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ELECTRONICS TODAY INTERNATIONAL

BUMPER Circuit Source Guide

TANDY'S TRS 80 COLOUR COMPUTER RELEASED

YAMAHA "X-POWER" B6 AMPLIFIER First Review

Build our SOUND BENDER for special voice-music effects

'Space Invaders' for our '660 Computer

ZX81 Reviewed

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Roger Harrison
Editor

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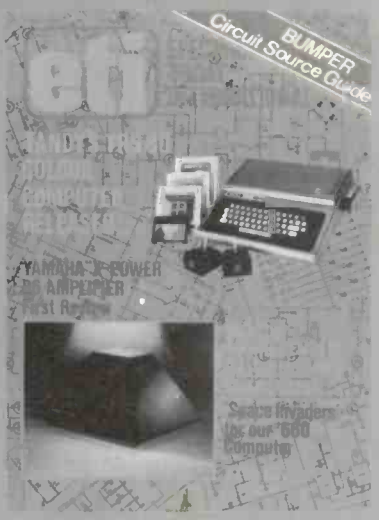


This month's feature, Circuit Source Guide, provides an interesting montage backdrop to our 'preview' story of Tandy's Colour/Color Computer and our Review of Yamaha's B6 'X-Power' amplifier. Background colour is real silver!

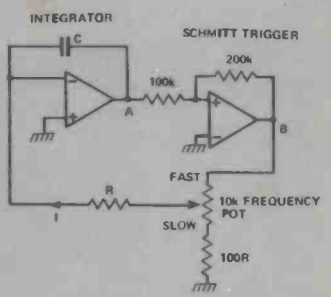
Cover design by Ali White.

*Recommended retail price only

features

CIRCUIT SOURCE GUIDE 16

An abundance of circuits giving a useful source from which you can derive other circuits or assemble a circuit from a variety of 'blocks' to suit a particular application. You may have seen some of them before, but there are bound to be some that are new to you.



projects

492: SOUND BENDER 37

Based on a remarkably versatile function generator IC, the XR2206, this project is capable of modifying an audio signal to produce tremolo effects on music or those peculiar, metallic robot voices so abundantly found in shows like 'Star Wars', 'Star Trek', 'Dr Who', etc.

723: SELECTACALL ADD-ON FOR HAM/CB TRANSCEIVERS 44

If you're listening on a channel for some particular station to call, but don't want to listen to the background chatter, then this simple accessory holds the mute shut until that 'certain party' calls — no tones or funny noises required.

news

NEWS DIGEST 8

Are there ten planets?; Fibre optics experiment in rural Canada; Newcastle Tech electronics courses; Batteries for toys and games; etc.

COMMUNICATIONS NEWS 65

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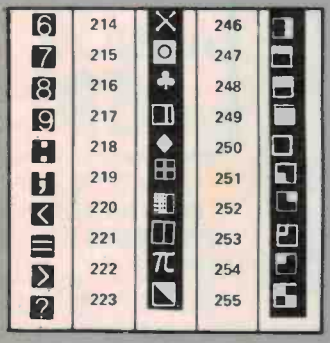
For Sorcerer apprentices; IBM wins West German videotext order; National software survey; Interfacing the PC-1211 to another computer; and lots more.

SIGHT & SOUND NEWS 119

The All-Japan Audio Show; Video industry group formed; TV wristwatch not far away?; New range of Marantz gold cassette decks; Double cassette deck from Sharp; and much more.

computing



sight & sound

general

next month

TRS-80 COLOR COMPUTER REVIEW

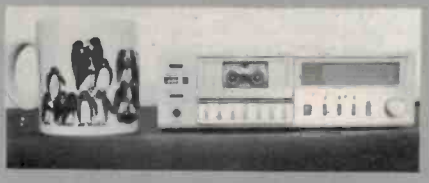
Latest on the colour computer bandwagon (behind Apple, TI, Acorn, Atari, Commodore . . .) is Tandy's new games/home computer featuring colour BASIC, graphics, games and applications software to hand and . . . well, read all about it. In conjunction with the review, we also have an interesting article on software.

THE JUNCTION FET

All about the haunts and habits of this useful semiconductor plus applications circuitry and practical notes on using them.

REVIEW OF SANYO'S RD-XM1 MICROCASSETTE

Scoop review of what might — or might not! — be the 'coming thing' in cassette recorders. Louis Challis takes a close look at the machine and the implications of its release.



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PROGRAMMING THE '660 IN COLOUR

Learning a few tricks and traps in CHIP 8 programming? Here's how to extend your programming of the '660 Learner's Microcomputer to include colour operation.

Although these articles are in an advanced state of preparation, circumstances may affect the final content. However, we will make every attempt to include all features mentioned here.

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NEWS digest

Come in, Planet X

Brace your tripods: the solar system may have ten planets, not nine.

No one has actually seen this new planet, nor are astronomers certain it exists, but recent computer studies and planetary observations by the US Naval Observatory have sparked renewed interest in the theory that yet another celestial object — too faint to be seen with the naked eye — is circling the sun.

So far the observatory's 'search' has been conducted largely with an IBM 4341 processor, a computer which is routinely fed a rich diet of astronomical data to plot past, present and future locations of the planets for navigational and other uses.

Soon the observatory plans to expand its efforts from the computer room to the night sky to track down this mysterious orb, explains Kenneth Seidelmann, director of the observatory's Nautical Almanac Office.

If astronomers should find something, it would mark the first discovery of a major planet since Clyde Tombaugh of the Lowell Observatory discovered Pluto in 1930.

The big question is: where to look? The observatory feels a detailed survey of the entire sky would be too time consuming and expensive, but identifying a target zone is easier said than done. Even if the object does exist, it could be anything from a massive planet far beyond distant Pluto to a 'minor planet' sandwiched between the orbits of Pluto and Neptune.

The only way to fix a search target area is to make some educated guesses. So the computer was asked to assume that the object lay beyond Pluto, that its orbit was tilted from the plane of most other planets, and that its path around the sun was very elliptical.

The IBM 4341 absorbed these assumptions, matched them against a crushing weight of astronomical data, and gave the scientists a list of possible places to start looking.

Scientists invoked the tenth planet to account for the curious wanderings of outer planets, such as Uranus and Neptune, from their predicted orbital paths. Pluto, the most distant known planet, was originally believed to be the culprit, but calculations based on recent observations of Pluto and its moon indicate that the tiny planet is simply too 'light' to have much of an impact on Uranus and Neptune.

Seidelmann is careful to point out that it is still possible the strange behaviour of the outer planets has nothing to do with a tenth planet — telescopes may have failed to pinpoint their locations with sufficient accuracy, for instance. But if he were a gambler, he says, "I would bet there is probably something out there."

Kenneth Seidelmann, director of the US Naval Observatory's Nautical Almanac Office, examines a chart showing differences between computer-predicted positions and the actual observations of Uranus, one of the solar system's outer planets.

IBM Quarterly, Sept.'81

Remote meter reading

Britain's Department of Industry is supporting research into using the public electricity mains supply as a two-way information carrier for meter reading and energy management in the home. The project, known as 'Mainsborne Signalling System', will be carried out by Thorn-EMI in conjunction with the Electricity Council, the British Gas Corporation and the National Water Council.

The potential benefits of such a signalling system include the remote reading of meters, the better control of energy, the detection of gas and water leaks, detection of fraud and vandalism of equipment, together with more detailed account information for customers.

Following the initial research, field trials will be carried out in about 1000 homes in the London and Milton Keynes areas involving the electricity, gas and water undertakings and the housing associations. Installations of the equipment into homes will commence early in 1982 and the trial itself will commence in the northern autumn of 1982.

During the trial period, the new system will not replace the reading of electricity or gas meters. They will continue to be read in the normal way by visiting meter readers for billing purposes.

Somewhat similar systems to this 'Mainsborne' system are being developed by the public and private sections of British Industry, but are based on the telephone network, long wave radio or cable vision systems to convey the information.

Discussions are taking place on the requirements of a compatible system so that UK Industry can take advantage of the considerable export opportunities.

Brian Dance

Zephyr Products in Queensland

Macron Electronics Pty Ltd, trading as Zephyr Products, have opened an office in Queensland at 3291 Pacific Highway, Underwood Qld. 4119. (07)341-3619.

Mr. Danny Cousins has been appointed Northern Area Manager for the Company, which distributes RCF professional loudspeakers, horns and drivers, Perreaux power MOSFET amplifiers, Primo microphones, Zephyr microphone stands, accessories, cables, components, Telecom-approved line isolation units, PAs, hazardous voltage opto-isolator units, L.M. Ericsson and Dyne Telecom-approved transformers, SECO night viewing devices and optical products, Elfa guitar amplifiers, Helpenstill electric pianos and music accessories.

The company also undertakes electronic assembly work of all types.

ERRATA

Project 685, 2650 S100 Computer; December '81. In the parts list, the power supply input bypass tantalum capacitors were erroneously specified as 6 V types. They should be 35 V types — these are capacitors C2, C4 and C5. Also capacitors C1 and C9 may be 6 V or 10 V tantalums, but capacitors C6 and C7 should be 15 V or 25 V types.

ETI-660 Learner's Micro, Nov. '81. In the circuit diagram on page 37 the data buss lines adjacent to pins 26 to 33 of IC5 are shown in reverse order; D0 goes to pin 26, D7 to pin 33. This reverses the data out signals from the 6821, but it's all taken care of, so do not worry, my little chickens. Note that, on page 39, the circuit shows the 1864 as IC3 when we all know damn well that it's actually IC4.

