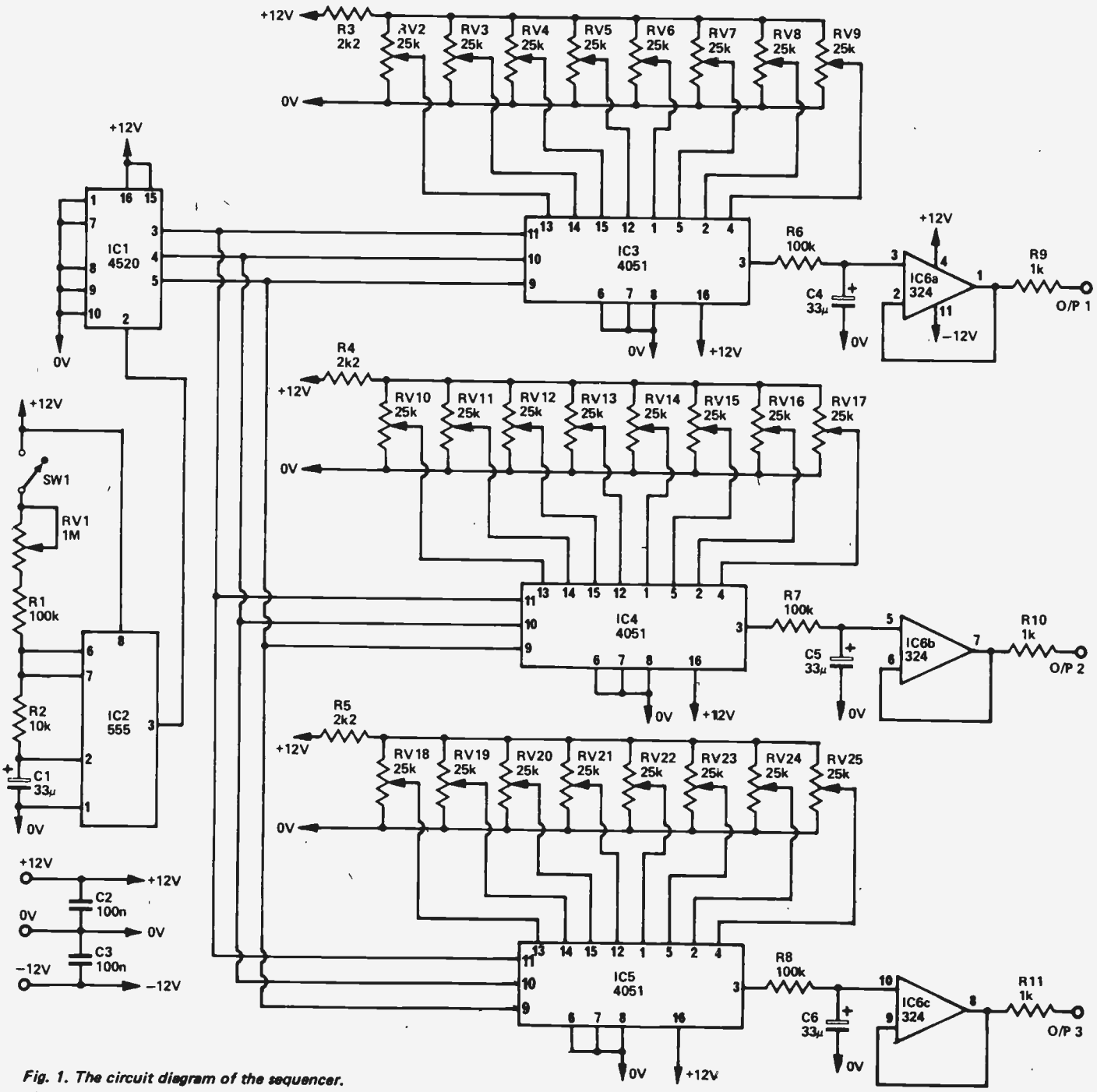


Fig. 1. The circuit diagram of the sequencer.

HOW IT WORKS

The unit consists of three identical channels controlled by a master selector. There are eight potentiometers associated with each channel which are used simply as voltage dividers. The 4051 IC associated with each set of potentiometers is a one of eight analogue multiplexer which means that one of the potentiometer outputs will be connected through to the output of the IC (pin 3) depending on the binary code presented to the control inputs (pins 9, 10 and 11).

The output from the 4051 is buffered by an op-amp with an RC network to give a slow change from one level to the next. The value of the capacitor can be reduced if the response is too slow. As the op-amp cannot swing to its supply rail a dropping resistor is used in series with the potentiometers limiting the maximum voltage to the op-amps to 7 volts.

The channel selection is done by IC1 which is a dual 4 bit binary counter. We are only using it as a single 3 bit counter with the unused inputs terminated to the supply rails. This IC is clocked by the 555 timer IC2 with the rate being determined by RV1. Again if the rate is wrong C1 can be changed in value.

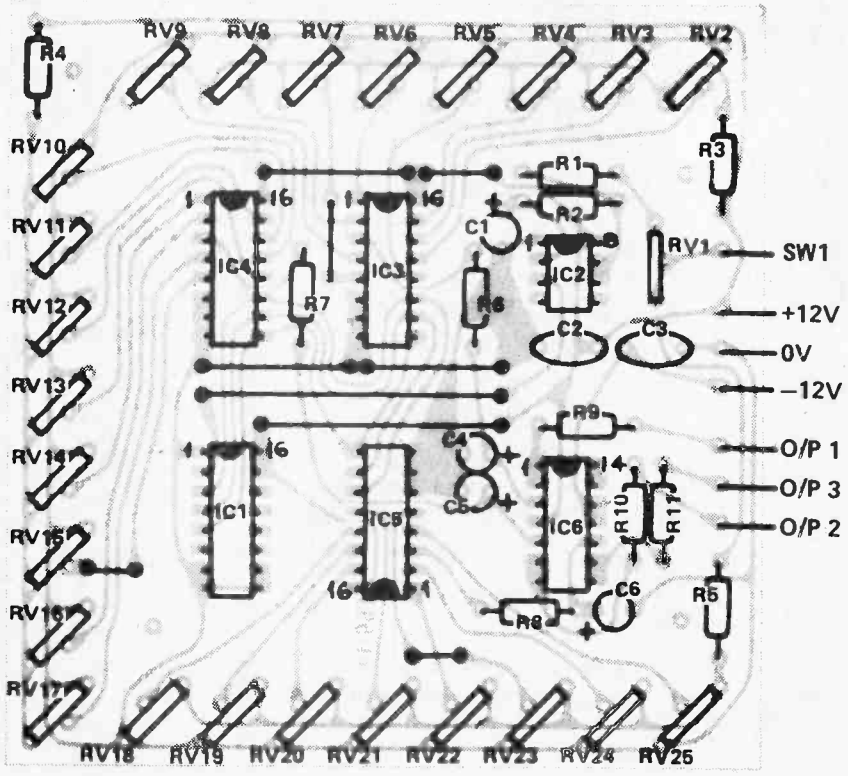


Fig. 2. The component overlay.

PARTS LIST

RESISTORS — all ½W, 5%
- R1 . . . . . 100k
- R2 . . . . . 10k
- R3–R5 . . . . 2k2
- R6–R8 . . . . 100k
- R9–R11 . . . . 1k

POTENTIOMETERS
- RV1 . . . . . 1M trim
- RV2–RV25 . . 25k trim

CAPACITORS
- C1. . . . . 33µ 16V electro
- C2,3 . . . . . 100n polyester
- C4–C6 . . . . . 33µ 16V electro

SEMICONDUCTORS
- IC1 . . . . . 4520 counter
- IC2 . . . . . 555 timer
- IC3–IC5 . . . . 4051 multiplexer
- IC6 . . . . . 324 quad op amp

MISCELLANEOUS
- PC board ETI 593
- single pole switch

PCBs for this project are available from: B & R Electronics, P. O. Box 6326F, Hamilton Ont., L9C 6L9, and Spectrum Electronics, 38, Audubon St. S., Hamilton, Ont., L8J 1J7. Kits of parts and boards are available from Northern Bear Electronics, P. O. Box 7260, Saskatoon Sask., S7K 4J2.

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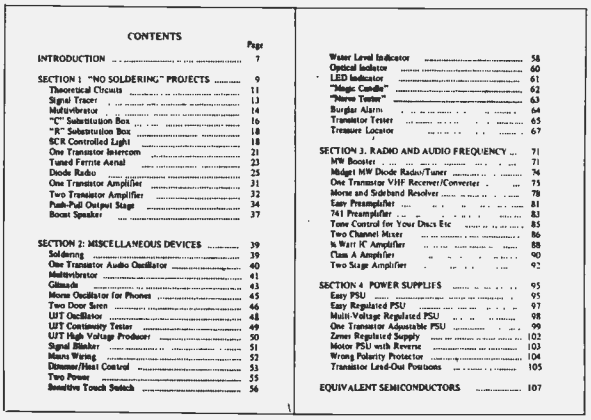
$4.30 + 30¢ postage & handling.



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(Not actual size)

Please use the card to order.

VHF Log Periodic Antenna Pt II

By Roger Harrison, who still swears (SWR's?) the prototype hasn't fallen down yet!.

BALUN CONSTRUCTION

THE BALUN TRANSFORMER consists of a trifilar winding on a ferrite balun core, Neosid type 1050/2/F14. Alternatively, a similar core could be stripped from a standard 4 - 1 TV balun and rewound. These are found in TV and FM 75 to 300 ohms adaptors. Construction is relatively non-critical, and details are illustrated in Fig. 7.
small-gauge hookup wire, preferably in three different colours to identify the different strands and assist construction. Alternatively, ordinary enamelled copper wire, about 22 gauge to 28 gauge AWG, would be satisfactory, although the three separate wires would have to be identified in some way, for example, by knotting wire 'b' once at each end, and wire 'c' twice at each end.

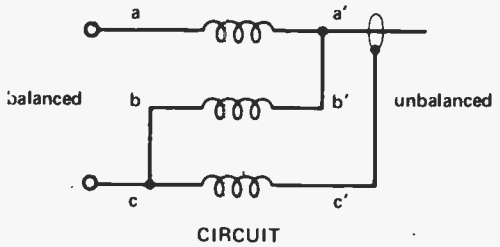
The three wires need to be about 150 mm long and should be lightly twisted together before commencing the winding. Wind 6½ turns through the two holes, around the outside of the balun core as illustrated in Figure 7.

The wound core is then glued to a small square of matrix board, about 25 mm long per side, using a small amount of five-minute epoxy or one of the 'super' glues. The windings are terminated to two pins on either side of the board, as illustrated in Figure 7. Two lengths of hookup wire should be soldered to the 'balanced' terminals, sufficient to reach from the mounting point of the balun to the feedpoint of dipole 10. A short length of coax, terminated in a line socket, is then attached to the 'unbalanced' terminals as indicated.

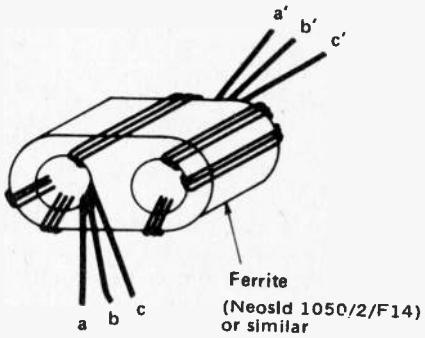
The balun assembly can be conveniently 'potted', using five-minute epoxy, to weatherproof it.

Mount the balun on the antenna boom, near or underneath, dipole 10, and connect the two 'balanced' connection leads to the feedpoint of dipole 10. Tape the assembly to the boom using weatherproof tape or plastic ties. Even string could be used, or the assembly glued in position using some more five-minute epoxy.

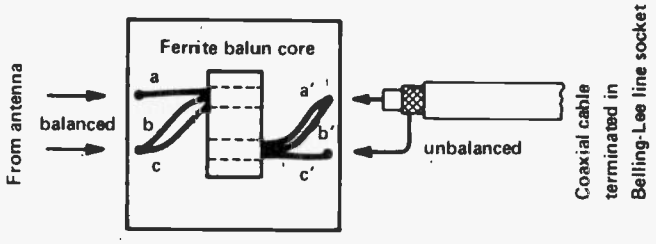
An alternative balun system would be to use standard 4 - 1 TV baluns. These perform a 300 ohm to 75 ohm transformation. With the type of construction employed, they can be used for a balanced-to-balanced or a balanced-to-unbalanced transformation.



CIRCUIT



WINDING BALUN



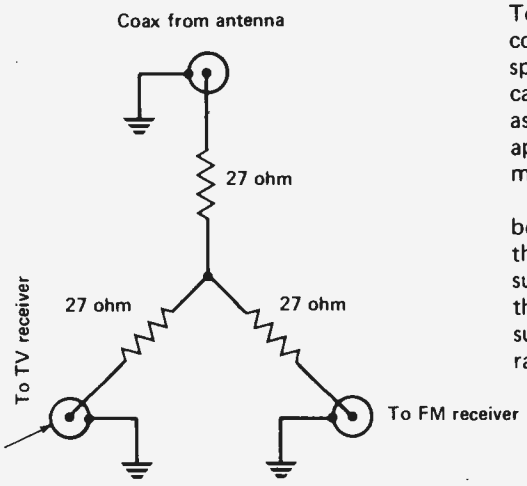
CONSTRUCTION

Fig. 7. Construction of 1:1 balun transformer.

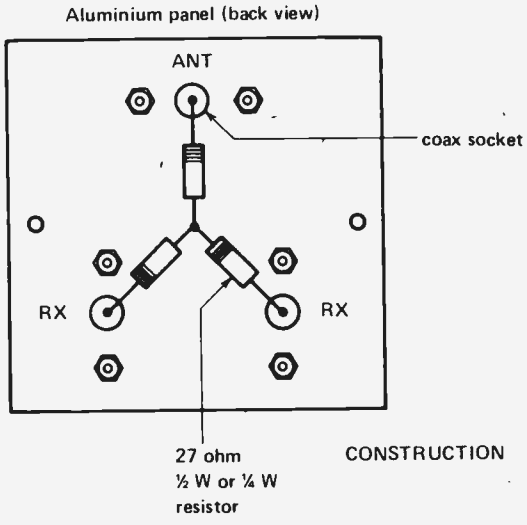
SPLITTERS

To run two different receivers from a common antenna a device called a splitter is necessary. The two receivers cannot simply be connected in parallel as they will interact with each other, apart from causing an impedance mismatch with the antenna feedline.