Specialised pcb tools

Scope Laboratories have a new range of specialised hand tools with a scissor-type cutting action, known as Scope Flushcutters and consisting of four flushcutting sidecutters and a set of long-nosed pliers.

The manufacturers claim that this new blade design produces benefits both for the OEM production engineer and the service technician:

- Fatigue reduction — wires are sheared not crush cut.
- Tool life is extended due to high-hardness blades (super-durable model due in November 1981).
- Safety offcut catcher — protects operator's eyes and avoids product damage from offcuts flying into equipment.
- Cuts superfine wires even at extreme blade tip.
- Gets into tight spots — e.g: can even cut single DIP pins in a pc board.
- Self-opening, allowing the user to concentrate on gripping.

For further information contact Bev Evans, Scope Laboratories, 3 Walton St, Airport West Vic. 3042. (03)338-1566.

Batteries for toys and games

A completely new range of dry batteries designed specifically for use in toys, models and games has been launched by the Vidor Batteries division of Crompton Parkinson Limited, a Hawker Siddeley company.

Called the Vidor 'T' range, the new batteries have been produced to provide optimum performance and power for the rapidly increasing variety of motorised toys, cable and remote-controlled models and electronic games now in common use. The batteries employ a specially-formulated zinc-carbon Leclanche system designed to maximise the power available for this type of application. All batteries in the 'T' range have a leak-resistant steel jacket.

Vidor provide a written guarantee offering to repair or replace any toy, model or game damaged by using a 'T' range battery defective in design, materials or workmanship, so confident are they of the quality of this range.

Vidor 'T' range batteries are available in the four most popular sizes for toys and games and comprise the T2, T11 and T7 round cell types and the PP3T type.

For further information contact Mark Whitfield, Hawker Siddeley Group Ltd, 32 Duke Street, St James's, London SW1Y 6DG, England.

Lighting controller for all effects

Alfa Lighting claim to have produced a 'light controller in a class of its own . . . ideally suited for virtually any application required for an effect'.

The controller is built for ruggedness, dependability and superb performance, and among its many features are:

- master dim control
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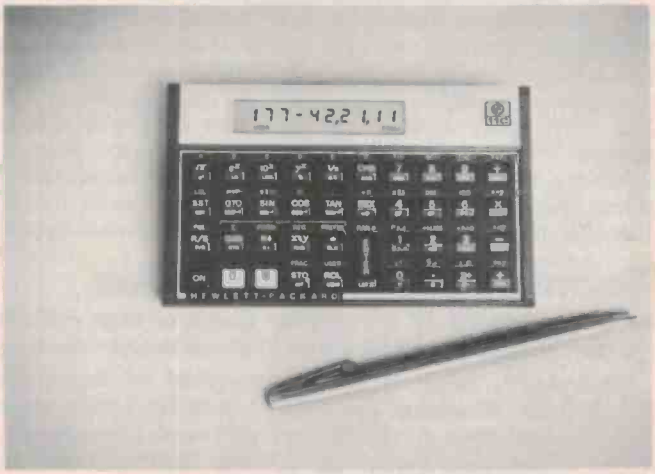
- sound to light
- sound synchronisation
- superimposing/mixing of all patterns
- 1000 watts per channel
- all outputs fused
- master fuse
- variable dimming rate
- infinite audio-in capacity
- and lots more!

The chaser controls strobes, snakelights, projectors, mirror-ball motors, dance floors, signs, displays, pinspots/hotspots, light screens, all resistive loads and all inductive loads. Options are available.

For further information contact Alfa Lighting Pty Ltd, 4 Weldon St, Burwood NSW 2134. (02)74-8905.



Slimline calculators for science and finance

Two new programmable calculators from Hewlett Packard, one scientific and one for financial and business problems, come in a 'slimline' design that fits in a shirt pocket.

Both feature liquid crystal display, continuous memory, a horizontal keyboard design and many built-in keyboard functions and programming tools.

The HP-11C scientific calculator features powerful programming tools and a full set of scientific functions, while the HP-12C financial calculator has a large number of built-in keyboard functions for solving time-value-of-money problems.

The HP-11C and HP-12C are also the first HP calculators to use easily available, disposable button-cell batteries, which cost under $2 each. Because the liquid crystal display and CMOS (complementary metal-oxide semiconductor) circuitry mean low power consumption, the calculators should run on one set of batteries for about one year.

Recommended tax-free price for the HP-11C is $160; tax inclusive would be $180.50. For the HP-12C the recommended prices are $178 tax-free, $201 tax included.

For more information contact Marcom Manager, Hewlett Packard Australia Pty Ltd, P.O. Box 36, Doncaster Vic. 3109.

Rural fibre optics experiment

Canada recently started a unique experiment in communications technology by installing a fibre optics system to deliver a full range of communications services to the farming communities of Elie and St. Eustache, Manitoba, some 50 kilometres west of Winnipeg.

The C$9 600 000 field trial will bring single-party digital telephone, cable TV, stereo FM radio and Telidon services to 150 households by means of hair-thin strands of glass called optical fibres. A rural setting was chosen for the project because telecommunications specialists believe fibre optics may provide the solution to the challenge of providing first-class communications over vast, sparsely populated rural areas.

Until now, many residents of the communities had only multi-party telephone services and received TV signals weakly by means of rooftop antennas. The fibre optics system will provide communications services comparable to those in urban environments, including nine TV channels and seven radio stations. Residents will test the fibre optics system for 1½ years.

The fibre optics system uses glass fibres in place of conventional copper cables, electronic signals being carried in the form of pulses of light. Sophisticated electronic equipment converts conventional electrical signals into light pulses at one end, then back into electrical signals at the other end.

The field trial will determine the feasibility of using fibre optics to deliver multiple communications services in rural or sparsely populated areas. One glass fibre has the capability of simultaneous voice, data and video transmission in volumes and over distances far in excess of copper-based counterparts.

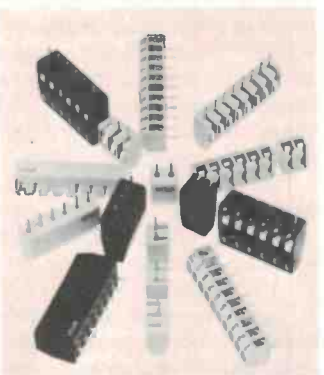
Terminal blocks from Utilux

New from Utilux is a complete range of high precision (screw) terminal blocks for printed circuit board mounting.

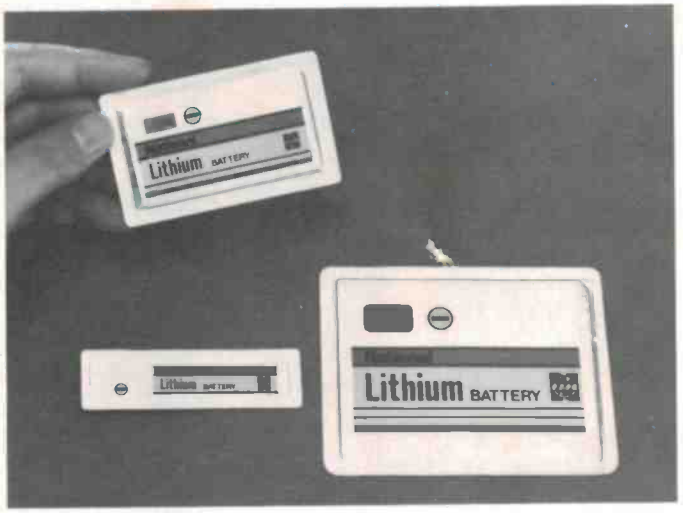
Designated series H1700, these terminal blocks are available in three basic styles with terminal spacings of 5 mm and 10 mm; phosphor bronze wire protector springs are also available in all assembly styles.

Whilst available circuit sizes differ in each assembly style, it is possible to obtain any circuit size required by 'butting' two terminal blocks end-on without variation in terminal spacing.

These terminal blocks are said to be inexpensive and versatile and to answer the need for fast, efficient termination of conductors to printed circuit boards.



For further details contact Utilux Pty Ltd, 14 Commercial Road, Kingsgrove NSW 2208. (02)50-0155; telex: 21516.



Paper-thin batteries for slimline electronics

Matsushita Battery Industrial Co Ltd have developed a paper-thin sheet-type lithium battery measuring only 1.3 mm thick, yet said to feature an energy density as much as ten times higher than that of manganese dry batteries.

The new battery uses lithium in its negative electrode and carbon monofluoride as the positive electrode. Nominal voltage is 3 V, double the voltage of ordinary batteries, and the temperature characteristics are said to provide high performance even at low temperatures. The energy density is claimed to be high enough to drive electric motors.

The paper-thin lithium battery comes in three sizes, and should find applications in LCD electronic calculators, digital watches, cameras, radios, compact tape recorders, pocket pagers, memory back-up systems and other miniature electronics products, particularly those which have to operate at low temperatures.

For further information contact Michelle Myers on (02)887-0144, Ext. 266.

Newcastle Tech courses

Newcastle Technical College will be offering several trades, post-trades and special courses in 1982.

The Electronics Trades course is of three years' duration and covers all aspects of analogue and digital techniques. Attendance may be either one day a week, two nights per week, or block release for country students (three days every third week).

Post-trades courses include Television Receiver Principles, Industrial Electronics, Semiconductor Electronics and Post-Trade Electronics. The College will also run special courses in Microprocessor Evaluation, Microprocessor Circuits and Applications, Film and Television Production for Education and Industry, Technical Principles of Two-way Radio, and a Two-way Radio Users' Course.

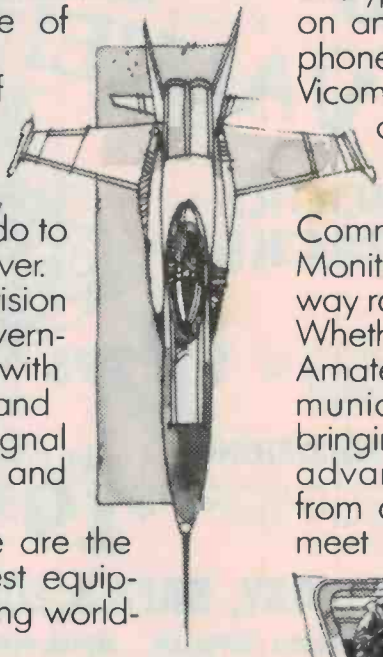
All enquiries should be directed to the Senior Head Teacher, School of Electronics, Newcastle Technical College, Maitland Rd, Tighes Hill NSW 2290. The College will be open for enquiries and enrolments from Monday, February 1 1982.

Hear and Now.

It may come as a surprise to some people to learn that Vicom are involved in more than Amateur Radio.

True, Vicom was founded by three of the best-known Amateur Radio operators in Australia.

But, like most good businessmen, they expanded their business to encompass the professional side of electronics and radio.



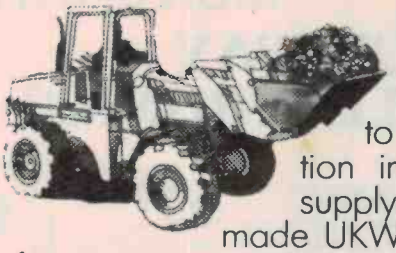
After all, the intricacies of today's advanced electronic technology apply as much to radar, avionics, marine and mining as they do to the smallest hand-held receiver.

In the Broadcast and Television Industry we supply the Government and private industry with Hirschmann Transponders and Test Equipment, Radio Signal Meters, TV Signal Meters and Group Delay Meters.

In the Avionics Industry we are the sole suppliers of avionic test equipment in Australia representing world-renowned IFR products.

In the Marine Industry we supply the high quality and highly sophisticated Dansk shipboard radio, radar and direction finding equipment among other brands.

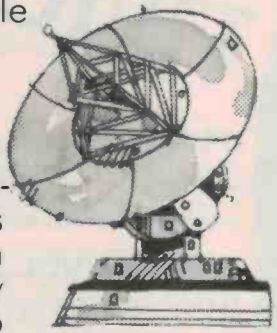
In the Television and Mining Industries we will be supplying Microdyne Satellite



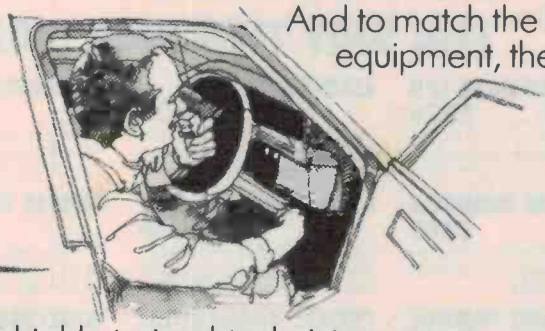
Receivers, suitable for the new Australian satellite due to come into operation in 1985. We also supply the West German made UKW satellite receivers for receiving weather information.

In the Mining Industry – or any high security industry – we supply Datotek Digital Voice Encryption equipment to ensure total security on any communication – radio, telex, telephone or facsimile.

Vicom is also the major supplier of top quality communication service monitors and assorted test equipment. In particular, the IFR portable Communication Service Monitor for testing two-way radio faults.



Whether Professional or Amateur electronic communications, Vicom is bringing the very latest in advanced technology from around the world to meet Australian electronic needs.



And to match the best in equipment, the most highly trained technicians to ensure the best possible back-up.

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WITH
DICK SMITH

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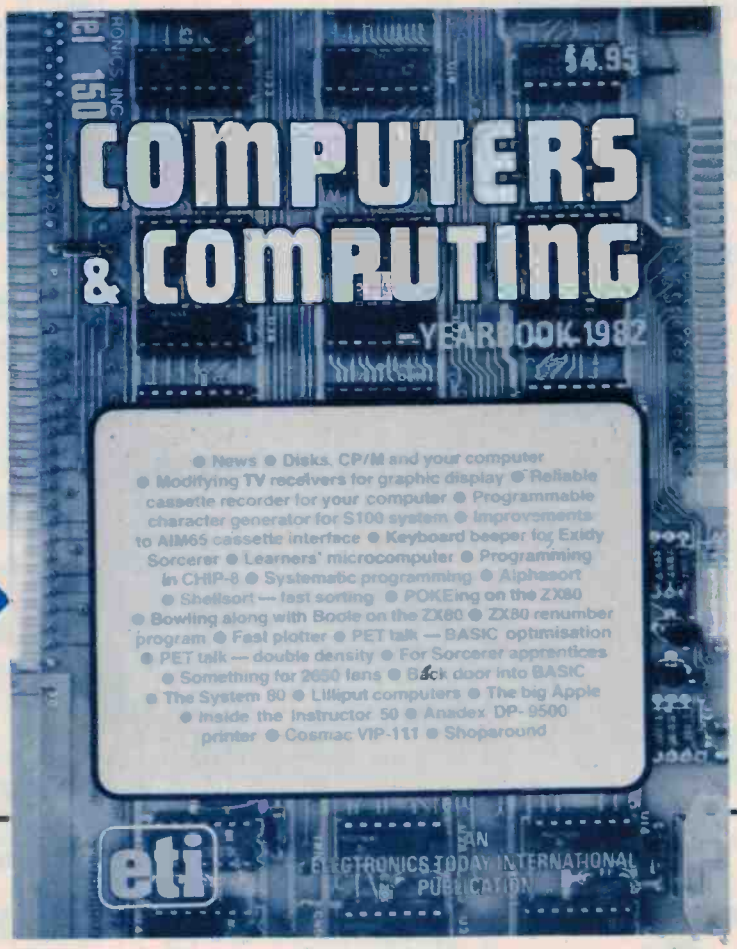

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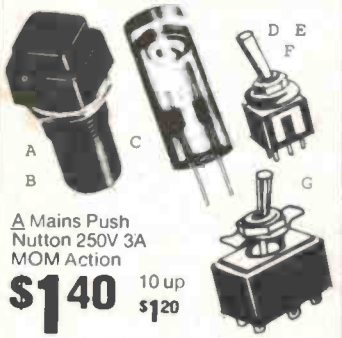

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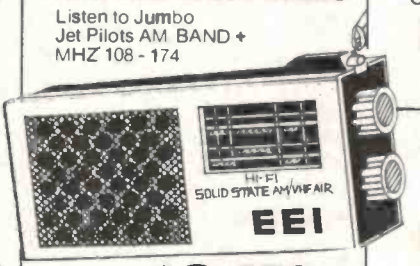

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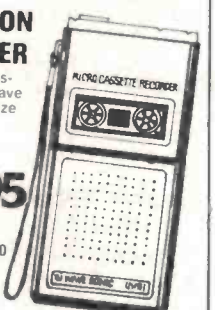

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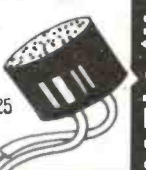

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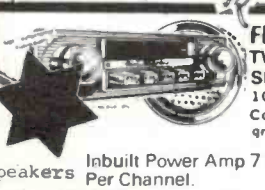

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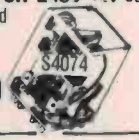

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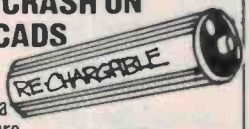

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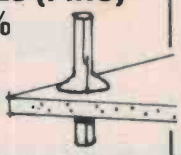

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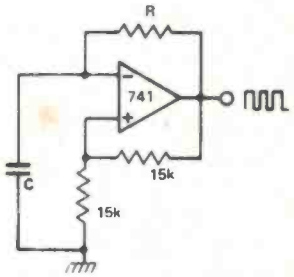
Circuit source guide

Here is an abundance of circuits that should prove a useful, if not informative, source from which you can derive other circuits or assemble a circuit from a variety of 'blocks' to suit a particular application or solve a circuit problem. Tim Orr has assembled this anthology, covering applications that range from dc control to digital instrumentation, preamps to power supplies and more. You may have seen some of these ideas before, but there are bound to be plenty you haven't.

You'll find device pinouts on the last page and a guide to purchasing components in Shoparound in this issue. Notes have been appended to some circuits by David Tilbrook.