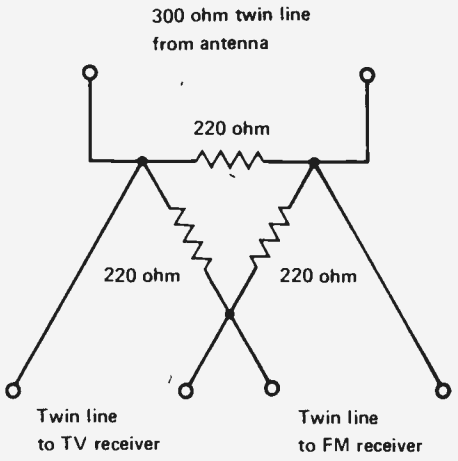
Two different kinds of splitters can be constructed – the resistive type and the transformer type. Alternatively, a suitable splitter may be purchased. As they are wideband devices they are suited for operation over the entire range from 40 MHz to 250 MHz.



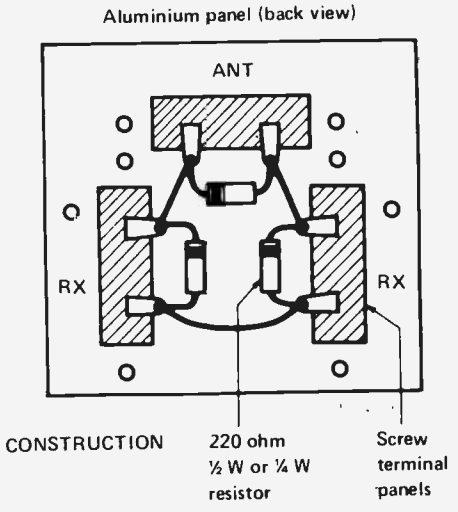
CIRCUIT



75 OHM SYSTEM SPLITTER



CIRCUIT



300 OHM SYSTEM SPLITTER

Fig. 8. a) Circuit of 75 ohm resistive splitter.
b) Layout of 75 ohm resistive splitter.
c) Circuit of 300 ohm resistive splitter.
d) Layout of 300 ohm resistive splitter.

If using these baluns, connect the 75 ohm side to the feedpoint of dipole 10 and run ordinary 300 ohm ribbon to your receiver installations from the 300 ohm balun connections. Be sure to take all the required precautions necessary with this sort of feedline installation as for TV feeder, to prevent signal 'suckout' by nearby metal structures and by line imbalance.

RESISTIVE SPLITTERS

Two resistive-type splitters are illustrated in Fig. 8. That on the left is for unbalanced, 75 ohm coaxial cable feedline systems; the one on the right is for 300 ohm systems. Both of these splitters are compromise solutions and are only recommended for TV & FM receiver installations in strong signal areas. If you are after DX, then the loss these splitters introduce will reduce receiver sensitivity.

Either type may be constructed on a small square or rectangular aluminium plate. Size is unimportant providing the feedline connectors are mounted reasonably close together so that the lead-length of the resistors and interconnections is kept short. Solder all connections.

Note that any terminal may be used as an input and the other two terminals may be used as the outputs.

When the splitter construction is completed, it can be mounted in a convenient place such as a cutout in a wall, shelf, or equipment cabinet.

TRANSFORMER SPLITTER

The best splitter is a transformer-type as it introduces a minimal loss, and can be constructed in a similar way to the balun previously described.

Commence by winding three wires on a balun core as shown in Fig. 7 and wind on 6½ turns, trifilar as described for the balun. The connections and construction are as illustrated in Fig. 9.

Once the transformer is completed, secure the windings, if necessary, with a small application of super glue. Then glue the transformer to a small scrap of plain phenolic board or matrix board. This assembly is glued to a small aluminium panel on which are mounted three coax sockets as illustrated in Fig. 9. Carefully separate and identify the three leads at each end of the transformer windings and connect them as shown. Carefully solder all joints.

When the construction of the splitter is complete it can be mounted as described for the resistive splitters.

FEEDLINE SYSTEMS

There are two alternatives for your feedline system: a 75 ohm coaxial cable system, or a 300 ohm twin-line system.

The coaxial cable system is recommended for a number of reasons: the coax may be run anywhere convenient as it is unaffected by wall material, metal objects and power cords. Many VHF receivers, TV sets and FM tuners these days have a coax connector antenna fitting to suit, and no interference can be picked up on the coax feedline as it is effectively shielded.

A 300 ohm twin-line feeder has the advantage of being inexpensive, but it must be correctly installed with stand-off supports and twists in the line to aid in maintaining 'balance'. It cannot be run as conveniently as coax, and noise and multi-path signals may be picked up on the feeder.

The required use of baluns and splitters in the system is illustrated in Fig. 10 for both systems. The 75 ohm coaxial cable system is illustrated on the left and the 300 ohm twin-line system on the right.

The coax required depends on the exact details of your installation. If a short run of coax is possible then a 6.5 mm diameter cable such as RG59 (variously designated as RG59/U or RG59/CU etc.), which is a 75 ohm characteristic cable, is suitable. If this cannot be obtained, then 50 ohm cable such as RG58 may be substituted, although a slight mismatch will result. The effect will be unnoticeable on a VHF or FM receiver but slight 'ringing' may be apparent on high contrast areas on a TV picture. This may not be visible at normal viewing distances.

For maximum sensitivity on reception or if you have to run the feedline more than 15-20 metres, then a low loss 75 ohm cable is recommended with black, weatherproof outer jacket.

If you wish to use a 300 ohm feeder system, any of the commonly available TV ribbon feeders should suffice, depending on your requirements. Solid dielectric type is adequate in strong signal areas and is the least expensive. If you want the maximum in sensitivity a low-loss type should be installed. There are various versions of low-loss 300 ohm feeder. Some types are similar to the solid dielectric type and simply have cutouts in the dielectric. 'Open wire' types have small spacers supporting the two wires at intervals. Another type has a continuous dielectric of foam material encased in a thin plastic 'shell'.

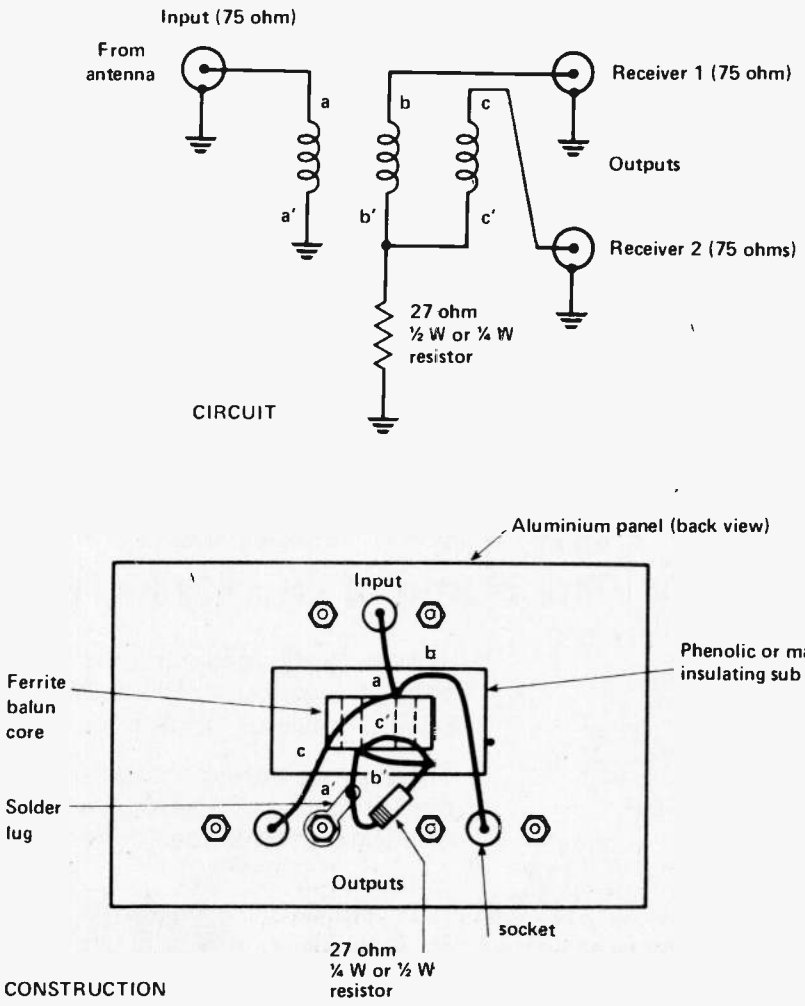


Fig. 9. a) Circuit of transformer-type splitter.
b) Construction of transformer-type splitter.

ANTENNA PERFORMANCE

The beamwidth of the antenna is about 50° (between the -3dB points). There were no discernable sidelobes in the forward direction which reduces problems with multi-path signals on FM and TV reception which are the cause of distortion on FM stereo and ghosting on TV signals.

The gain of the antenna is around eight to nine dB and the front to back ratio (rejection of signals behind the antenna) around 30 dB.

The broad beamwidth allows reception over a wide range of angles in the forward direction, very handy when the DX starts pouring in from all over the place as it saves a great deal of rotating the antenna. If you are using it for TV/FM reception the beamwidth should prove adequate for many city locations. However, you may think that you will have problems with a fixed antenna.

Installed at a height of roughly six metres above ground level, the antenna gave a good account of itself. Admittedly, as far as the local TV and FM transmitters are concerned I live in a strong signal area, although we have in the past suffered from ghosting on TV signals from the south. The good front-to-back ratio improved this problem considerably.

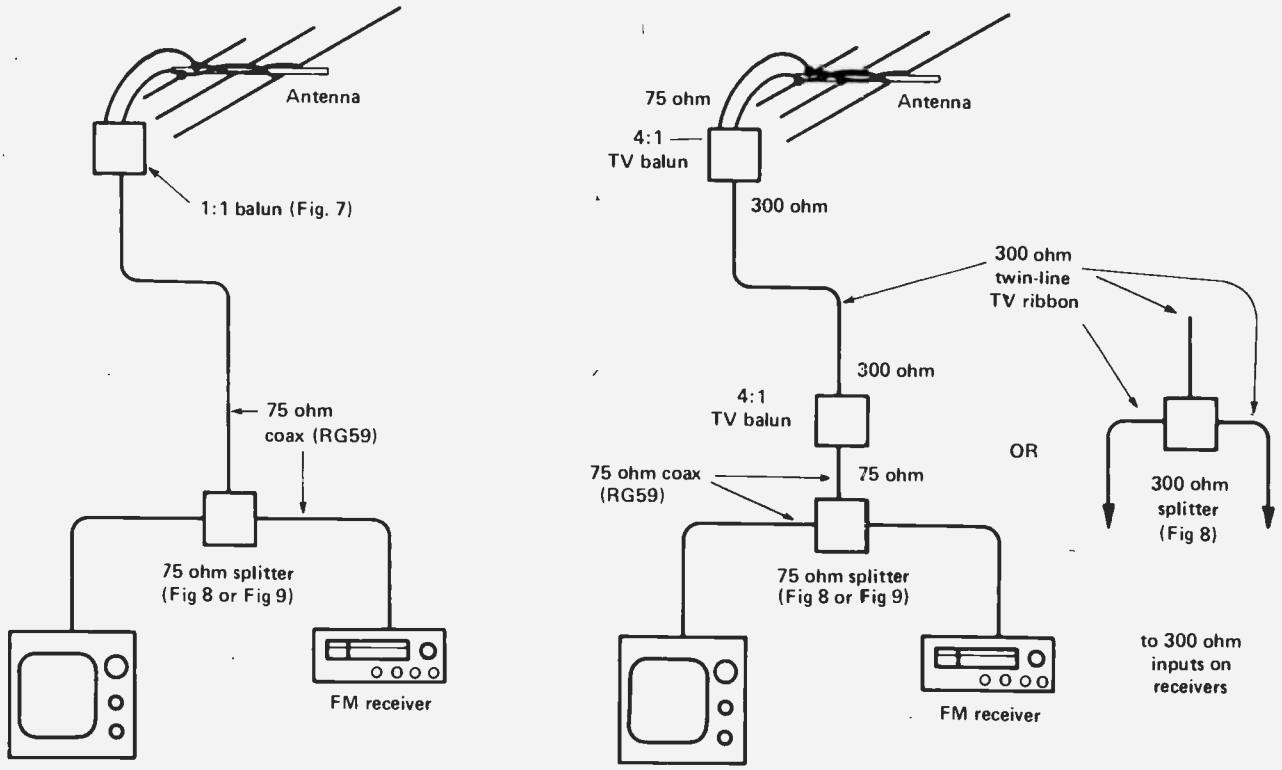


Fig. 10. Feedline and splitter systems installation.

Bip Beacon

A.J. Lowe designed this project to help a friend from his local Blind Association. All the device does is emit a continuous series of 'bips' to enable a blind person to get his bearings. So if you know anyone who might like one, have a go at making this simple project.

WHEN BLIND PEOPLE put something down, working around the house or garden, they sometimes have difficulty in locating it again. The Bip Beacon provides a sound signal on to which they can 'home'.

When two blind people arrange to meet at a certain place, each has difficulty in knowing when the other has arrived. The Bip Beacon provides an innocuous signal that says 'I'm here'.

You can build a beacon for about $3. If you don't know any blind people contact your local Blind Association, they'll be glad to hear from you. Many of these beacons have been built and eagerly accepted by blind folk.

WHAT IT DOES

The beacon simply emits a series of 'bips' (a 'bip' is a short 'beep') at four second intervals. That's all, but it's enough.

HOW IT WORKS

The circuit, shown in Fig. 1, is based on one IC, a quad two-input NOR gate. Two of the gates form a slow.running multivibrator the output of which enables the other two gates to form an oscillator whose output is amplified by transistor Q1. Component values are chosen so that a short duration audio note is produced every four seconds or so.

These beacons are most conveniently built in transistor radio cases. Most readers will be able to find one or two of them in which the radio is dead and not worth fixing. As long as the case and speaker are intact that's all that matters.

A suitable printed circuit board design is shown in Fig. 3. The actual circuit is in the middle of a board measuring 65 x 50 mm. This size is large enough to reach the support posts in the typical pocket radio.

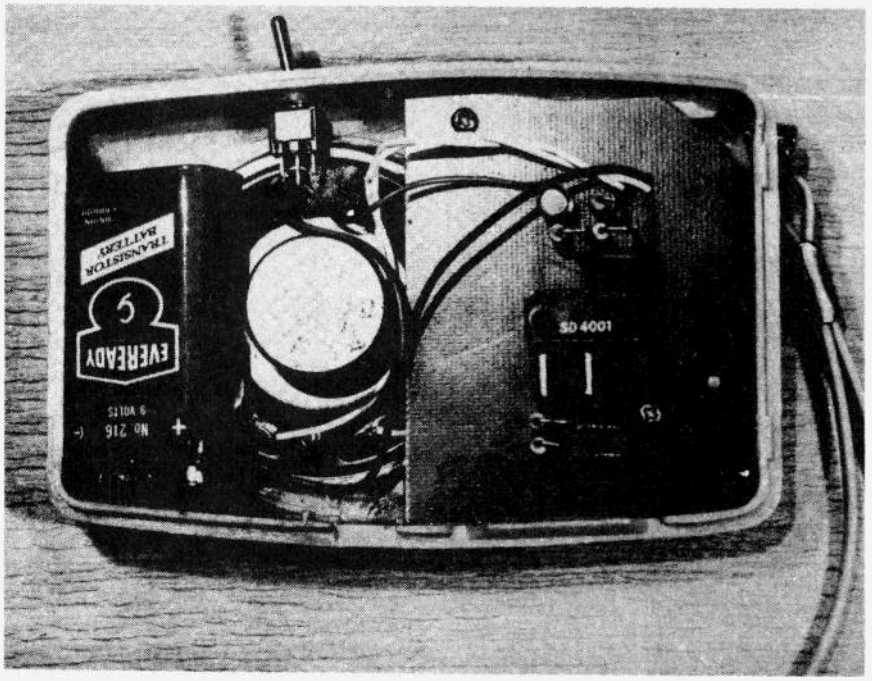
The board should be cut and shaped to suit the exact shape of the case. A good way of doing this is first to make a cardboard template and get that right, and then use it to mark the pc board for cutting.