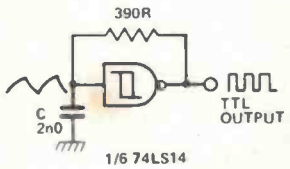
GENERATORS

Op-amp Oscillator



$F \sim \frac{1}{RC}$ (rule of thumb)

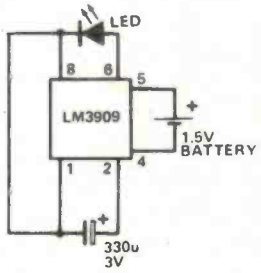
TTL Oscillator



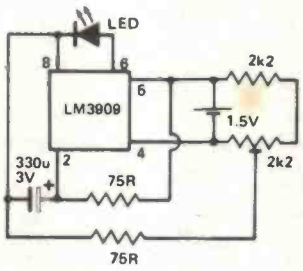
Vary C to change frequency
Do not **increase the size of the 390R resistor**

Frequency range = 1 Hz to 1 MHz

LED Flasher

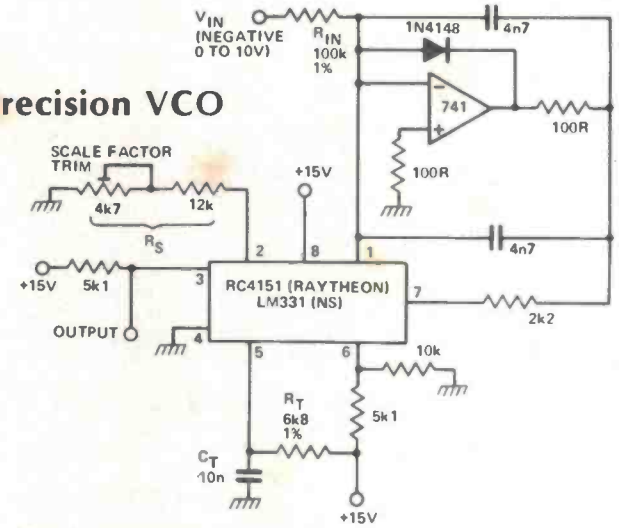


1 Hz flash rate
Average current drain = 0.32 mA
Circuit uses the timing capacitor to boost the output voltage



Variable flash rate 0 to 20 Hz

Precision VCO



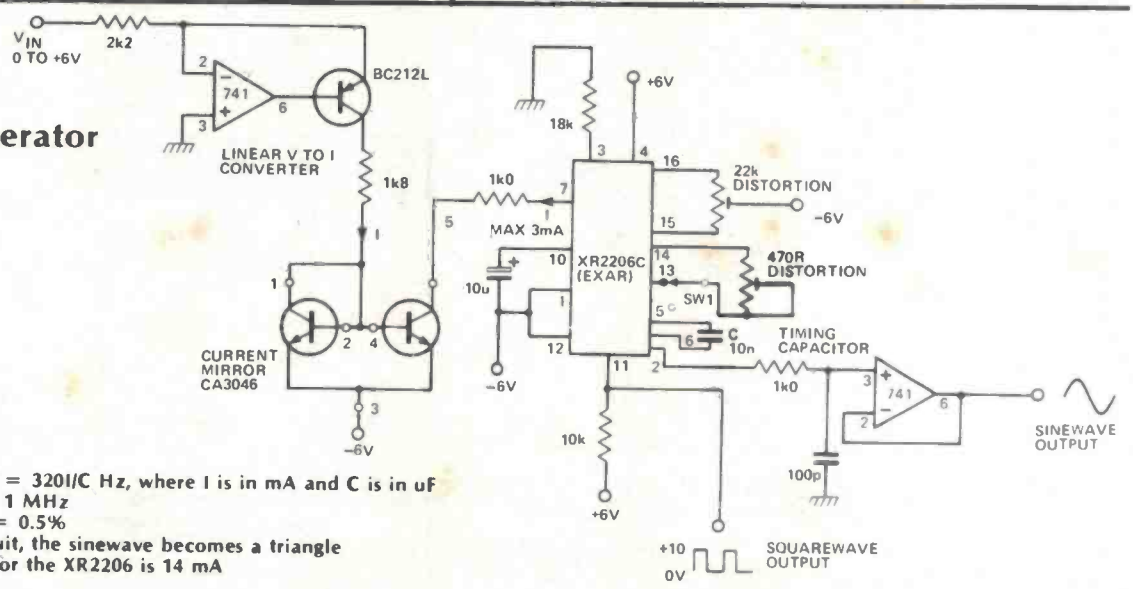
$F = (-V_{IN})/2.09 \times (R_S/R_{IN}) \times 1/(R_T C_T)$ Hz

Maximum frequency = 10 kHz
Linearity = 0.05%
Response time = 10 us
Op-amp powered from ± 15 V

The LM331 is a precision voltage-to-frequency converter. In this application an additional op-amp is used to facilitate immediate response to changes of the input control voltage. The other advantage of the use of an additional op-amp is an increase in the sensitivity of the circuit to low control voltages. The limit here is the offset voltage and current for the particular op-amp used. The 741 specified is satisfactory although an improvement would be obtained if alternative devices were used, e.g: LM108, LM308A or LF351B.

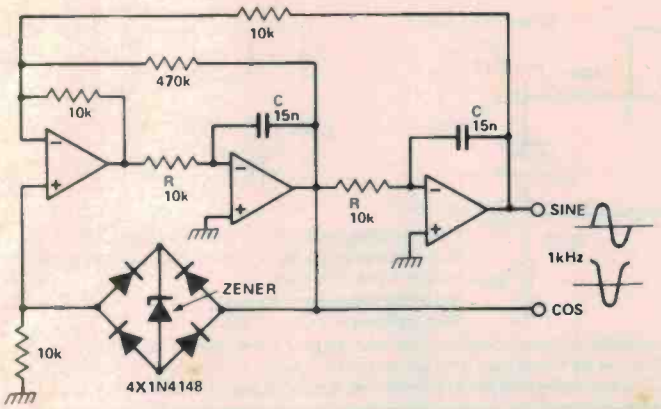
Note that the 4n7 capacitor in the integrator should be a mylar capacitor to ensure accurate operation.

Function Generator



Oscillation frequency F = 320I/C Hz, where I is in mA and C is in uF
Maximum frequency = 1 MHz
Best THD of sinewave = 0.5%
When SW1 is open-circuit, the sinewave becomes a triangle
Typical supply current for the XR2206 is 14 mA

Dual Integrator Oscillator



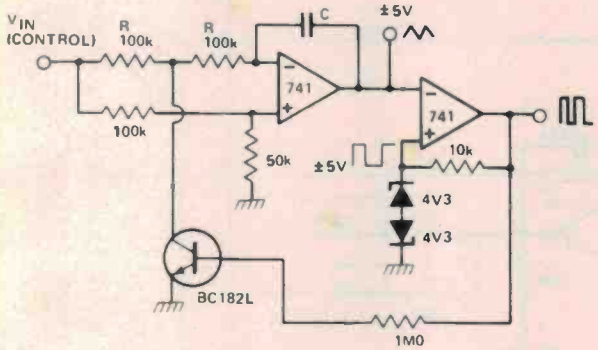
Quadrature outputs (ie sine and cosine)

Output frequency $F = \frac{1}{2\pi RC}$ **Hz**

To change frequency, change both R's or both C's.
Maximum frequency ~ 20 kHz
Minimum frequency ~ 0.016 Hz using C = 1u0, R = 10M, and TL081 op-amps
Oscillation amplitude = 2x(zener voltage + 1V2) V_{pp}

This oscillator provides two sinewave outputs with a phase shift of 90° with respect to each other, i.e: sine and cosine waveforms. The output frequency is relatively stable provided good components are used, and distortion figures below 0.1% are easily obtained.

Linear VCO



Triangle and square wave outputs

Output frequency $F = (1.667 \times 10^{-7} \times V_{IN})/C$ **Hz**

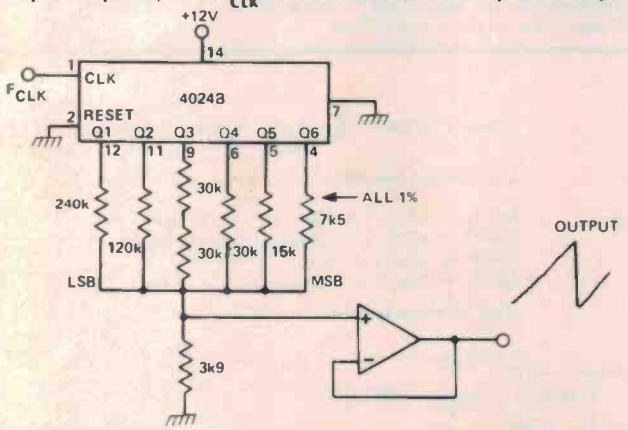
If C = 1n0 and V_{IN} = 10V, then F = 1.66 kHz

Changing both R's from 100k to 10k will increase F by x 10

For low frequencies use TL081 op-amps
Frequency range 0.1 Hz to 10 kHz

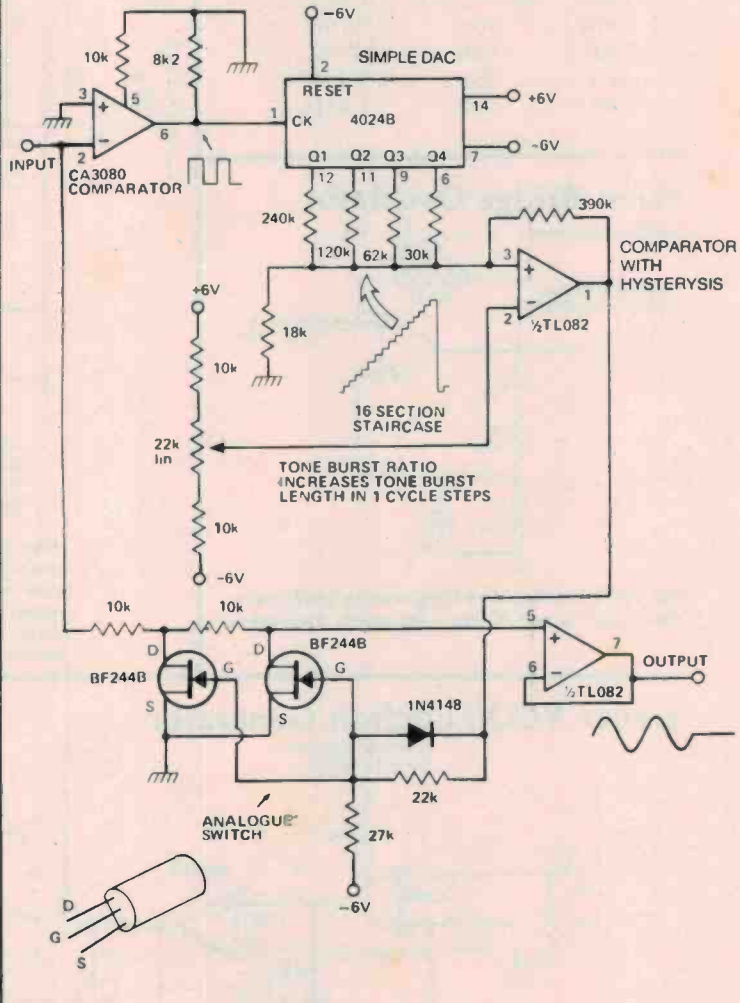
Staircase Generator

Output frequency $F = F_{CLK}/64$ **Staircase is made up of 64 steps**



The 4024B is a CMOS seven-stage binary ripple counter. Upon receipt of a clock pulse the counter selects a combination of the resistors and increases the voltage at the output of the op-amp buffer. As with all edge-triggered devices the clock should be conditioned to have a single clean edge with a rise and fall time faster than 5 uS. The device clocks on the falling edge of the clock waveform.

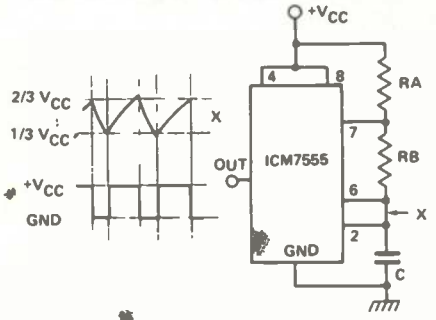
Variable Length Tone Burst Generator



Input is a sinewave or any other periodic waveform, maximum level ± 2 V, maximum frequency 100 kHz
Output is a tone burst variable from one cycle on, 15 cycles off to 15 cycles on, one cycle off
All devices powered from ± 6 V

GENERATORS

CMOS 555 Oscillator

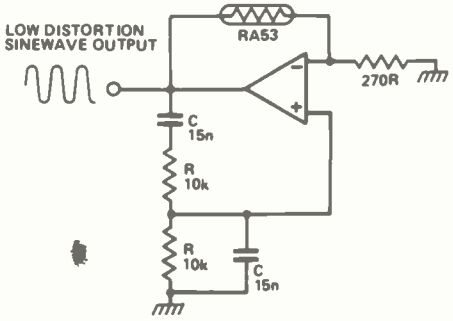


Output frequency F = 1.46/C(RA + RB)
C in farads, R in ohms
Quiescent current ~ 120 uA
Input current ~ 50 pA (this allows the use of resistors up to 10M in value)
Frequency range 0.001 Hz to 500 kHz
Supply range 2 to 18 V
Rise and fall time (pin 3) = 40 ns

RA,RB	C	F
10M	10u TANT	7.3 mHz
1M0	1u0	0.73 Hz
100k	100n	73 Hz
10k	10n	7.3 kHz
10k	1n0	73 kHz

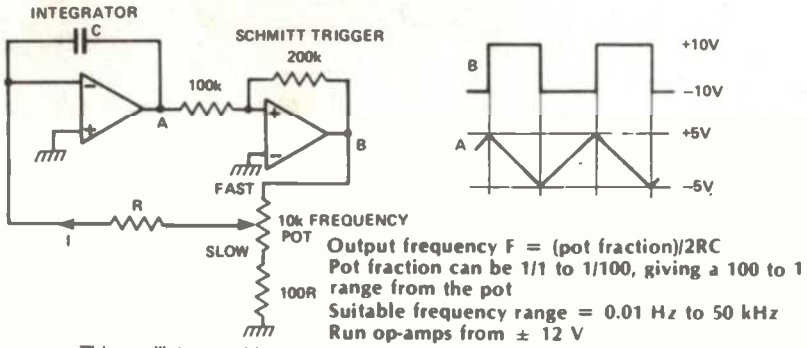
Wien Bridge Oscillator

Output frequency $F = \frac{1}{2\pi RC}$ Hz



The RA53 is a negative temperature coefficient thermistor; it sets A_V to 3 for stable oscillation.

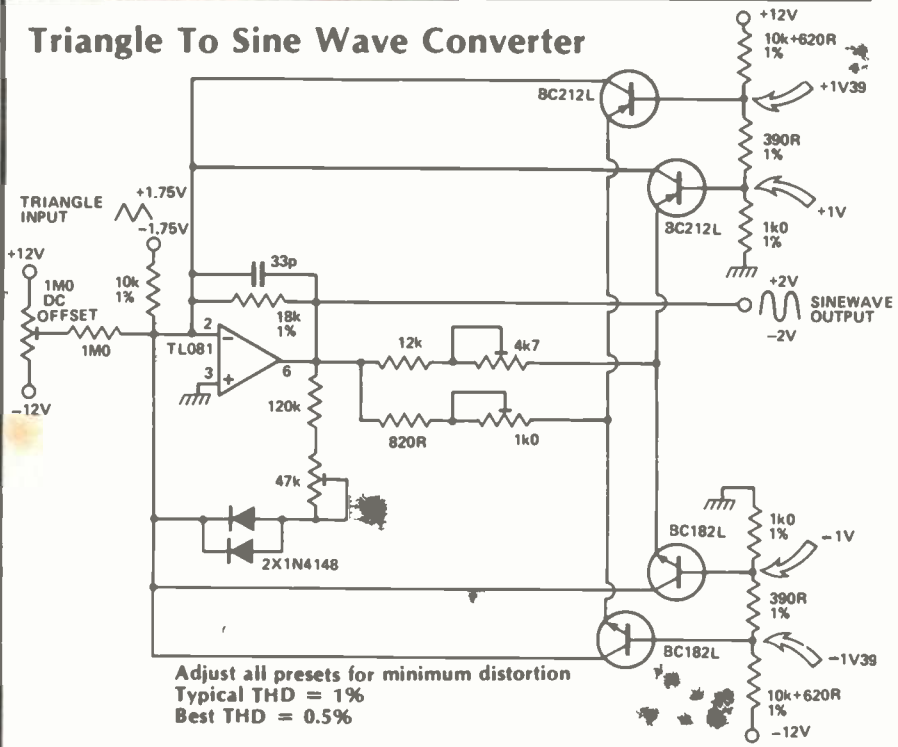
Triangle/Square Wave Oscillator



Output frequency F = (pot fraction)/2RC
Pot fraction can be 1/1 to 1/100, giving a 100 to 1 range from the pot
Suitable frequency range = 0.01 Hz to 50 kHz
Run op-amps from ± 12 V

This oscillator provides both triangle and square wave outputs at a frequency that can be varied over a range set by the 10k pot. A dual op-amp such as the TL072 is suitable and would provide frequencies to beyond 50 kHz.

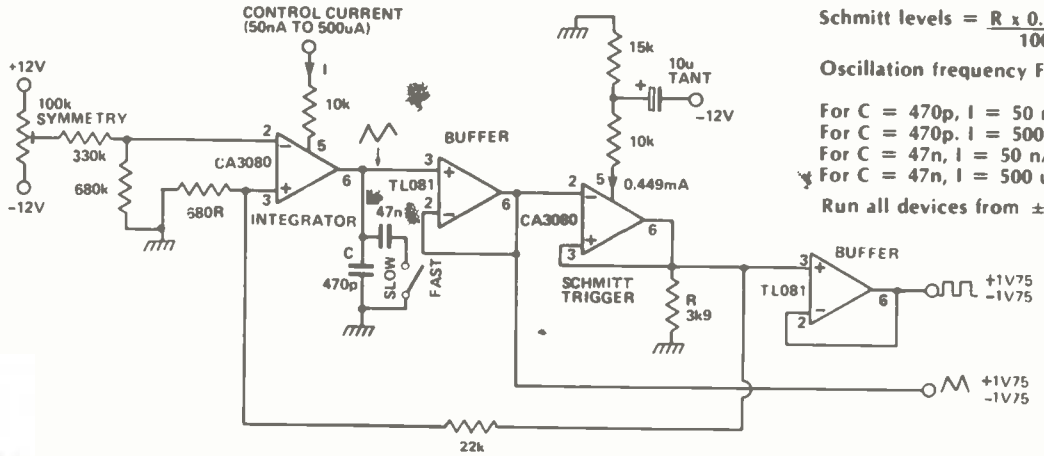
Triangle To Sine Wave Converter



Adjust all presets for minimum distortion
Typical THD = 1%
Best THD = 0.5%

When designing a complete function generator it is often convenient to start with one of the triangle/square wave oscillators given earlier and convert the triangle wave into a sinewave. This is a particularly good method if a sweep oscillator is required, since sinewave sweep oscillators are extremely difficult to design. Some experimenting with the preset pots is necessary to obtain minimum distortion, although this is not particularly difficult.