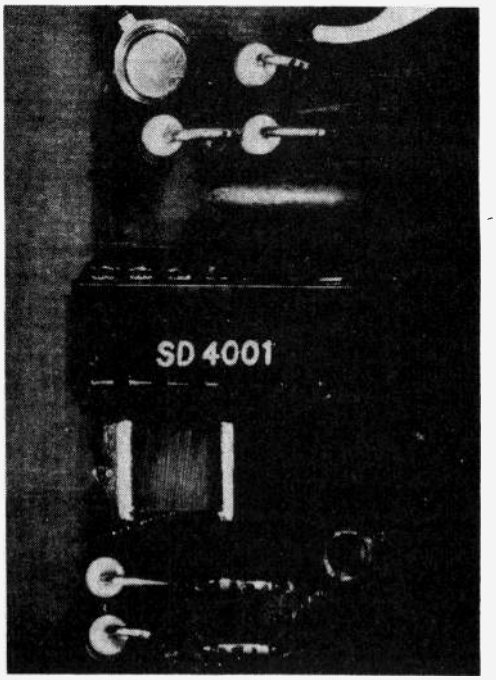
Care must be taken in locating the holes in the board for the mounting screws. Holes are not shown in Fig. 3 as they must be drilled to suit each individual case. A good way of finding hole positions is to make a transparent template from stiff plastic film, using the card template as a guide. The support posts can be seen through this clear template and it is easy to mark the hole positions and transfer them to the pc board.

All this cutting, shaping and drilling should be done before mounting any components.

Next mount all the components except R2, whose value must be determined on test to allow for variations in the value of C1. Take care with the correct orientation and handling of IC1 which is a CMOS IC.

The board, with all components except R2 mounted, is then hooked up to the battery and speaker and a value of R2 selected so that the bips occur



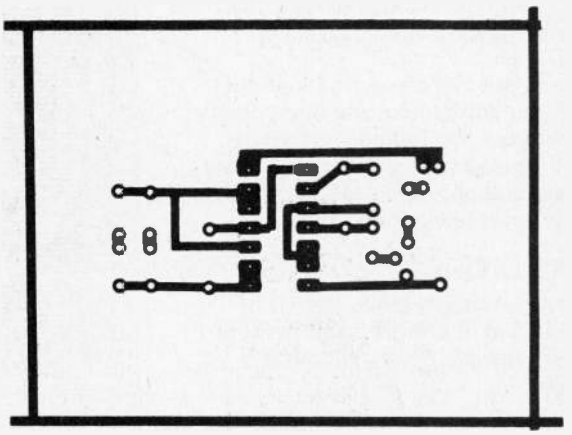


The photographs above show the construction of the Bip Beacon on a pcb which fits inside a cheap transistor radio case.

every four seconds. As R2 is a high value resistor 5.6 megohms or more, it must not be held between hands during this test or spurious results will be obtained. Use test leads with clips.

Finally insert R2 and assemble the board, switch and battery in the case. See the photos.

As these beacons are needed by people who can't repair them themselves, they should be made very thoroughly – with first class soldered joints.



The pcb artwork.

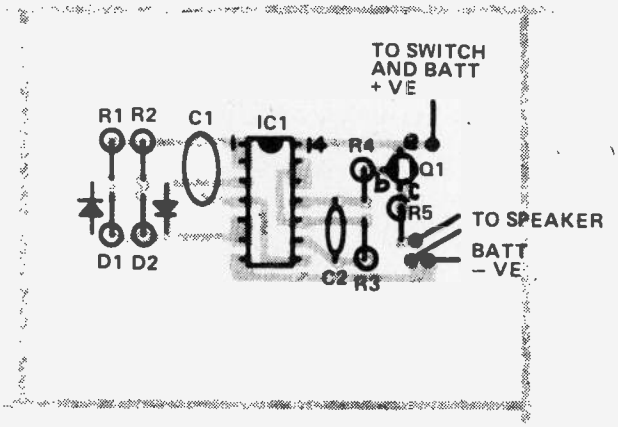
CLUBS

Electronic clubs who undertake production of beacons for local blind associations might approach local chain stores to see whether they can provide any new but 'dud' radios which they might otherwise throw away.

Well there it is – a not very difficult project, but a worthwhile one to help the sightless to 'see'.

CHIP

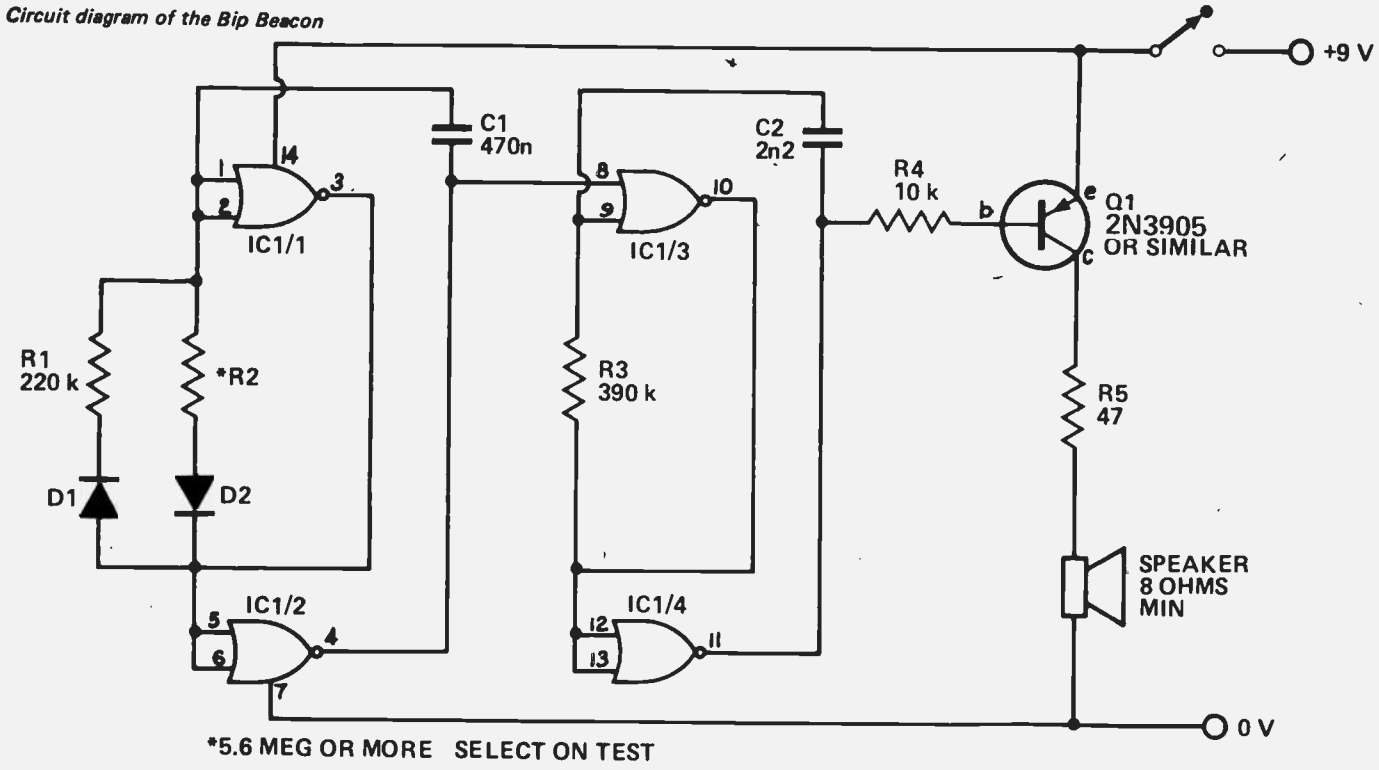
Not all types of 4001 will work as oscillators, you must specifically request type 4001A, not 4001B. Motorola does not have an A series, but their 4001 (not B) will work.



The component overlay.

PCBs for this project are available from: B & R Electronics, P. O. Box 6326F, Hamilton Ont., L9C 6L9, and Spectrum Electronics, 38, Audubon St. S., Hamilton, Ont., L8J 1J7.

Circuit diagram of the Bip Beacon



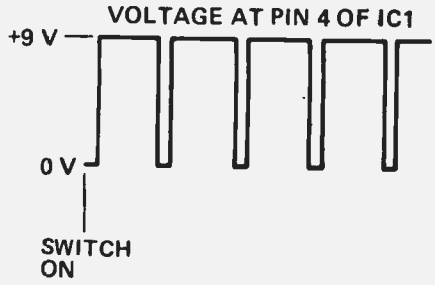
PARTS LIST

RESISTORS all ¼ watt
R1 220 k
R2 5M6 or more – select on test
R3 390 k
R4 10 k
R5 47 ohms

CAPACITORS
C1 470 n non polarised
C2 2n2 ceramic

SEMICONDUCTORS
D1 and D2 diodes 1N914 or similar
Q1 transistor PNP type 2N3905 or similar
IC1 4001 ACMOS

Transistor radio case with speaker and 9 volt battery.
Miniature toggle switch.



HOW IT WORKS

The IC contains four (hence its name QUAD) NOR gates which are separate from one another except for the power supply connections. Consider any of the NOR gates, such as gate 1, which has its input terminals connected to pins 1 and 2 of the IC and its output terminal connected to pin 3. The NOR description is a short way of saying NOT OR, and it means that – only when the input voltage on pin 1 or pin 2 or both pin 1 and pin 2 is high, (i.e. above about 3½ volts) then the output voltage at pin 3 is low (i.e., at the level of the negative rail). If neither pin 1 nor pin 2 is high i.e. both are low, then the output voltage on pin 3 is high.

That's all there is to a NOR gate. Now, applying this knowledge to the interconnection of the four gates, the description goes as follows:

Consider gates 1 and 2. Immediately after 'switch on' there is no reason why there should be any voltage at pins 1 2 5 and 6. So if 1 and 2 are low, then pin 3 must go high. As this pin 3 is connected to pins 5 and 6 they must go high, and so pin 4 goes low. Now capacitor C1 charges fairly rapidly from pins 3, 5 and 6 through diode D1 and resistor R1. As C1 charges, the voltage at its top end, and hence on pins 1 and 2, increases. When that voltage is high enough gate 1 inverts (because with pins 1 and 2 connected it is an inverter) and its output pin 3 goes low. This makes pins 5 and 6 go low, and hence pin 4 goes high.

Next, C1 discharges through diode D2 and resistor R2 – slowly, as R2 is a very high value resistor. Ultimately the voltage of the top of C1 has fallen to a low value and so it takes pins 1 and 2 down low. So pin 3 goes high, 5 and 6 go high, and 4 goes low, and the process repeats over and over.

From this description it can be seen that the voltage at pin 4 would follow the graph shown in Fig. 2.

Now consider gates 3 and 4. A moment after 'switch on' pin 8 is low because it is connected to pin 4 which is low. Also pin 9 is low because there is no reason why it should be high. So pin 10 goes high, and, following the earlier description, pins 12 and 13 go high and 11 goes low, C2 charges through R3 and when it is charged, which doesn't take long as it is a very small capacitor, then its top end is high. So pin 9 is high. This then sends pin 10 low (that's the NOR gate action), pins 12 and 13 low, and 11 high. The capacitor discharges rapidly through R3 and the cycle repeats at an audio frequency. Its output, pin 11, turns on and off transistor Q1 and so a note is produced by the speaker.

However, at any time when pin 8 is high gate 3 ensures that pin 10 is held low. Hence 12 and 13 go low and pin 11 goes high and transistor Q1 is turned off.

Now pin 8 is connected to pin 4, which, as already seen is high for most of the time and low for only a small fraction of the time – while C1 is charging. Thus the audio output occurs for only short intervals when pin 4 is low.

By suitable choice of R1 and R2 the device has been made to give a short bip every four seconds or so.

The pitch of the audio note can be adjusted by selection of R3 and C2.

As the IC used is of the CMOS type its current drain is very low and a long battery life can be expected.

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☐ Bill Mastercharge. Signature _____

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STAC Timer

The National MM57160 is an example of how to REALLY control the timing of EVERYTHING in sight — it's a microprocessor in disguise.

The standard timer and controller chip is a preprogrammed member of National's Controller Oriented Processor (COP) family. The device is designed for use in repetitive timing application where 1 to 4 outputs are to operate at 4 user-programmed times. Minimal external hardware is needed for complete system implementation due to direct display drive capability and a key-switch interrogation feature. Strap selection for 50/60 Hz input and 7-day/8-day mode has been included for added versatility.

Initialization

Power for the device is a single power supply of 7V9 to 9V5. Proper initialization will occur internally if the supply rise time is between 11 µs and 1 ms. If the supply rise time to final value exceeds 1 ms, an external RC network with a time constant in excess of the supply turn-on time should be placed on the Power On Reset (POR) pin. This delays initialization until the power supply voltage is within specifications. Initialised conditions are (a) time (real-time clock) at 00 00, (b) all set point times to 00 00 and all outputs off, (c) all days valid, (d) present day counter to day 1, and, (e) real-time clock mode.

Setting the time is performed in the normal real-time clock mode by depressing the SET HOURS (10) or SET MINUTES (9) keys. Each depression will cause an increment of the hours from 0-23 or minutes from 0-59, respectively, holding the appropriate key depressed will cause the numbers to roll (slew) at a 4/second rate. Normal operation is to slew the value close to the desired setting and then "bump" it to the final value.

OPTION SELECTION

Strap switches can be used to implement key functions. Figure 1 illustrates "strapping" of keyswitch functions 1-5.

Programming

For proper operation, the system must have 1 or more of its set point times loaded. To load (or program) set points, the DATA ENTRY key (5) must be depressed momentarily to take the system from the normal real-time clock mode to the data entry mode. Upon activation, 1 of the set point times will be displayed and its output status will be shown on the decimal points of the display. After power-up, this will be 00 00 and the decimal points will be off. To examine or go to another set point, the ADVANCE SET POINT key (6) is depressed in the data entry mode for each new time. The 4 values are held in a revolving stack (similar to a calculating stack) and each advance causes it to roll 1 position. Four advances returns to the original position.

To activate a set point, the hours and minutes will be loaded with the same SET HOURS (10) and SET MINUTES (9) keys used in setting the real-time clock. In addition the SET STATUS (8) key is activated and is used to load the output(s) to be activated at the programmed time. Depresssion of the SET STATUS key causes the 1st decimal point to turn on (which will correspond to output 1 turning on at run time). If this output is the only one to be used at this programmed time, one can go to the next set point by using the ADVANCE SET POINT key. If, however, the desired output is to be either output 2, 3 or 4, the set status key should be pressed again to advance to number 2, 3 or 4. Each advance turns off the previous decimal point.

Features

- 24-hour real-time clock with 4-digit display
- 60 Hz (50 Hz option) timing derived from the power line
- 4 Control outputs at each set point time
- 4 set point times may be programmed with repeat every 24 hours
- Valid day programming to "skip" certain days
- Manual mode to verify programming
- Transducer input to force to a preset condition
- Time of day reset to ease time setting or to allow use as a sequence timer
- High speed "demonstration" mode for verification of capability
- Single 9V power supply

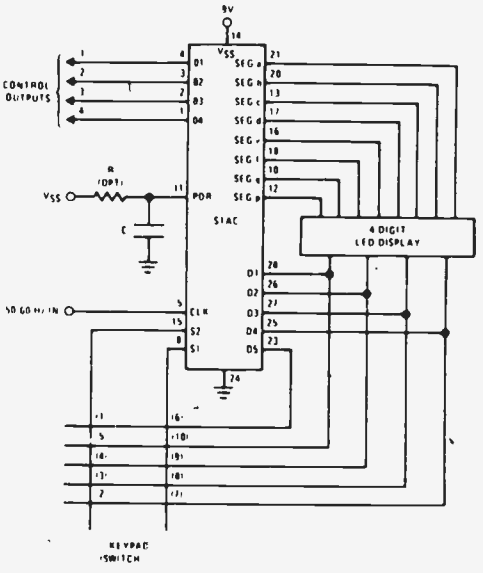


FIGURE 1. Typical STAC Connection

If a *combination* of outputs is designed (such as numbers 2 and 4), the HOLD STATUS key (2) is used to hold the number 2 decimal point on *before* the SET STATUS key advances through 3 to number 4. With the use of the HOLD STATUS key and the SET STATUS key, any combination of the 4 outputs can be programmed at each set point. If an error in programming occurs, using the SET STATUS key from position 4 will clear all data (including that set by the HOLD STATUS) and the proper information may be re-entered by following the proper sequence.

If conditions permit, the programming can be verified on the actual outputs by using the MANUAL key (1). This key, when depressed in the data entry mode, transfers the decimal point set-status data to the output latches; thus, the motor, solenoid, valve, or whatever is being controlled will be activated. When all 4 times and their respective output conditions have been programmed, the system is returned to the real-time clock mode by another depression of the DATA ENTRY key. If the valid day information is not used, the system is ready to operate.

Depression of the DAY MODE key (7) enables setting and display of the current and valid day information. The current day is displayed in the left-ost digit of the display and the validity of the day in the right-most digit with a "1" for a valid day, and "0" for an invalid "off" day. As the clock steps through the week, the programmed conditions occur on all valid days and do not occur on invalid days. The SET DAY key (10), when depressed in the day mode, advances to the next day upon each depression. The SET STATUS key (8), in the day mode, is used to change the validity information. Another depression of the DAY MODE key will return the system to the real-time clock mode.

Closure of the HOLD STATUS/DEMO key (2) will provide a means to rapidly cycle through the programmed sequence or set up an "in store" display. With this key closed in the real-time clock mode, time is advanced at the rate of 1 hour per second; thus, a 24-hour day requires 24 seconds to verify and a 7-day week requires less than 3 minutes.

Closing key 6 during the real-time clock mode (either normal or demo operation) will reset the clock time to zero without changing the set point timing but will reset the valid day information.

External Inputs

The MANUAL / REMOTE TRANSDUCER key (1), when depressed in the real-time clock mode, will override any time-related programming and immediately force output 1 on and 2 through 4 off. This condition will remain until the next valid set point occurs.

Using It

A table of key functions and an example program are given on the next page, the permutations are endless!

KEY NO.	KEY SWITCH NAME	FUNCTION		
		REAL-TIME CLOCK MODE	DATA ENTRY MODE	DAY MODE
1	MANUAL/ REMOTE TRANSDUCER	Remote transducer input; forces output 1 ON, outputs 2–4 OFF until next valid set point after switch is off	Manual verification mode, allows data to be transferred to outputs 1–4	(None)
2	HOLD STATUS/ DEMO	Allows rapid demonstration of sequence by advancing clock at rate of 1 hr/sec	Holds output N ON while programming advances to output N+1, N = 1–4	(None)
3	8 DAY	Specifies 8-day cycle in lieu of 7-day	Specifies 8-day cycle in lieu of 7-day	Specifies 8-day cycle in lieu of 7-day
4	50 Hz	Specifies 50 Hz line frequency input	Specifies 50 Hz line frequency input	Specifies 50 Hz line frequency input
5	DATA ENTRY	Places unit in the data entry mode	Returns unit to the real-time clock mode	(None)
6	ADVANCE SET POINT/ RESET TIME	Resets time of day to 00:00 without changing set points but resets all days to valid	Advances display to the next set point so that it may be verified or altered	(None)
7	DAY MODE	Places unit in the day mode	(None)	Returns unit to the real-time clock
8	SET STATUS	(None)	Controls programming of outputs; resets output N to "0" (unless preceded by HOLD key) and advances to output N+1	Alternate action key, changes day from valid ("1") to invalid ("0") and vice-versa
9	SET MINUTES	Advances minutes display of real-time clock	Advances minutes display of selected set point	(None)
10	SET HOURS/ SET DAY	Advances hours display of real-time clock	Advances hours display of selected set point	Advances display to next day – must be set to current day before returning to real-time clock mode

Dual-In-Line Package

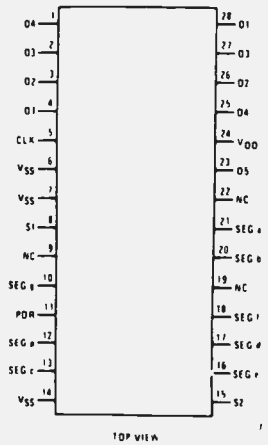


FIGURE 2: Pinouts

Programming Example

1. Output 1 should turn on at 2:00 a.m., and turn off at 4:00 a.m. each valid day.
2. Output 2 should turn off at 2:05 a.m. and turn back on at 4:00 a.m. each valid day.
3. Output 3 should turn on at 2:00 a.m. and turn off at 2:05 a.m. each valid day.
4. Output 4 should turn off at 3:01 a.m. and turn on at 4:00 a.m. each valid day.
5. Monday through Friday are valid days – Saturday and Sunday are invalid.
6. It is now Monday, the time is 1:00 a.m.

Given these conditions, it is now advisable to construct an "output truth table":

TIME/OUTPUT	O1	O2	O3	O4
2:00 AM	ON	ON	ON	ON
2 05 AM	ON	OFF	OFF	ON
3:01 AM	ON	OFF	OFF	OFF
4.00 AM	OFF	ON	OFF	ON

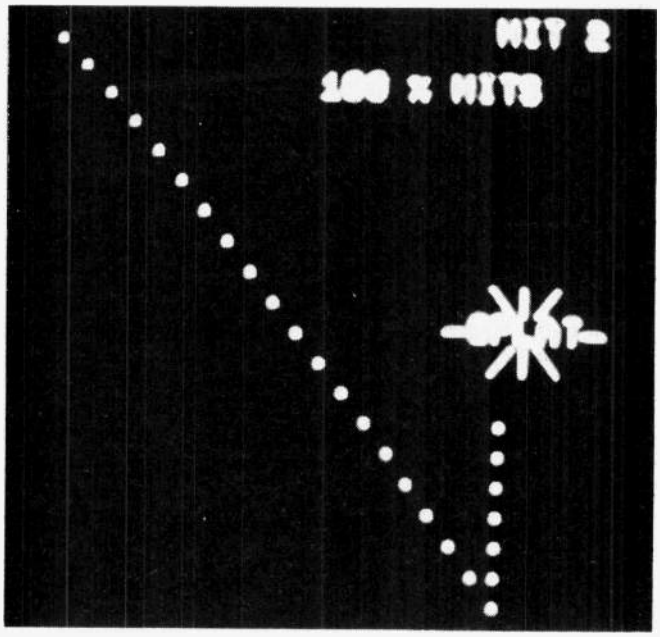
The following key sequence may be used to load the preceding program into the STAC memory.

KEY DEPRESSED	DISPLAY	NOTES
	0000	Initial display
Data Entry	0000	
Set Hours	0100	
Set Hours	0200	
Set Status	0.200	Set point 1 at 2:00 a.m.; output 1 ON
Hold Status	0 200	Hold output 1 ON
Set Status	0 2.00	Output 2 ON
Hold Status	0.2.00	Hold output 2 ON
Set Status	0 2.0 0	Output 2 ON, output 3 ON
Hold Status	0.2 0 0	Hold output 3 ON
Set Status	0.2 0.0.	Output 4 ON
Advance Set Point	0000	
Set Hours	0100	
Set Hours	0200	
Set Minutes	0201	
Set Minutes	0202	
Set Minutes	0203	
Set Minutes	0204	
Set Minutes	0205	
Set Status	0.205	Set point 2 at 2:05 a.m.; output 1 ON
Hold Status	0.205	Hold output 1 ON
Set Status	0.2.05	Output 2 ON
Set Status	0.20.5	Output 2 OFF, output 3 ON
Set Status	0.205.	Output 3 OFF, output 4 ON
Advance Set Point	0000	
Set Hours	0100	
Set Hours	0200	
Set Hours	0300	
Set Minutes	0301	
Set Status	0.301	Set point 3 at 3.01 a.m., output 1 ON
Advance Set Point	0000	
Set Hours	0100	
Set Hours	0200	
Set Hours	0300	
Set Hours	0400	
Set Status	0.400	Set point 4 at 4:00 a.m., output 1 ON
Set Status	04 00	Output 1 OFF, output 2 ON
Hold Status	04 00	Hold output 2 ON
Set Status	04.0 0	Output 2 ON, output 3 OFF
Set Status	04 00	Output 3 OFF, output 4 ON
Data Entry	0000	Present time
Day Mode	1 1	Day 1, valid
Set Day	2 1	Day 2, valid
Set Day	3 1	Day 3, valid
Set Day	4 1	Day 4, valid
Set Day	5 1	Day 5, valid
Set Day	6 1	Day 6, valid
Set Status	6 0	Day 6, invalid
Set Day	7 1	Day 7, valid
Set Status	7 0	Day 7, invalid
Set Day	1 1	Return to current day
Demo	(Running)	Run thru at least one 24 hour cycle intermittently (use Hour & Minute keys to "nudge" display to set points) to verify output settings. After passing set point just prior to present time, release Demo key
Set Hours	0100	Present time

Programming of the STAC is now complete. The program will continue in 24-hour, 7-day cycle until manually altered.

Stomper

This month since we're concentrating on computers, Softspot is also in this vein, with an example of what can be done with screen graphics, in this case on the popular PET from Commodore. By Pete Howells.



The program, as listed, is suitable for running in 4K on a PET. It is the result of sitting down at the machine and doing it, and, as you can see, in no way have the most efficient or elegant solutions to the problem been used.

```
 1 PRINT "DO YOU WANT INSTRUCTIONS (Y
   OR N)
 2 GETA$
 3 IFA$=""THENGOTO2
 4 IFA$="Y"THENGOTO700
 5 DIMB$(8),C(8)
 6 YY=160:MM=102:SS=46:SY=32
 7 DATA"7",-41,"8",-40,"9",-39,"4",-1,"6",1,
   "1",39,"2",40,"3",41
 8 FORK=1TO8:READB$(K),C(K):NEXT
10 REM
15 INPUT "SET SPEED (1 TO 10) ";DF
16 IFDF>10ORDF<1THENGOTO10
20 DF=DF/50
100 J=32768
105 PRINT"{CLR}"
110 I=33267
111 POKEJ,YY
```

This is the initialisation bit i.e. printing instructions if required, setting the graphics characters for the target etc., setting up a table for "key pressed"/"direction of move" and setting the delay for the speed. J is the position of the cursor, I for the target. Line 105 is to clear the screen, but the clear screen character is not reproduced by the printer.

```
200 GETA$
210 IFA$=""THENGOTO260
212 IFA$="S"THENGOTO500
213 IFA$="N"THENGOTO900
215 POKEJ,SS
220 FORK=1TO8
230 IFA$=B$(K)THENJ=J+C(K)
235 NEXT K
240 IF J>33767THENJ=J-40
250 IF J<32768THENJ=J+40
260 POKEJ,YY
```

Moving the cursor; the direction depending on which key was pressed — the main action takes place in the loop on lines 220-235. Lines 240 and 250 stop you from going off the top and bottom of the screen.

```
265 IF RND(TI)>DF THEN 200
270 X=RND(TI)
271 POKEI-41,32
272 POKEI-40,32
273 POKEI-39,32
274 POKEI-1,32
275 POKEI,SY
276 POKEI+1,32
277 POKEI+2,32:POKEI+3,32
278 POKEI+39,32
279 POKEI+40,32
280 POKEI+41,32
281 IFX<.25THENI=I-40
290 IFX>.25ANDX<.5THENI=I—1
300 IFX>.5ANDX<.75THENI=I+1
310 IFX>.75THENI=I+40
320 IFI>33767THENI=I-40
330 IFI<32768THENI=I+40
340 POKEI,MM
341 POKEI-41,77
342 POKEI-40,66
343 POKEI-39,78
344 POKEI-1,87
345 POKEI+1,64:POKEI+2,64:POKEI+3,64
346 POKEI+39,78:POKEI+40,66
347 POKEI+41,77
350 GOTO200
```

Moving the target; the speed delay takes place at 265. Lines 271-280 blank the target, lines 281-330 move the target and lines 340-350 restore the image on the screen.