Linear VCO/Function Generator



Schmitt levels = $\frac{R \times 0.449}{1000}$ = 3.9 x 0.449 = ± 1V75

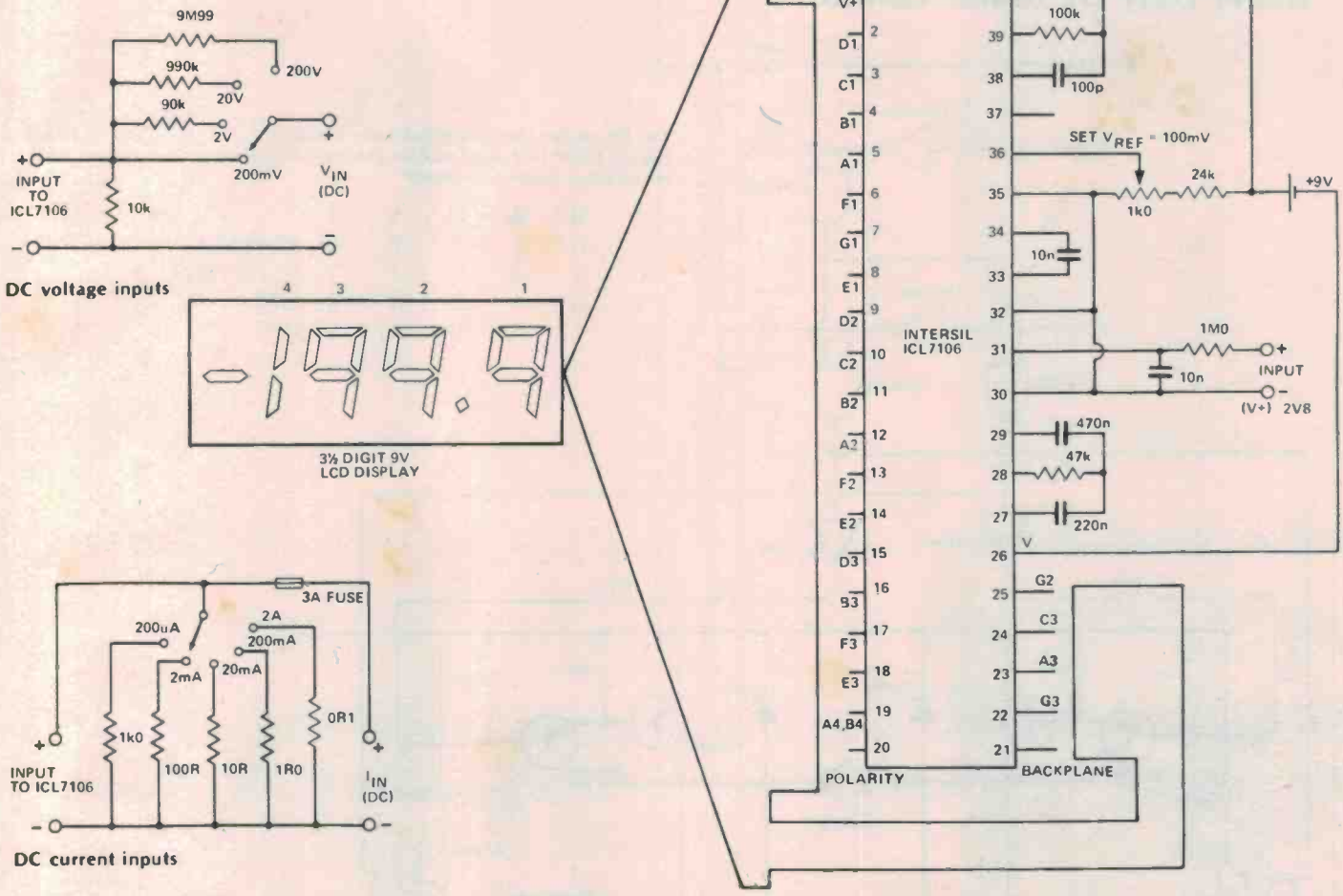
Oscillation frequency F = I/(C x 4 x 1.75) = I/7C Hz

For C = 470p, I = 50 nA, F = 15 Hz
For C = 470p, I = 500 uA, F = 150 kHz
For C = 47n, I = 50 nA, F = 0.015 Hz
For C = 47n, I = 500 uA, F = 150 Hz

Run all devices from ± 12 V

MEASUREMENT

3½ Digit LCD DVM



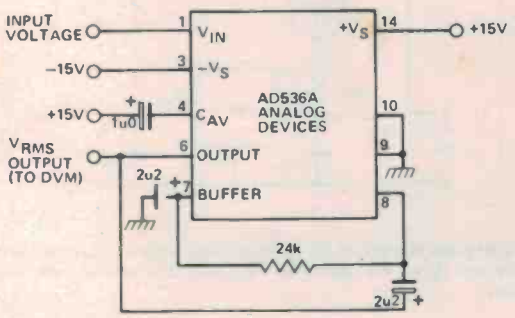
Input voltage range = ±200 mV
Quiescent current = 0.8 mA
Common mode input range = (V+)−0V5 to (V−)+1V
Decimal point must be driven externally by EXORing the decimal point data with the backplane strobe

The Intersil ICL7106 is a high-performance CMOS 3½-digit analogue-to-digital converter capable of driving a liquid crystal display directly. The device uses dual-slope integration to ensure accurate performance independent of component variation. The accuracy is guaranteed to ± 1 count in 2000 counts and draws only 10 mW from a 9 V battery. Intersil market a 'Single Chip Panel Meter Evaluation Kit' that contains all the necessary components for this circuit.

True RMS Measurement

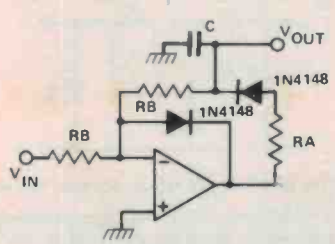
Input voltage 7 V_{RMS} maximum
Bandwidth: 300 kHz, V_{RMS} > 0V1
Error of 1% for a crest factor of 7

Quiescent current = 1mA
60 dB range



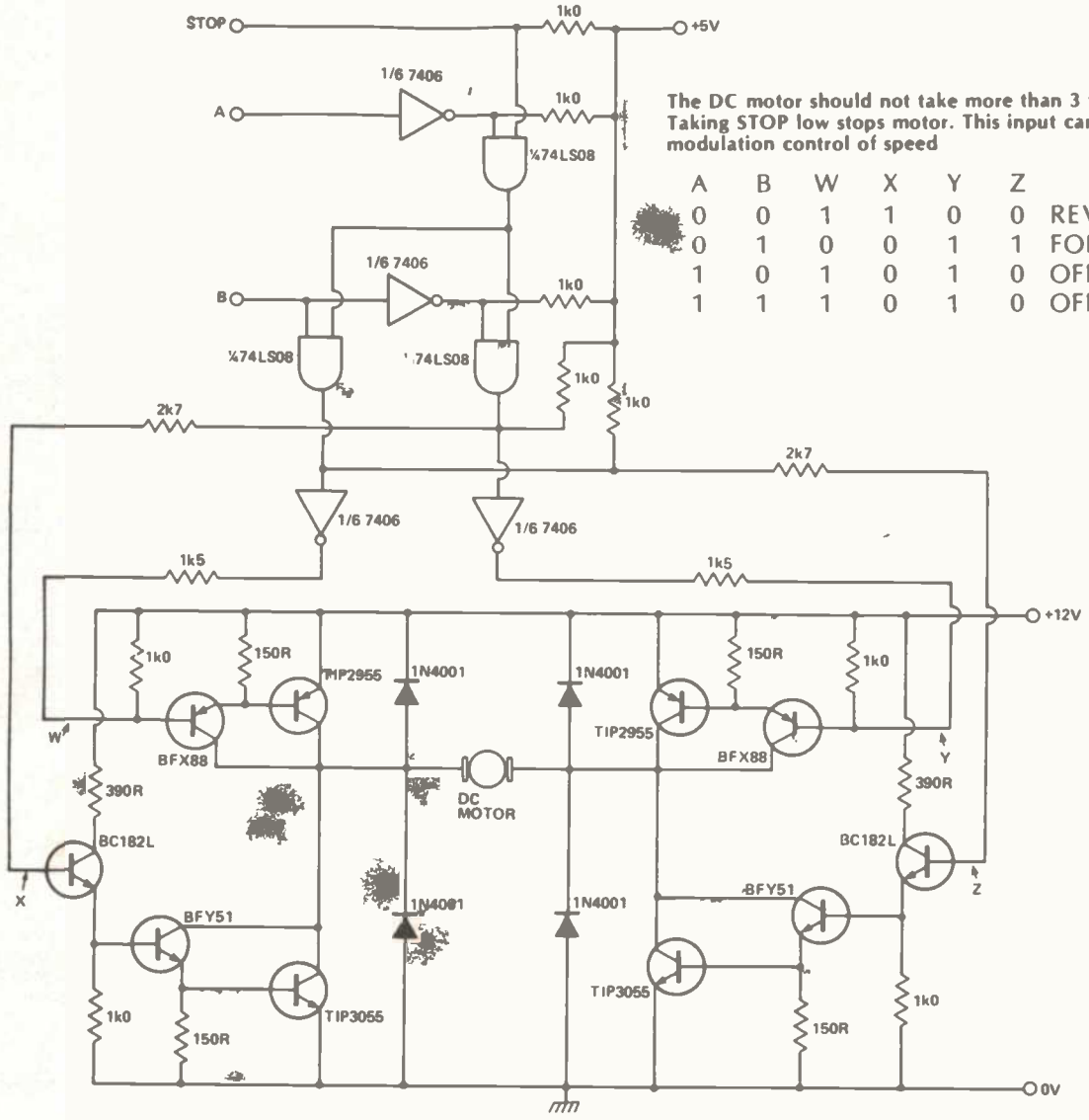
Inverting Peak Voltage Detector

Attack time constant = C.RA
Decay time constant = C.RB



This circuit works well at high frequencies

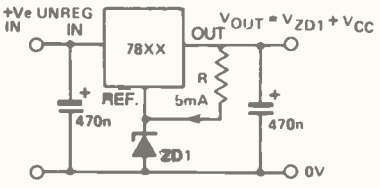
Heavy Duty DC Motor Control



The DC motor should not take more than 3 to 4 A continuous current Taking STOP low stops motor. This input can be used for mark/space modulation control of speed