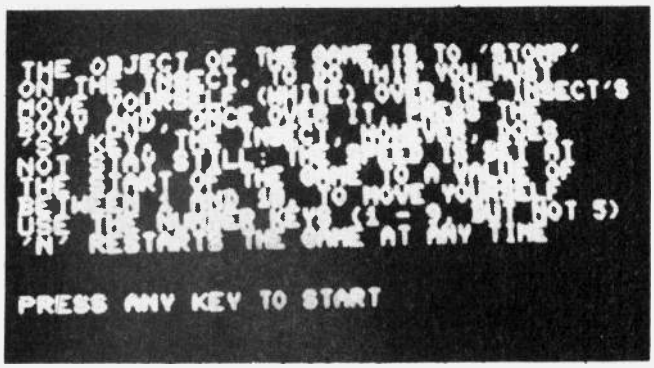
```
500 IFI=JTHENGOTO600
510 POKEJ,YY:POKEI,MM
520 PRINT"          MISSED"
```

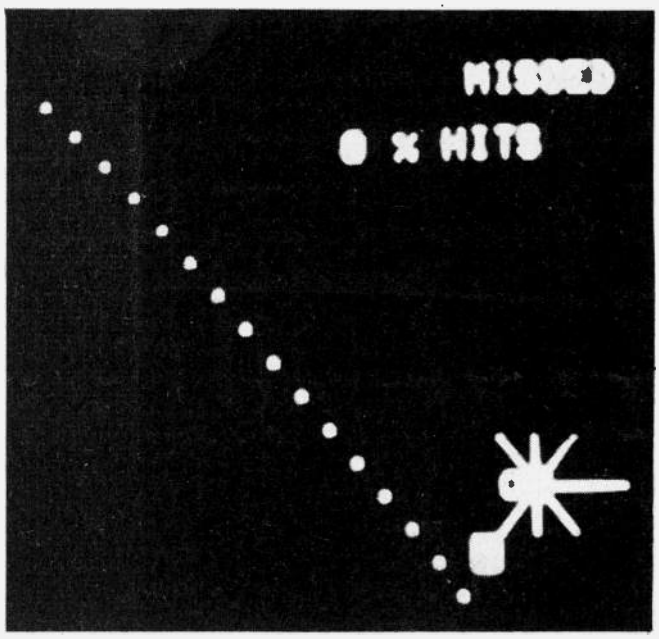
```
521 MX=MX+1
522 PRINT"   ";100*(N/(N+MX+1E-30));"%HITS"
523 FORKK=1TO1000:NEXTKK
525 PRINT""
530 GOTO270
600 N=N+1
605 POKEI-2,19:POKEI-1,16:
    POKEI,12:POKEI+1,1:POKEI+2,20
606 POKEI-3,64
610 PRINT" HIT";N
613 PRINT"      ";100*(N/(N+MX+1E-30)):
    "%HITS"
614 FORKK=1TO1000:NEXTKK
615 PRINT""
616 J=32768
620 GOTO200
```

The test for a "hit" (the position of the cursor and the position of the target coincide) is made at line 500. If they don't a message is displayed which is kept on the screen for the duration of the delay at line 523. The game then continues from where it was left off. If a "hit" has been scored then again a message is displayed, but the cursor position is reset (line 616) before continuing.

```
700 PRINT "THE OBJECT OF THE GAME IS TO
    'STOMP' "
710 PRINT "ON THE INSECT. TO DO THIS YOU
    MUST"
720 PRINT "MOVE YOURSELF (WHITE) OVER
    THE INSECT'S"
730 PRINT "BODY AND, ONCE OVER IT, PRESS
    THE"
740 PRINT " 'S' KEY. THE INSECT, HOWEVER
    DOES"
750 PRINT "NOT STAY STILL: THE SPEED IS SET
    AT"
760 PRINT "THE START OF THE GAME TO A
    VALUE OF"
770 PRINT "BETWEEN 1 AND 10. TO MOVE
    YOURSELF"
780 PRINT "USE THE NUMBER KEYS (1-9, BUT
    NOT 5)"
790 PRINT "'N' RESTARTS THE GAME AT ANY
    TIME"
800 PRINT "PRESS ANY KEY TO START"
810 GET A$
820 IFA$=""THENGOTO810
830 GOTO5
900 N=0: MX=0
950 GOTO10
```

This displays the instructions. The lines, along with lines 1-4, can be omitted if the facility is not required.





The program leaves plenty of room for improvement, and not only in its logical structure. The scoring system could easily be made more imaginative, for instance, and the intricacy of the game increased — a suggestion is to have the insect slow down if a leg is stomped off.

Geography test program

The program shown will test the geographical knowledge of the user.

The program will first prompt with a request for the area of the world that will be tested — options are Europe, South America and Asia. After this the machine will prompt with a request that the user enters the name of the capital city of one of the countries within the chosen continent. After ten questions the computer will show the score for the session and enquire whether or not the user wishes the test to continue.

The program was written for TRITON but should be suitable for implementation on most small BASIC systems.

```
 10 PRINT "GEOGRAPHY TEST—CAPITAL
    CITIES"
 20 LET R=0,W=0
 30 PRINT
 40 PRINT "1.EUROPE 2.SOUTH AMERICA
    3.ASIA"
 50 PRINT
 60 INPUT "PLEASE TYPE NUMBER OF CONTI-
    NENT CHOSEN" A
 70 IF A=1 GOTO 100
 80 IF A=2 GOTO 180
 90 IF A=3 GOTO 260
100 PRINT
110 FOR I=1 TO 12; at(I)=0; NEXT I
120 FOR L=1 TO 12
130 PRINT
140 PRINT "WHAT IS THE CAPITAL OF"; GOSUB
    340
150 GOSUB 500; INPUT "THE ANSWER IS
    NUMBER" B; GOSUB 910
160 NEXT L
```

Record That DX

John Garner discusses the convenience of taping your receiving sessions.

FOR THE SERIOUS DXer, a modest but functional tape recorder can prove an invaluable asset to his listening activities. A recorder is very useful for the shortwave listener in that he can replay broadcasts and gather exact information for reception reports. The facility to replay a broadcast a number of times can mean the difference in being able to identify stations received with considerable interference or broadcasts in a variety of foreign languages. This replay facility also allows the listener to note such pertinent facts as announcer names, program names, and specific wording of station identification.

DXers enjoy sharing their reception experiences with fellow DXers and non-listeners alike. A recorder will allow the DXer to build a basic library of broadcasts which he can replay for his personal enjoyment and the enjoyment of others.

THE MACHINE:

A number of articles have been written advocating the reel-to-reel recorder as the most useful format for the SWL. However, Don Dawson, of Alberta, who has had over 15 years experience with the use of home recording equipment, has found the cassette recorder to be much more versatile. I must agree with Don and I have used several cassette recorders in my listening room. Quality tape available in the cassette format is considerably less expensive than reel-to-reel tape of an equivalent quality. The compact format of cassette make them ideal for storage purposes and for mailing recorded material. It also allows one to remove a recording from the machine without having to rewind the tape. The knock-out feature of cassettes ensures that valuable recordings will not be accidently erased. The cassette recorder itself is also a nice compact size.

In selecting a cassette recorder, the first decision that the SWL will be faced with is whether to buy a portable or a stereo cassette deck. Although the cost is definitely higher for the stereo deck ($125 — $175 as opposed to $60 - $100) it is recommended. A number of features which are useful to the SWL are only found in the deck models. The stereo feature will allow the user to record music as well as his DX activities. If you have two receivers the stereo model will allow you to record the time from WWV or CHU on one channel as you record the program on the second channel. This would allow you to have the exact time of program details to aid you in your reception reporting.

The following is a list of features which the listener will find useful in his recording activities:

Automatic Recording Level: This feature is extremely useful in that it will tend to compensate for fluctuating recording levels due to fading. This feature should be switchable to allow for manual level control which is preferable when recording music.

Digital Tape Counter: This provision will allow the listener to note critical points in broadcasts when IDs are given, frequencies listed and interval-signals are played. It also allows you to find a particular portion of the tape quite rapidly.

Pause Control: This function is useful for editing recordings the listener may wish to keep and for momentarily stopping the tape when making written transcriptions.

Automatic Full-System Shutoff: With this provision the listener can leave the recorder unattended and it will automatically stop at the end of the tape.

Microphone/Auxiliary Input Jacks: Both these jacks have a significant bearing on the type of receiver the recorder can be connected to. This will be discussed further later.

Headphone Jack: This facility is extremely useful in transcribing broadcasts where reception quality is poor. What may sound like hash when played over a speaker may prove to be much more readable over headphones. Also headphones are good for late hour listening without disturbing the rest of the household.

Dolby Noise Reduction: While this feature is not essential it will certainly enhance the quality of musical recordings and will assist in cutting high frequency noise on some broadcast recordings.

Frequency Response: This area is not critical for DX recording as even the bottom-of-the-line recorders have an adequate frequency response for broadcast recording. If the machine will also be used for music recording it is recommended to have at least a frequency response of 30 — 15000 Hertz with Chrome or Ferri-Chrome cassettes.

THE TAPE:

With the growth in popularity of cassette recorders over the past dozen years or so there are literally hundreds of different brands of cassette tapes available. Unfortunately, many of the bargain priced tapes are highly unacceptable in terms of both mechanical and recording quality. From a mechanical point of view, a good cassette should operate smoothly and quietly in all tape movement modes. The shell of a good cassette is usually held together by four small screws rather than by glue. The tape itself should be relatively low in background hiss and free from

dropouts (ferrous oxide inperfections which cause blank spots in recordings). Cassettes marketed by the leading tape recorder manufacturers are consistently good quality buys. Tapes produced by the manufacturer of a recorder are designed to compliment the machine's capabilities and are a worthwhile investment, especially for good musical reproduction.

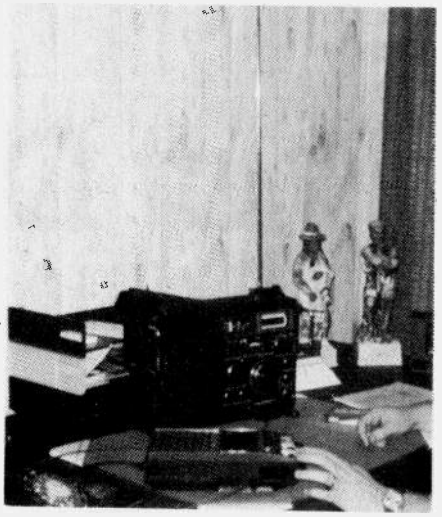
There are a number of different classes of cassette tapes on the market. The top-of-the-line Ferrichrome and Chrome tapes are best for recording music if the cassette machine has the appropriate bias and equalization settings for them. Tapes in the "High Fidelity" and "Low Noise" categories are in the middle price range and are of sufficient quality for broadcast recording. Standard or budget-priced tapes tend to be high in background noise and are unsuitable for most recording applications.

Cassettes are available in a range of time-lengths from 15 minutes per side (C-30) to 60 minutes per side (C-120). From practical experience the C-90 (45 minutes per side) is most useful for SW recording. The 45 minute time span allows one to start the machine a few minutes before a broadcast is due to start and still allows a sufficient time margin to record the closing identifiation at the end of the program. While the C-120 cassettes offer even greater recording time, they are comprised of extremely thin recording tape and have been known to bind or jam easily. The C-30 tapes are ideal for keeping recordings of interval signals or excerpts from favorite broadcasts.

EQUIPMENT OPERATION:

There are a number of different ways to connect a cassette deck to a receiver. If your receiver is equipped with a tape recording output jack you simply used the appropriate patch cord to connect it to the auxiliary (sometimes called Line) input jack of your cassette recorder. In some cases the cord may have to be connected to the microphone input jack to provide sufficient recording level (read both the recorder and receiver manuals to determine the recommended procedure). This method is the most ideal means of interconnection in that the recording signal is not altered by receiver gain and attenuation controls.

Unfortunately, the provision of a recording output jack is a relatively recent innovation on the part of receiver manufacturers. If your receiver does not have a record output jack, there are three different ways in which it can be connected to a recorder. The simplest and least expensive method is to place a microphone in front of the speaker. This method is almost totally unsatisfactory as the recorded audio quality will be very poor due to the microphone picking up all extraneous room noise as well as the speaker audio. The second method is to use a patch cord with alligator clips on one end and a plug that matches the recorder on the other end. The alligator clips are attached to the speaker lugs of the receiver and the plug is inserted in the Aux/Line input of the recorder. While this method will eliminate the recording of extraneous room noise, the signal is still influenced by receiver Gain and Attenuator controls. The speaker signal from the receiver is very strong compared to conventional recording outputs and resistors may have to be used to cut the signal power down for tape recorder input. The most suitable and most expensive method is to take your receiver to a competent technician and have a recording output added to the circuitry.



John Garner's hand activates his cassette recorder as he awaits an exciting broadcast from Radio Tahiti.

It is strongly recommended that listeners should keep their recorders running whenever they are tuning around the bands. You never know when you may run across that hard-to-catch station and you may miss getting the interval signal or sign-on remarks if you have to fumble around loading a tape and starting the recorder.

If you are planning on building a library of DX recordings it's useful to have access to a second cassette recorder. In this way you can edit your tapes and make up short representative samples of programs you have heard.

Some of the latest additions to the cassette recorder market feature a provision for connecting the recorder to a timer. This may be useful for those who prefer a good night's sleep to nocturnal DX-chasing. It also enables you to record a program when you are unable to be present at your radio.

So add a recording mode to your listening operation and add a whole new dimension to your enjoyment of the hobby of shortwave listening.

Thanks to Don Dawson who supplied most of the material for this article.

SHORTWAVE MAILBAG: P.O. Box 142, Thunder Bay, Ontario, P7C 4V5

Gordon Penn of White Rock, B.C. asks for the length of a long wire antenna for each of the shortwave bands from 10 to 120 metres. — A long wire antenna, no matter how long, will work satisfactorily on most bands. Usually 75 feet is quite a good length. For improved reception on a specific band an antenna cut for that band will yield better results. To find the required length for a half-wave antenna simply divide the metre band by 2 and you have the length in metres. To convert to feet simply multiply by 3.28. Thus a half-wave antenna for the 120 metre band will be 120 2 x 3.28 or 196.8 feet. The length for the 10 metre band would work out to 16.4 feet. Other bands in between may be figured out in the same manner.

ANARC '79 CONVENTION:

The 1979 Convention of the Association of North America Radio Clubs (ANARC) will be held on the weekend of June 22, 23, 24, 1979 at the Radisson Downtown Hotel in Minneapolis, Minnesota. Among the international broadcasters who will be attending the convention are Bob Zanotti of Swiss Radio International, Jonathan Marks of Austrian Radio and Ian McFarland of Radio Canada International. The convention is open for all shortwave listeners whether you are club members or not. So come to Minneapolis for a great weekend and meet others interested in this hobby.

REALISTIC DX-300

Radio Shack have recently introduced a new receiver on the market, the DX-300. I had a chance to have a look at this set the day it arrived at a local Radio Shack store and was quite impressed. The circuitry and controls have led me to believe that this receiver is manufactured for Radio Shack by the Yaesu-Musen Co. (the makers of the FRG-7 and FRG-7000). There is just too

much similarity between the DX-300 and the FRG-7 for coincidence.

The DX-300 Quartz-Synthesised Communication receiver covers 10kHz through 30MHz, and is able to receive AM (Amplitude Modulation), CW (Continuous Wave) and SSB (Single Sideband) signals.

The synthesized drift-cancelling triple-conversion mixer system provides thirty tunable ranges form 10 kHz to 30 MHz and is derived from a single 4 MHz quartz oscillator. This aids frequency control and stability. A stable low frequecny "kHz tuning circuit" covers the 1MHz increments and the 5-digit display shows the exact frequency.

The DX-300 uses 37 transistors (10 of which are field-effect type), a Large-Scale Integration IC frequency counter, 3 integrated circuits, 25 diodes, 5 seven-segment LED displays and six LEDs.

You can use the DX-300 at home (on 120 volts AC or 12 volts DC - 8 "C' cells) or in your car or recreation vehicle (12 volts DC negative ground).

A six element ceramic filter provides outstanding selectivity (freedom from adjacent channel interference), while a dual MOS Field-effect transistor is used in the critical mixer stage (freedom from cross-modulation and undesirable RF distortion).

Radio Shack's super-receiver, the DX-300.

The DX-300 sells in Canada for $499.95. Dimensions of the receiver are 146 mm high x 362 mm wide x 252 mm deep and it weighs 6 kilograms.

Next month I will have some information on other Radio Shack receivers. Until then, 73 and good listening.

All in ETI's 741 Cookbook:

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- Non-inverting x100 DC amplifier
- Non-inverting variable-gain DC amplifier
- High input impedance, non-inv, x100 AC amplifier
- Non-inverting x100 AC amplifier
- DC voltage follower
- AC voltage follower
- Very high input impedance voltage follower
- Unidirectional DC v-follower, boosted output
- Bidirectional DC v-follower, boosted output
- Unity-gain inverting DC adder (audio mixer)
- Unity-gain balanced DC phase splitter
- Unity-gain differential DC amplifier (subtractor)
- Semi-log AC voltage amplifier
- Constant-volume amplifier
- 1kHz tuned amplifier (twin-T, acceptor)
- 1kHz notch filter
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- Variable high-pass filter
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- Precision half-wave rectifier
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- DC voltmeter converter
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Dick Cartwright covers the C E A S A, which is rapidly becoming better known, and attracting more members.

AS PROMISED in the previous column I have devoted most of the last 2-3 weeks to researching the origins and goals of CEASA (Canadian Electronic & Appliance Service Association). Mr. Bill White, the General Manager, most kindly supplied me with several editions of their quarterly publication, Service Contacts, and the most recent edition of their monthly news bulletin. These contained a wealth of information.

This Association was founded some two years ago by a group of concerned manufacturers, importers and retailers; Canadian Admiral, the T. Eaton Company. Electrohome, Simpson-Sears, Sony, to name just a few. The aims and objectives of the Association can best be summed up by quoting verbatim a letter written by Mr. K. R. Allen, the first President. This letter is taken from the first issue of Service Contacts and outlines very well the objectives of this very down-to-earth national association.

CEASA BACKGROUND

"For many years, representatives of the major servicing companies and servicing operations of importers, distributors and retailers were invited to attend the Service Committee Meetings of CAMA, CEMA and latterly EEMAC. It was a friendly relationship but a difficult situation since representatives from many of the major service operations attended the meetings as observers, by invitation only. Imagine, the Canadian Electronic and Appliance Service industry is a four hundred million dollar a year business and some of the largest service operations did not have a single voice in the formation of policy, government legislation, consumer relations, etc. This situation was of great concern to many, including members of CAMA, CEMA, EEMAC, as well as importers/distributors, like Sony and Hitachi, and national retailers, like Eatons and Simpsons-Sears. A seed was sown, however, something had to be done to bring ALL of the Canadian Electronic and Appliance Service Industry into one association.

"It took two years for the seed to develop and the result is the Canadian Electronic & Appliance Service Association, incorporated under federal law. An entity at last! A voice for Service in the marketplace!

"But why CEASA? The Aims and Objectives tell it all! The "Code of Ethics" puts it all in order! AND NOW THE WORK BEGINS. Putting together a National Association representing 'consumer oriented' service organizations, from British Columbia to Newfoundland, all dedicated to one overall objective — consumer satisfaction. Working together, great things can happen and when consumer acceptance and trust has been built up, the consumer will, rightly, look upon service as an 'assurance of value' and 'peace of mind' in the Canadian marketplace. That's a good part of what CEASA is all about."

AFFILIATIONS

Since its formation a number of provincial associations have affiliated themselves with CEASA, and again I would like to quote an excerpt from the second edition of Service Contacts:

"PROVINCIAL SERVICE ASSOCIATIONS ARE ON THE MOVE: The past history of electronic/appliance service in Canada has been one with little organization or association. Over the last five years, however, service technicians and businesses have gathered together in several provinces across this fair land to form associations or guilds. CEASA proudly counts three Provincial Associations as members, is assisting in the formation of three more and is talking about affiliation with two others. Readers interested in membership should contact the association in their province as listed

***Appliance Service Association of B.C.,**
860 Kingsway, Vancouver, B.C. V5V 3C3
Mr. D.W. Loughran, Secretary.

***Electronic Guild of B.C.,**
735 Sixth Street, New Westminster, B.C.
V3L 3C6
Mr. George Quan, President.

***Professional Electronic Guild of Alberta,**
P.O. Box 784, Stony Plain, Alta.
Mr. R.A. Hopkins, President.

***Manitoba Electronics Service Association,**
297 St. Mary's Road, St. Boniface, Man.
Mr. M. Wrublowshy, President.

New Brunswick Electronic Technicians Association,
247 Dundonald St., Fredericton, N.B.
Mr. Glen Smith, President.

***CEASA Provincial Members**

"Taking an active part in a Provincial Service Association is a good investment in many ways. It gives you the opportunity to meet others interested in the same business, share the same concerns and experiences, exchange ideas and come up with solutions to everyday situations. The membership fee to belong to a Provincial Service Association is not only tax deductible but also yields much richer returns in knowledge, experience and future planning.

"Make a point to invest in your future by becoming a member of your Provincial Association."

On March 8th in Toronto CEASA, at their Annual Meeting, elected a new Board of Directors for the 1979-80 term, who in their turn appointed the following Executive Committee to conduct the business affairs of the Association: Chairman and Chief Executive Officer — N.A. Stewart, Inglis Ltd.; President — A.G. Brooks, T. Eaton Co. Ltd.; Vice-President — Retailers — K.R. Allen, Simpson-Sears Ltd.; Vice-President — Electronic Manufacturers — J. Leitmann, Sony of Canada Ltd.; Vice-President — Appliance Manufacturers — D. Good, Canadian Admiral Corp. Ltd.; Vice-President — Finance — W.C. Bradbury, GSW Home Service; Vice-President — Provincial Membership — R.A. Hopkins, Professional Electronics Guild of Alberta;

Heartiest congratulations to this most imposing Board of Directors.

(Permission to reprint any part of, facts or figures, from Service Contacts, CEASA's official quarterly publication, has been granted by Mr. W. A. White.)

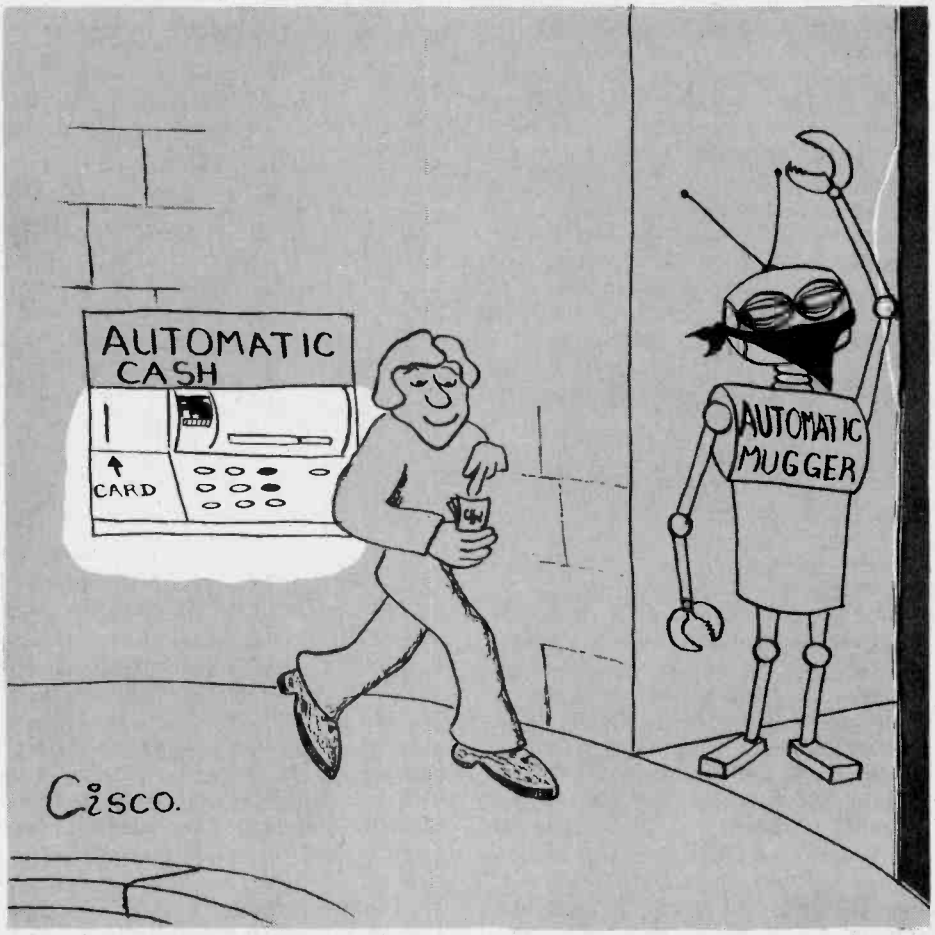
My discussions with the General Manager of CEASA left me with a feeling that this Association should quickly attain its objective, as previously stated, of coast-to-coast representation through affiliated provincial associations. They have a lot on the ball!

Inquiries re CEASA should be direct to: Mr. W.A. White, Canadian Electronic & Appliance Service Association, Suite 804 - 45 Wynford Heights Cres., Don Mills, Ont. M3C 1L3

Thanks, CEASA! For the first time I feel I now have a source of service news which is not just provincial in scope but is nation-wide.

All the best.

Richard H. Cartwright.



QRM QRM QRM

Bill Johnson, VE3APZ, talks about what wasn't done about split-splits, and himself, amongst other interesting (to him at least!) topics.

SPRING IS SPRUNG, the grass is riz, I wonder where the birdies is? It's a pity that you won't be reading this until the summer, but I just had to get it out of my system. Now is the time for antenna work, hamfests, hamfests, club picnics, mobile rallies, and public service events, and another round of hamfests for good measure. Still, we hams don't need events like these to get to know each other — we have the privilege of using the ether waves to accomplish this. Which has led me to discover one thing... I am almost unknown west of Thunder Bay. Since I don't stand around the magazine racks in Stores autographing copies of ETI west of Mississauga, and I don't get on the Transcanada net, the above fact is not surprising. Naturally, everybody in Toronto has heard of me. I have moved around so much that I have lived near and been a member of every Metro Toronto area radio club of note for at least one year. Since I haven't been on the short wave bands for almost a demi-decade most of the people I talk to have been on six, two, and 450 MHz. So I'm not surprised that the only fan mail I get is from Ontario. The opinions I express are those of an Easterner. That's not the way I want it, because ETI is a Canadian magazine and is read all across Canada. While I try to speak for the amateurs of Canada it is very difficult for me to voice the opinions of those out west if they don't let me know what they are. To help you all out there build a mental picture of me, I've decided to give a brief description of myself. I've been licensed since 1969, hold all three Canadian Certificates, but don't use the privileges afforded me by at least two of them. For the last five years my amateur activity has been all VHF/UHF, and has focussed around repeaters owned by the Toronto FM Society, of which I have been a Director for five years. I have somehow managed to get into microcomputers, which is somewhat like taking your job home, since I work as a Computer Technician. (amongst other things).

That's enough about me. Please vote for me in the next election etc etc. Now that you realise that I'm an FM, nob maybe you'll understand why I write about VHF and repeaters a lot. It used to be people on FM were regarded as a bit 'funny'. As we put up more and more repeaters, and more and more people flocked to use them, it became an accepted thing. Now everybody has a 2 metre rig — at least in their car. Again we are faced with another example of lack of communication in this country of ours. In the beginning, we had repeater channels every 60 kHz from 146.1 to 146.46. We then put extra channels half-way in between them and added inverted 30 kHz channels above 147 MHz. As crowding grew and the equipment became good enough to accept it, natural evolution said we should split the 30 kHz channels into two and go to 15 kHz "split-split" channels. To confuse matters more, these 15 kHz channels were "inverted" meaning that, for instance on a frequency below 147 MHz you would transmit high and receive 600 kHz lower instead of the low transmit — high receive orientation of the rest of below-147- land. These channels became known as the "inverted split-splits" or "tertiary" channels. Well, strangely enough, despite planning, these new 15 kHz channels were found to be too close for comfort in high density areas. A repeater operating at too wide a deviation would open the squelch of another repeater whose input was only 15 kHz away from the former's output. The system was designed for ideal conditions.

I heard a voice crying in the wilderness, but nobody listened. The voice was saying "Stop — before it is too late — go to channels every 20 kHz instead of 15 — this will reduce intermod, remove the need for inverted channels, and make modification of existing synthesizers unnecessary. (Many models need an extra switch to go on a 15 kHz boundary). This voice came from Vancouver. It went unheard in the East. 15 kHz split-splits were "in". Motion carried unanimously. Some communicators we are!

LESSON OF THE MONTH

Q. "I want to put a 110 foot self supporting tower in my garden, with a 5 element beam for 10-15-20 metres, stacked 15-element yogi's for 450, and a J—Beam for two. My local township won't give me planning permission. What can I do?

A. First of all, to to your local library. Get a copy of the Office Consolidation of the Radio Act, and the Radio Regulations parts 1 & 2. In the back you will find engineering data on the construction of antennas. If your proposed antenna meets these requirements, then there is not a law on the books in any province or municipality in Canada that can prevent you putting up that antenna. If it doesn't then the proposed antenna is classified as a "dangerous thing" and the local municipality or city, if appointed by the Federal government, can prevent its construction or demand its repair to the standards.

This is due to a uniquely Canadian legal loophole known as "Federal Jurisdiction", which works like this; in a field where there is a Federal law applying, which is also proven to be

a matter of Federal jurisdiction by precedent then no authority in Canada can pass a valid law which limits the Federal law. Since there is a Federal law on antennas, and radiocommunications is Federal jurisdiction, then you are safe in putting up your antenna, provided that it complies with the Federal law. (which doesn't mention anything about zoning or planning by-laws).

QRM LETTERS

Either nobody wrote to us, or the postie is still away sick with the hernia that he got delivering last month's letters. Either way, we got not mail, so I'll have to rely on word of mouth.

Again, since you guys out West have little chance to talk to me on 2mFM, you'd better write to get your fair share

The thing that people mention most is their support for my views on the RSO repeater issue. It seems that all those who have criticized them misunderstood my views, so here they are in simple-to-understand one-liners:—

1) Southern Ontario does not need another 2 metre repeater, especially a wide-area one.