A	B	W	X	Y	Z	
0	0	1	1	0	0	REVERSE
0	1	0	0	1	1	FORWARD
1	0	1	0	1	0	OFF
1	1	1	0	1	0	OFF

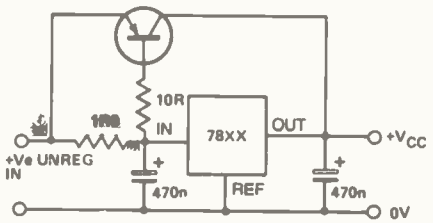
Increasing Regulator Voltages



Increasing the output voltage using a zener diode.

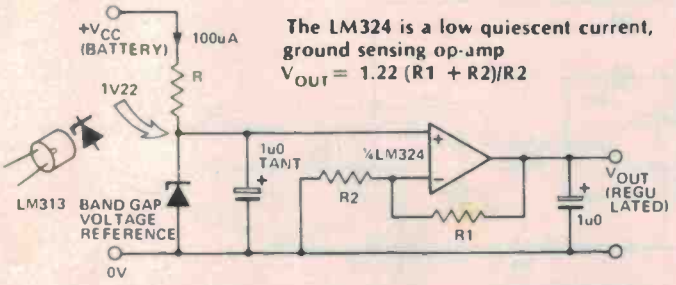
The output voltage of three-terminal voltage regulators can be increased by increasing the voltage on the reference or common lead on the regulator. This can be done as shown in the circuit diagram with the use of a zener diode. The resistor R should be selected to ensure sufficient current through the zener for a stable voltage reference.

Increasing Regulator Currents



Using a bypass transistor to increase the output current drive. The first 600 mA flows through the regulator, the rest via the external transistor.

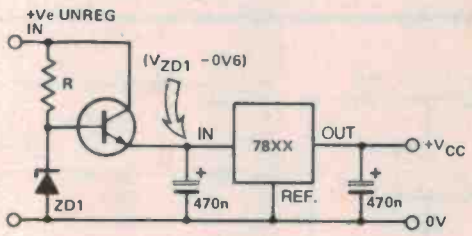
Low Current/Precision Supply



The LM324 is a low quiescent current, ground sensing op-amp
V_{OUT} = 1.22 (R1 + R2)/R2

This circuit is useful whenever a precision voltage reference is necessary or as a low current, well-regulated supply. The value of the resistor R is calculated from the battery voltage to ensure around 1 uA through the LM313. Use the equation R = V_{cc} x 1000 ohms.

Low Dissipation Regulator

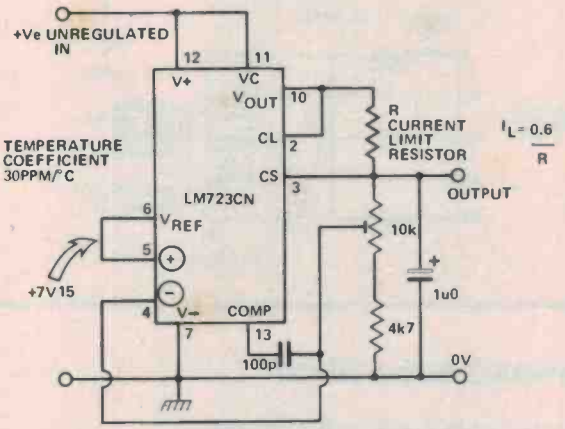


The three-terminal IC regulator is probably the most-used integrated circuit, offering a simple and effective solution to the problem of power supply design. These devices, however, have a maximum input voltage of around 35 V (40 V for some). The circuit shown here enables the regulator to function from a higher supply voltage by dropping the excess voltage across an external transistor. You should ensure that the voltage drop across the transistor is within the capabilities of the particular device used. The zener diode ZD1 sets the voltage that appears at the input of the IC regulator. (The actual voltage will be ZD1-0.6). The resistor R should be selected to ensure adequate current through the zener diode so that it will provide an effective voltage reference for the pass transistor. This is determined by the maximum power dissipation of the zener. Set the required power dissipation for the zener at about half its maximum rating then calculate the required zener current from Ohm's law; i.e: I = P/ZD1. The value of the required resistor is then given by R = (Ve−ZD1)/I.

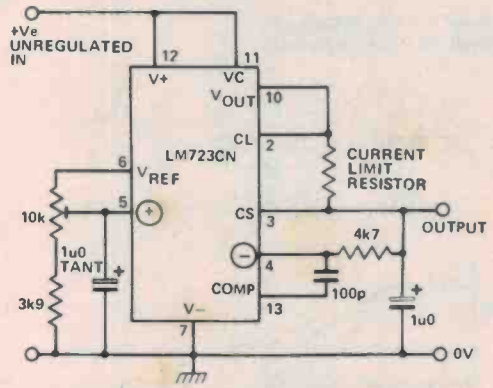
The circuit can also be used to decrease the power dissipation in the IC regulator. These require an input at least 2 - 3 volts above their rated output voltage. If this voltage is set by the zener the remainder of the power dissipation will be done by the pass transistor. Once again, ensure that the maximum power dissipation expected of the transistor is within its capability. If the device becomes excessively hot an additional heatsink should be used.

Precision Power Supplies

723 general specifications:
Maximum input voltage = 40 V
Maximum current output = 150 mA
Output voltage range = 2 to 37 V



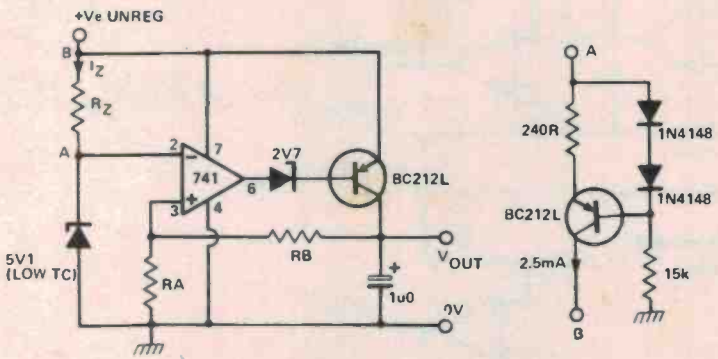
Adjustable +7 V to +21 V



Adjustable +2 V to +7 V

The 723 is a precision, variable voltage regulator. Output voltage is adjusted by the 10k preset and a current limit can be set by a suitable choice of resistor R.

Battery Regulator



A very low dropout voltage can be obtained by allowing Q1 to saturate. This gives maximum lifetime on battery power.

Better regulation can be obtained by replacing RZ with this 2.5 mA current source. However, the unregulated supply rail must not drop below (5V1 + 1V2) = 6V3

Select R_Z for an I_Z of about 2.5 mA

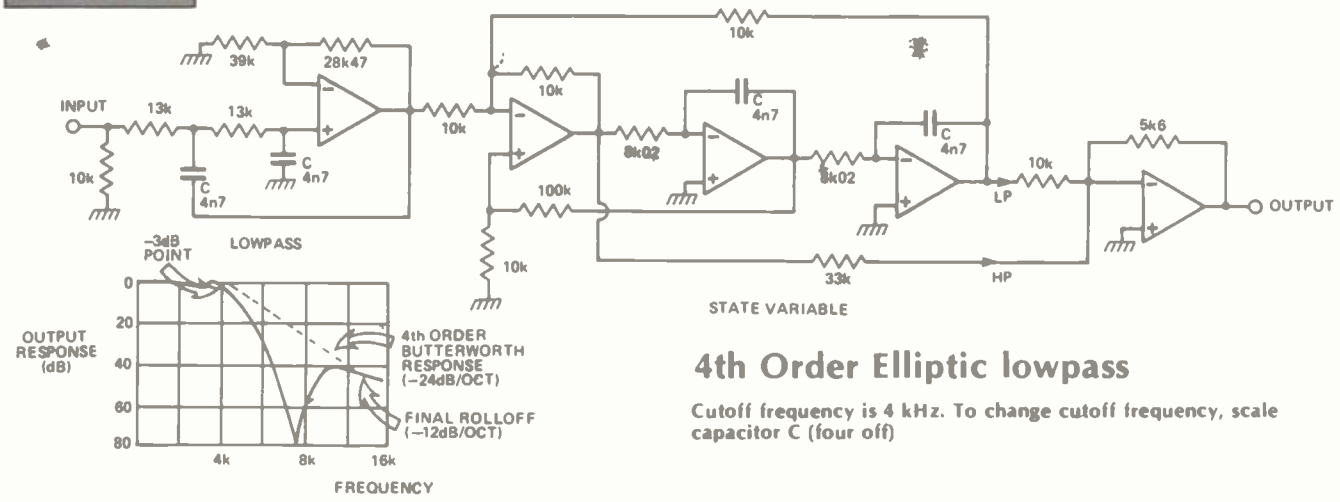
V_{OUT} = 5V1 X (RA + RB)/RA

Minimum V_{OUT} ~6V

Dropout voltage = V_{CE}(Q1 saturated) ~ 0V3

Keep I_{OUT} less than 50 mA

FILTERS



4th Order Elliptic lowpass

Cutoff frequency is 4 kHz. To change cutoff frequency, scale capacitor C (four off)