2) Morse code practise is fine, but let's not spoon-feed students. If they can't put up a decent antenna to receive W1AW or, perhaps VE3RSO on 80 metres, then they won't survive long as amateurs.

3) If the RSO is going to do any linking between repeaters, it has to be on 220 MHz or above. That was what we told the D.O.C. in 1971 and that is what they made their official policy. If the RSO violates the spirit of the law then it will become the letter of the law. That's all I have to say on the matter. 73 till next month.

It is with deep regret that we record the passing of Don Green VE3HDV on April 15th, at the age of 39.

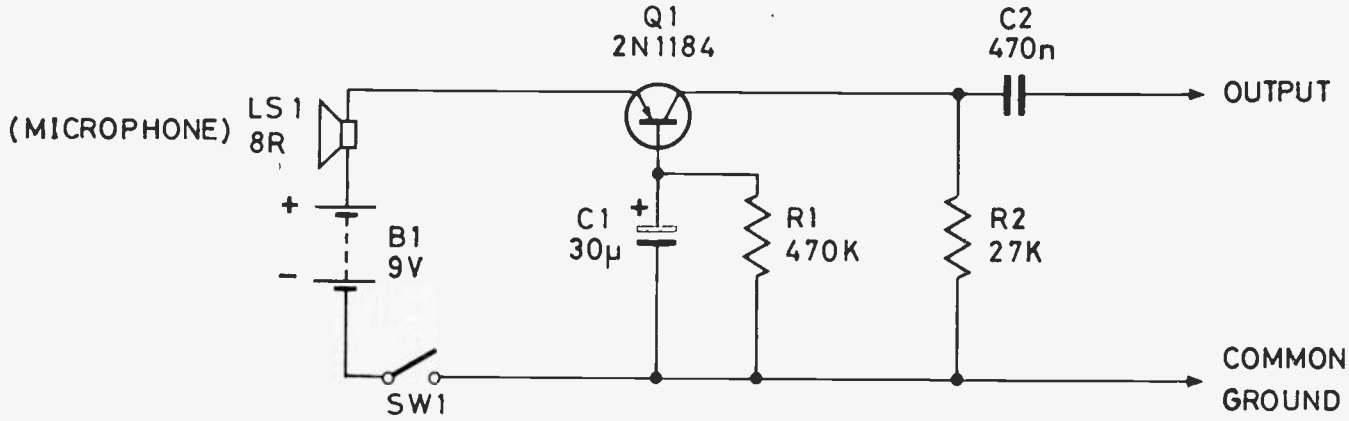
In 1966 Don was involved in a crippling auto accident,and despite operations and continuous care, he became extensively paralized. He became an amateur in 1972, although at times it was difficult for him to use the radio. Amateurs who knew him only on the air would never have guessed this, since he was very willing to help out by making a phone call or relaying a message to another ham.

He was formerly a member of the Scarborough Amateur Radio Club, and, more recenyly, of the South Pickering Amateur Radio Club. His membership in the Toronto FM Society never lapsed, neither did his participation in the public service events such as the Canadian Winter Car Rally. As well as maintaining a full HF & VHF schedule from his hospital bed, he spent countless hours phoning blood donors for the Red Cross. This tremendous attitude towards his fellow man is exemplified by one of his last wishes — that his equiptment be available for loan to any needy amateur. Anybody knowing of a deserving candidate should contact: Brent Davis, VE3EJW, Cherrywood, Ontario,LOH 1C0.

Don will be sadly missed by all his friends on the air, especially on VE3RPT and VE3OSH repeaters, ONTARS and the ROAD RUNNERS nets. A memorial net held on VE3 OSH on Wednesday April 18th received well over sixty check-ins.

Tech Tips

Tech Tips is an ideas forum and is not aimed at the beginner. ETI is prepared to consider circuits or ideas submitted by readers for this page. All items used will be paid for. Drawings should be as clear as possible, and the text should preferably be typed. Circuits must not be subject to copyright. Items for consideration should be sent to ETI Tech Tips, Unit 6, 25 Overlea Blvd., Toronto, Ontario, M4H 1B1



Microphone Speaker

J. Smith

What do you do if you need a microphone in a hurry — the shops are closed and your friends are on holiday? Or you are just a little short of money? The answer is to build the following circuit from your odds and ends box. This circuit uses a small speaker as a microphone, one transistor and only four other parts, draws only about 2 mA of current from a 9 volt battery so an on/off switch is not really necessary.

The transistor shown is 2N1184 and is a PNP germanium medium power type but is not critical — try the ones you have first before buying this new type. The components too are not critical and the prototype was found to work OK with 20% variation in values. The output is high impedance and is fed into the mic input of a tape recorder or pick-up input of an amplifier.

Speed Alarm

D. Ian

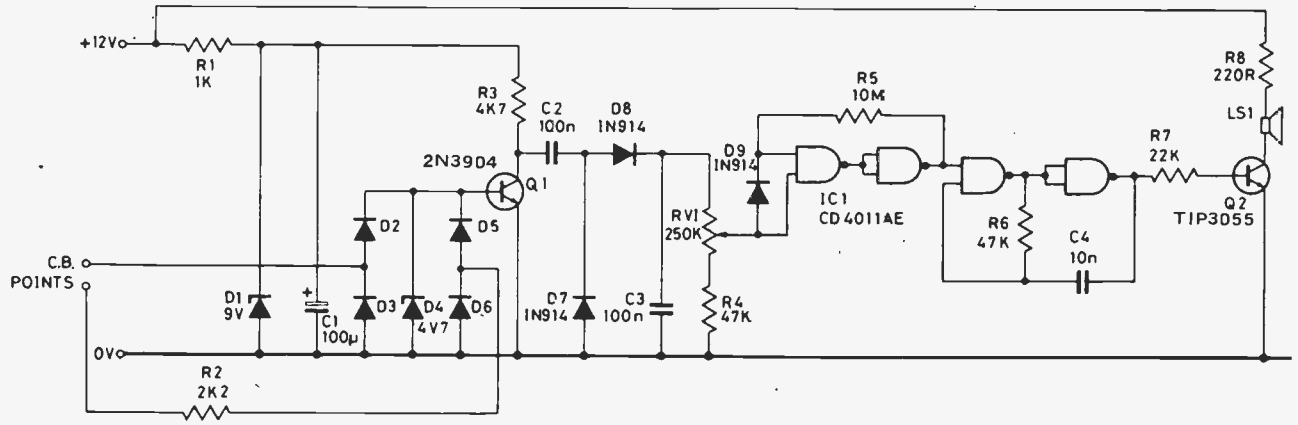
It is all too easy, during a long journey on a motorway, to allow one's speed to gradually creep beyond that point which the boys in blue take an unwelcome interest; this alarm gives an audible nudge whenever you drift over a pre-set speed.

Pulses from the distributor points (due to the ignition coil up to 400V may be developed as the points open) are passed through a current limiting resistor, rectified and clipped at 4V7. Via Q1 and the diode pump a DC voltage, which is proportional to engine revs, is presented to RV1; the sharp transfer characteristic of a CMOS gate, assisted by feedback, is used to enable the oscillator formed by the remaining half of the 4011.

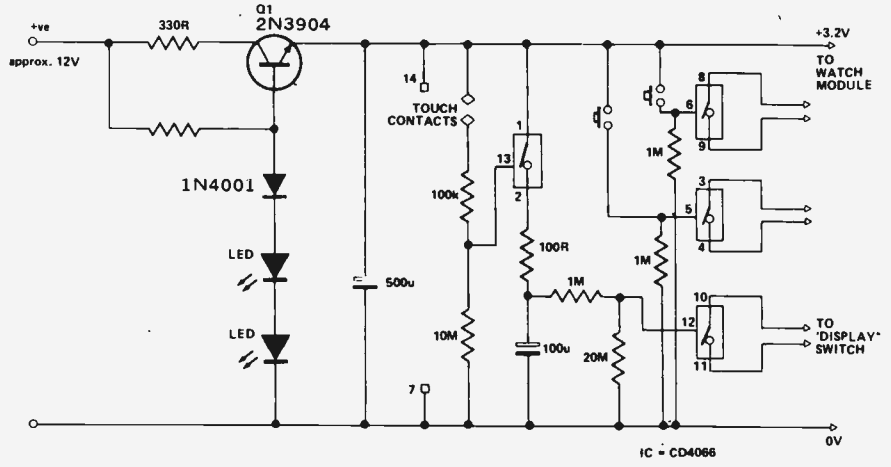
At the pre-set 'speed' (revs) a non-ignorable tone emits from the speaker, and disappears as soon as the speed drops by three or four mph.

Calibration of Ca may be conducted with an accurate pulse generator remembering that, for a four stroke engine, frequency = revs per minute times the number of cylinders divided by 120; for a car with a specification of 17½ MPH per 1000 revs, in top gear, f=133Hz at 70 MPH, 124Hz at 65 MPH (4000 RPM and 3714 RPM). The necessary frequency should be fed to Q1 and VR1 set so that the alarm is *just* off. Reliable switching occurs on the prototypes with a change of only 5Hz (150 RPM), ie less than 3 MPH for the above example.

Direct calibration 'on the road', while covering discrepancies due to tyre size, etc, will only be as good as the speedometer and obviously should be carried out by a passenger rather than the driver.



Tech Tips



Micro-Digi Car Clock

D. Ian

With the availability of economical LCD wristwatches has come a surplus of very cheap LED types which, with a little ingenuity, are eminently suitable for a permanent display installation; one obvious use is a cheap digital car clock.

The majority of these timepieces use two silver oxide cells in series to give 3.2 volts; current consumption, with the display on, is rarely more than 30 mA, easily provided by a simple stabiliser circuit.

Remove the back of the watch-case and discard the cells; the contacts of one cell holder are shorted together and the 3V2 supply soldered, noting polarity, to the two remaining contacts: with the 'display on' switch shorted out the result is a highly accurate mini-clock with negligable current drain as long as the vehicle is in regular use; even 35 mA will eventually flatten a car battery that receives no charge. Most simple LED watches have a brass tag, bearing on the metal case, as a common terminal to the various controls, these generally being spring loaded pins pressed, as required, into contact with clips on the perimeter of the module. These connections can be extended to panel mounting push switches, allowing the unit to be housed in a suitable box.

If the car is used infrequently it is prudent to arrange for the display to automatically extinguish at the end of a fixed amount of time; this also implies the simplest possible 'on' switch to minimise loss of attention when driving. One half of a CD4066 quad bilateral switch is connected as a touch-operated monostable and wired, as shown, across the LED display switch: C and R may be selected for a shorter or longer time period, those specified will enable the display for about 15 minutes. The remaining two sections of the 4066 are used to control the other functions, set time, etc., of the watch module.

Note that, in the stabiliser section, LED's are deliberately used to provide the reference voltage at the base of T1 since they 'zener' at appreciably smaller currents than a normal zener diode; total current of the stabiliser and clock (display off) is about 2 mA — the smallest car battery should be able to supply this for about a year!

Jana Quality Kits

LJ 12016A
Project #23

Color Organ

The Jana Color Organ is an ideal project for the experimenter who is a musician or a serious audiophile. This project is a three channel color organ with a capacity of 200 watts per channel.* It comes complete with the PC board and instructions and its high power capability makes it ideal for all kinds of lighting effects, either with spotlights or back-lit lucite panels.

Remember, Jana projects come complete with electronic components of the exact value, so there's no need to substitute or hunt for specific capacitors, transistors or IC's.

Pick up a Jana Color Organ kit at your nearest Jana dealer today and while you're there, check out the other Jana Quality Kits.

1. Automatic Headlight Reminder
2. Battery Operated Fluorescent Light Kit
3. Bug Shoo
4. Code Oscillator
5. Crystal Radio
7. Curiosity Box II
8. Dally Lighter
9. Decision Maker
10. Fish Caller
11. Hi Power 12V DC Flasher
12. Photo Electric Night Light
13. 6V Power Supply
14. 9V Power Supply
15. 0-24V Power Supply
16. Single Channel Color Organ
17. Electronic Siren
18. Shimmer Strobe Light
19. Tone Generator
20. 5 Transistor 1 Watt Amplifier
21. Tube Continuity Checker
22. Xenon Strobe
23. LJ 12016A Color Organ
24. Loudmouth Siren
25. Roulette Wheel
26. Electronic Skeet Game
27. Electronic Dice
28. Super Roulette
29. FM Mini Broadcaster

***Optional circuit to increase wattage capability to 1,000 watts per channel is shown in the instructions.**

Available from

CAM GARD SUPPLY LTD.

Distributors of all Jana kits, plus parts and components for most Electronics Today projects. Come in or mail your order. Offices across Canada.

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REGINA
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306-525-1317

SASKATOON
1501 Ontario Avenue
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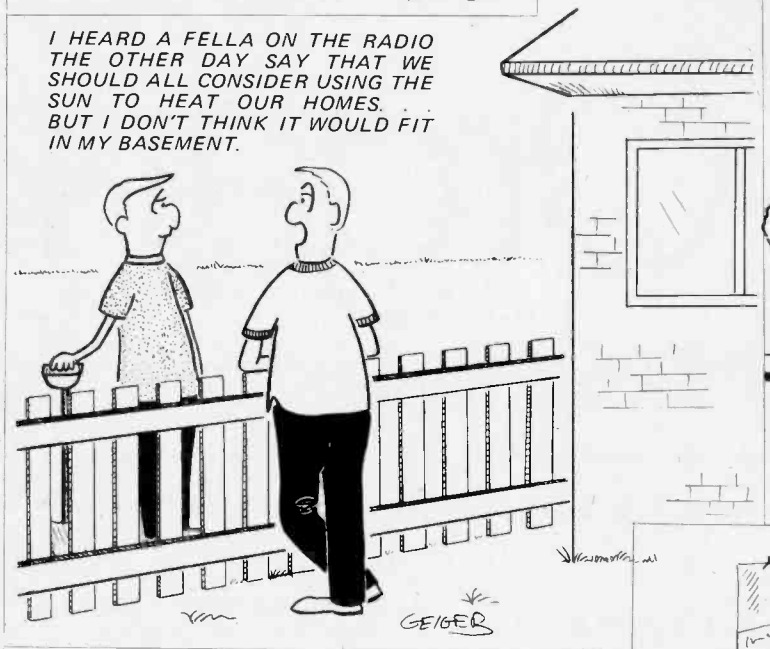
FREDERICTON
Rookwood Avenue
506-455-8891

MONCTON
15 Mount Royal Blvd.
506-855-2200

HALIFAX, N.S.
3065 Robie Street
902-454-8581

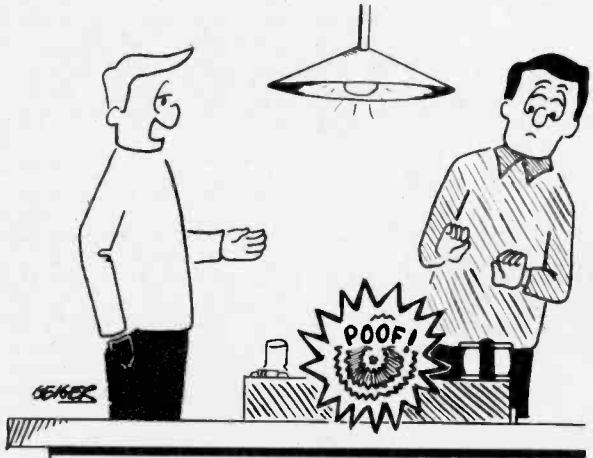
The Fun of Electronics

I'M AFRAID, SIR, THAT THE ONLY AUDIO COMPRESSOR WE HAVE FOR UNDER THIRTY DOLLARS IS BRUNO HERE.



I HEARD A FELLA ON THE RADIO THE OTHER DAY SAY THAT WE SHOULD ALL CONSIDER USING THE SUN TO HEAT OUR HOMES. . . BUT I DON'T THINK IT WOULD FIT IN MY BASEMENT.

THIS MORNING MY WIFE ASKED ME WHAT I WAS BUILDING, I TOLD HER I WAS WORKING ON A MULTI-VIBRATOR CIRCUIT – SHE TH–OUGHT I WAS BEING KINKY.



DON'T LOOK UPON THIS AS A FAILURE IN CIRCUIT DESIGN, JOE, LOOK AT IT AS THE DISCOVERY OF THE WORLD'S FIRST LIGHT EMITTING TRANSISTOR!

Y'KNOW, I'VE GOT OVER $5000 WORTH OF CB, HAM, AND SHORT-WAVE EQUIPMENT HERE, AND I'M NOT REALLY THAT INTERESTED IN ELECTRONICS OR COMMUNICATIONS – IT'S JUST THAT WITH A WIFE AND TWO DAUGHTERS, I DON'T STAND A CHANCE OF GETTING NEAR THE TELEPHONE.

You can write for Eti

75 cents per word

ETI's new classified advertising section allows you to reach 30,000 readers nation-wide. For as little as $15 (there's a 20 word minimum) you can promote your business from coast to coast.

WHAT DO YOU DO?

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We typeset your words (and put the first word and your company name in bold capital letters).

If we get your message by the 14th of the month, it will appear in ETI 1½ months later. For example, if we receive it by November 14th, you (and thousands more) will see it in the January issue

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AP SUPERSTRIP SS-2 Solderless breadboards. 6½ by 2⅛ inches. Immediate delivery. $20.95 postpaid. **WOLVERTON ENTERPRISES,** Dept ETI, 5 South Hythe, Burnaby, BC, V5B 3H6.

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BE off to a good start with your projects use our P.C. Boards. ETI No, Price: No 812, $4.90 • No 490, $4.60 • No 592, $13.90 • No 591C, $2.25 • No 550, $3.55 • No 062, $3.00 • No 243,$2.45 • No 135, $4.00 • No 593, $6.90 • No 133, $5.10 **Write for full list to:—B&R ELECTRONICS,** Box 6326F, Hamilton, Ontario,L9C 6L9.

NORTHERN BEAR ELECTRONICS Box 7260, Saskatoon, SK S7K 4J2. June **ETI** Kits; Colour Sequencer (parts & PCB) $45.00. (& power supply) $65.00. Digital Temp. Meter (lettered case,PCB, all parts) $115.00. ICL7106EV $74.95. STAC Timer IC $17.95. Add $1.00 P/H. Sask. add tax. Free Flyer.

ETI Project File

Updates, news, information, ETI gives you project support

PROJECT FILE is our department dealing with information regarding ETI Projects. Each month we will publish the Project Chart, any Project Notes which arise, general Project Constructor's Information, and some Reader's Letters and Questions relating to projects.

PROJECT NOTES

Since this magazine is largely put together by humans, the occasional error manages to slip by us into print. In addition variations in component characteristics and availability occur, and many readers write to us about their experiences in building our projects. This gives us information which could be helpful to other readers. Such information will be published in Project File under Project Notes. (Prior to May 78 it was to be found at the end of News Digest.)

Should you find that there are notes you wish to read for which you do not have the issue, you may obtain them in one of two ways. You can buy the back issue from us (refer to Project Chart for date of issue and see also Reader Service Information on ordering). Alternatively you may obtain a photocopy of the note free of charge, so long as your request includes a self addressed stamped envelope for us to mail it back to you. Requests without SASE will not be answered.

PROJECT CONSTRUCTOR'S INFORMATION

Useful information on the terminology and notation will be published each month in Project File.

PROJECT CHART

This chart is an index to all information available relating to each project we have published in the preceding year. It guides you to where you will find the article itself, and keeps you informed on any notes that come up on a particular project you are interested in. It also gives you an idea of the importance of the notes, in case you do not have the issue refered to on hand.

Every few months we print a pull out section in the magazine which may be used as a photographic negative for making printed circuit boards (as described in our January 78 issue). Each edition of this sheet contains projects from the preceding few issues. Information on where to find which negative is included in the chart.

Write to: Project File
Electronics Today International
Unit 6, 25 Overlea Blvd.,
TORONTO, Ontario
M4H 1B1

Component Notations and Units

We normally specify components using an international standard. Many readers will be unfamiliar with this but it's simple, less likely to lead to error and will be widely used sooner or later. ETI has opted for sooner!

ISSUE DATE	ARTICLE
Mar 78	Hammer Throw
June 78	Neg.
Feb 79	Note:C,D
Mar 78	True RMS Meter
Apr 78	Neg.
Jan 79	Note:N
Feb 79	Note:N
Mar 78	Home Burglar Alarm
Apr 78	Computer PSU & Neg.
Apr 78	Audio Delay Line & Neg.
Apr 78	Gas Alarm & Neg.
May 78	White Line Follower
June 78	Neg.
Apr 79	Note:C
May 78	Acoustic Feedback Eliminator
June 78	Neg.
May 78	Add-on FM Tuner
June 78	Neg.
June 78	Audio Analyser
June 78	Ultrasonic Switch & Neg.
June 78	Phone Bell Extender & Neg.
July 78	Proximity Switch
Aug 78	Neg.
July 78	Real Time Analyser MK II (LED)
Aug 78	Neg.
July 78	Acc. Beat Metronome.
Aug 78	Neg.
July 78	Race Track
Aug 78	Neg.
Aug 78	Sound Meter & Neg.
Dec 78	Note: N
Aug 78	Porch Light & Neg.
Aug 78	IB Metal Locater & Neg.
Aug 78	Two Chip Siren & Neg.
Sept 78	Audio Oscillator
Nov 78	Neg.
Sept 78	Shutter Timer
Nov 78	Neg.

ISSUE DATE	ARTICLE
Sept 78	Rain Alarm
Oct 78	CCD Phaser
Nov 78	Neg.
Oct 78	UFO Detector
Nov 78	Neg.
Oct 78	Strobe Idea
Apr 79	Note:N
Nov 78	Cap Meter &Neg.
Nov 78	Stars & Dots
Nov 78	CMOS Preamp & Neg.
Dec 78	Digital Anemometer
Feb 79	Neg
Mar 79	Note:C. D
Dec 78	Tape Noise Elim
Feb 79	Neg
Dec 78	EPROM Programmer
Feb 79	Neg
Jan 79	Log Exp Convert.
Feb 79	Neg
Jan 79	Digital Tach.
Feb 79	Neg
Jan 79	FM Transmitter
Feb 79	Neg
Feb 79	Phasemeter & Neg
Feb 79	SW Radio
Feb 79	Light Chaser & Neg
Mar 79	Tape-Slide Synch
Mar 79	Synth. Sequ.
Mar 79	Dual Dice
Apr 79	Solar Control
Apr 79	Audio Compressor
Apr 79	Wheel of Fortune
May 79	Light Controller
May 79	AM Tuner
May 79	VHF Ant.

ETI Project Chart

Canadian Projects Book

Audio Limiter
5W Stereo
Notes N, D May 79
Overled
Bass Enhancer
Modular Disco
G P Preamp
Bal. Mic. Preamp
Ceramic Cartridge Preamp
Mixer & PSU
VU Meter Circuit
Headphone Amp
50W-100W Amp
Note N May 79
Metal Locator
Heart-Rate Monitor
GSR Monitor
Phaser
Fuzz Box
Touch Organ
Mastermind
Double Dice
Reaction Tester
Sound-Light Flash
Burglar Alarm
Injector-Tracer
Digital Voltmeter

Key to Project Notes

C:- PCB or component layout
D:- Circuit diagram
N:- Parts Numbers, Specs
Neg:- Negative of PCB pattern printed
O:- Other
S:- Parts Supply
T:- Text
U:- Update, Improvement, Mods
***:- Notes for this project of complicated nature, write for details (enclose S.A.S.E., see text)

ETI Project File

CANADIAN PROJECTS BOOK

Firstly decimal points are dropped and substituted with the multiplier, thus 4.7uF is written 4u7. Capacitors also use the multiplier nano (one nanofarad is 1000pF). Thus 0.1uF is 100n, 5600pF is 5n6. Other examples are 5.6pF = 5p6, 0.5pF = 0p5.

Resistors are treated similarly: 1.8M ohms is 1M8, 56k ohms is 56k, 4.7k ohms is 4k7, 100 ohms is 100R, 5.6 ohms is 5R6.

Kits, PCBs, and Parts

We do not supply parts for our projects, these must be obtained from component suppliers. However, in order to make things easier we co-operate with various companies to enable them to promptly supply kits, printed circuit boards and unusual or hard-to-find parts. Prospective builders should consult the advertisements in ETI for suppliers for current and past projects.

Any company interested in participating in the supply of kits, pcbs or parts should write to us on their letterhead for complete information.

READER'S LETTERS AND QUESTIONS

We obviously cannot troubleshoot the individual reader's projects, by letter or in person, so if you have a query we can only answer it to the extent of clearing up ambiguities, and providing Project Notes where appropriate. If you desire a reply to your letter it must be accompanied by a self addressed stamped envelope.

PLEASE NOTE: WE CANNOT ANSWER PROJECT QUERIES BY TELEPHONE,

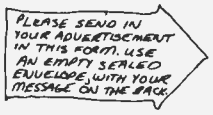
50/100 AMPLIFIER

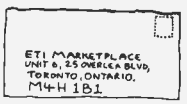
Repeating for those who missed it before: Q6 is incorrectly shown as a 2N4250, it can be replaced by a 2N3904.

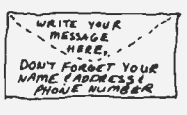
Some confusion has resulted over the driver transistors in this project. The types of transistors used in the prototype were the BD139 (Q4, Q8) and BD140 (Q5 and Q7), with alternates TIP29C and TIP30C. Although electrically equivalent, these latter types cannot be mounted with either face against the heatsink, as can the BD types. Naturally, it turns out that the face that can be mounted towards the heatsink (Q7, Q8) results in the leads being in the reverse order for the pcb.

Solution? Mount Q8 and Q9 as shown but use jumper wires to get the e and b connected to the right points, or cut neat holes in the pcb and mount them on the back side (leads will now be in order), or redo the pcb. Apology? Heh heh sorry about that!

By the way, DON'T FORGET TO USE INSULATORS FOR ALL HEATSINK MOUNTED TRANSISTORS!







MARKET PLACE

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Reader Service Information

Editorial Queries

Written queries can only be answered when accompanied by a self-addressed, stamped enveloped, and the reply can take up to three weeks. These must relate to recent articles and not involve ETI staff in any research. Mark your letter ETI Query.

Projects, Components, Notation

For information on these subjects please see our Project File section.

Sell ETI

ETI is available for resale by component stores. We can offer a good discount and quite a big bonus, the chances are customers buying the magazine will come back to you to buy their components. Readers having trouble getting their copy of ETI could suggest to their component store manager that he should stock the magazine.

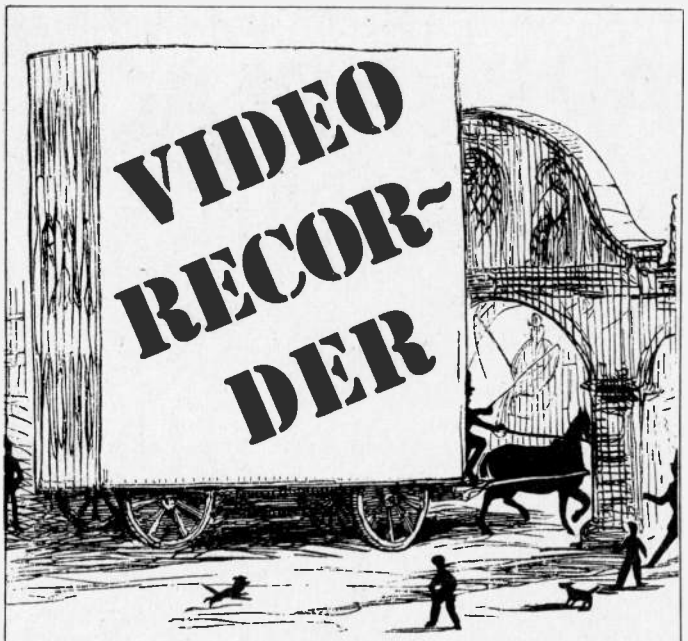
Back Issues and Photocopies

Previous issues of ETI-Canada are available direct from our office for $2.00 each. Please specify issue by the month, not by the features you require. The following back issues are still available for sale.

1977	1978	1979
February	~~January~~	January
May	February	February
June	March	March
July	April	April
September	May	May
November	June	June
	July	
	August	
	September	
	October	
	November	
	December	

LOOK! We found some more!

We can supply photocopies of any article published in ETI-Canada, for which the charge is $1.00 per article, regardless of length. Please specify issue and article. (A special consideration applies to errata for projects, see Project File.)



The new video cassette recorders are a bit smaller than those available in 1870, in fact they are quite compact. It also seems that the "standards" battle is about over, with only two systems left. SO, now manufacturers can get down to serious business, and buyers can be confident that the machine they purchase is not going to be an orphan. Next month we survey the available machines, Steve Rimmer tells the story. Plus: A sophisticated timer (based on the STAC), and a light activated tacho project. And of course much more. Stav tuned!

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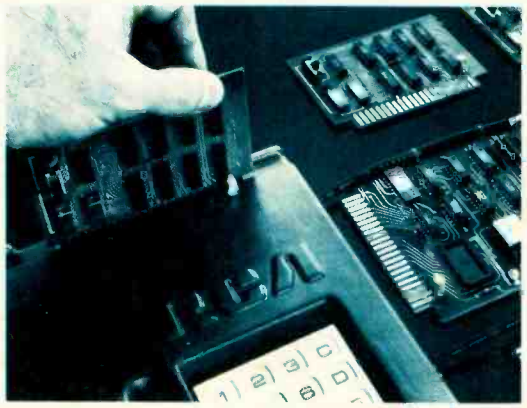

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