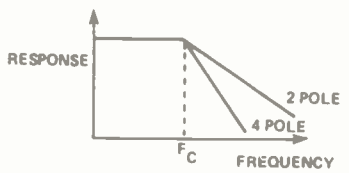
Lowpass Active Filters

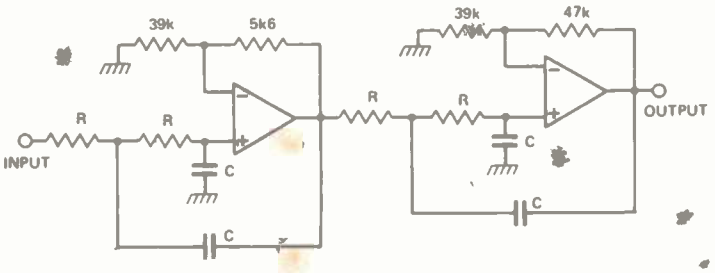
Inputs must have a DC path to ground

$$F_c = \frac{1}{2\pi RC}$$

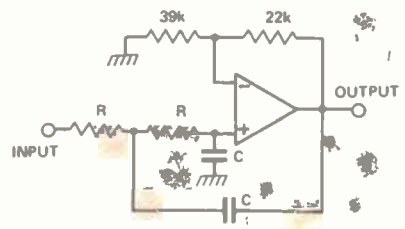
2 pole roll-off = −12 dB/octave
4 pole roll-off = −24 dB/octave

R	C	F_C
107k	15n	100 Hz
10k7	15n	1 kHz
10k7	1n5	10 kHz





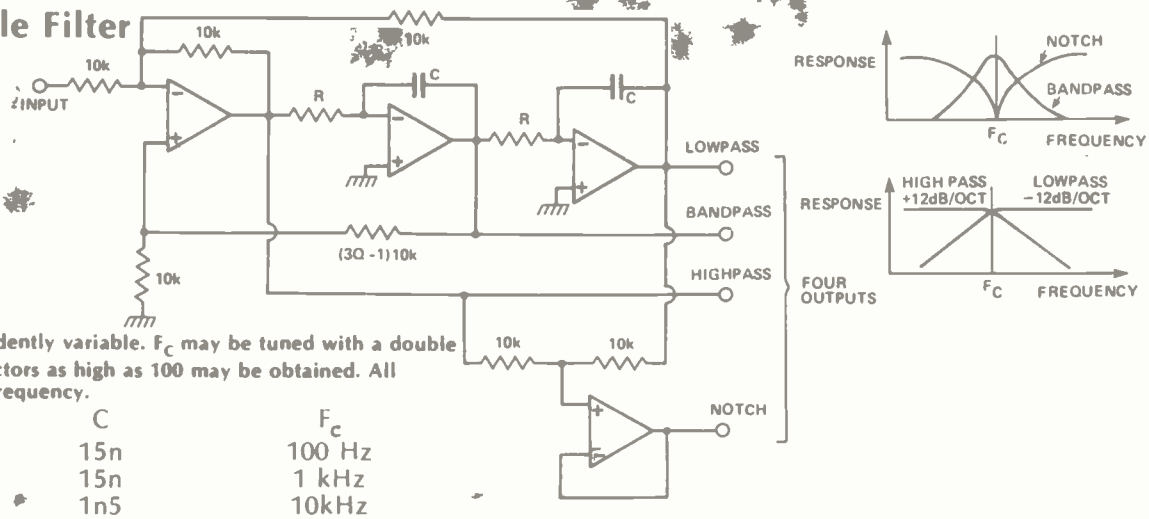
4 pole Butterworth



2 pole Butterworth

State Variable Filter

$$F_c = \frac{1}{2\pi RC} \text{ Hz}$$

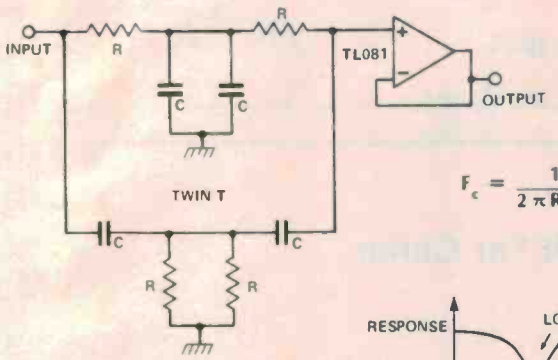


Gain = Q
Q and F_C are independently variable. F_C may be tuned with a double gang pot (for R). Q factors as high as 100 may be obtained. All responses track with frequency.

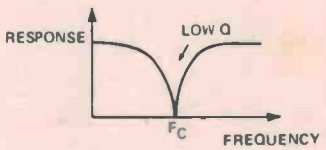
R	C	F_C
107k	15n	100 Hz
10k7	15n	1 kHz
10k7	1n5	10kHz

Active Notch Filter

The two R's in parallel represent R/2
The two C's in parallel represent 2C
For 50 Hz, R = 680k, C = 4n7 (a hum remover)

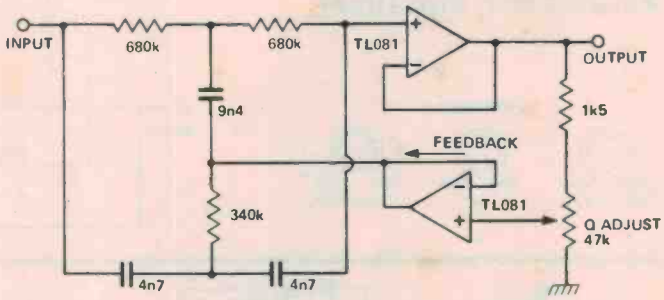


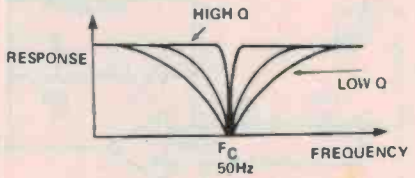
$$F_c = \frac{1}{2\pi RC}$$



A basic Twin-Tee notch. Rejection depends on component matching, so for best results use high-stability components.

50 Hz Notch, Variable Q

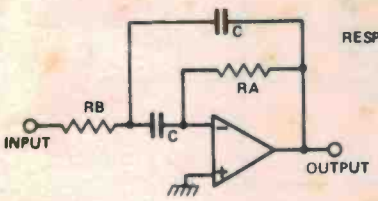


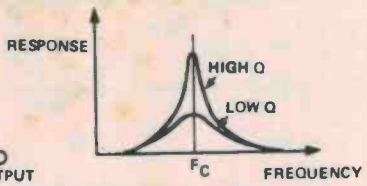


This is a modified version of the basic Twin-Tee notch filter. The Q can be adjusted by controlling the amount of feedback with the 47k potentiometer. The rejection offered by the circuit is determined by the matching of the passive components, but even with ordinary components a figure of 30 dB to 40 dB should be obtained.

Bandpass Active Filter

$F_C = 1/2\pi C\sqrt{RA+RB}$
$Q = 1/2\sqrt{RA/RB}$
Gain $= 2Q^2$





F_C = 1kHz, C = 15n

RA	RB	Q	GAIN
10k6	10k6	0.5	x 0.5
21k2	5k3	1.0	x 2.0
42k4	2k65	2.0	x 8.0
84k8	1k32	4.0	x 32.0

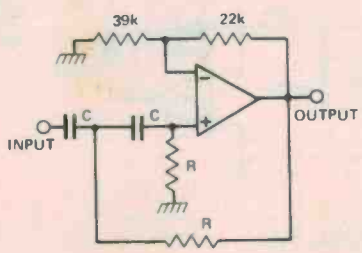
This is probably the most common bandpass filter. The circuit is really only useful for the relatively low Q shown. For a higher Q one of the more complex bandpass circuits should be used, such as the state variable filter.

Highpass Active Filters

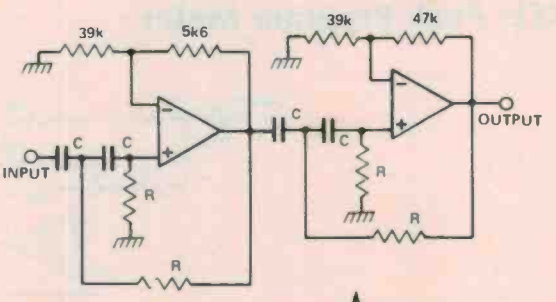
$$F_c = \frac{1}{2\pi RC} \text{ Hz}$$

2 pole roll-off = +12 dB/octave
4 pole roll-off = +24 dB/octave

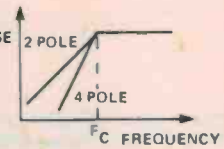
R	C	F_C
107k	15n	100 Hz
10k7	15n	1 kHz
10k7	1n5	10 kHz



2 pole Butterworth

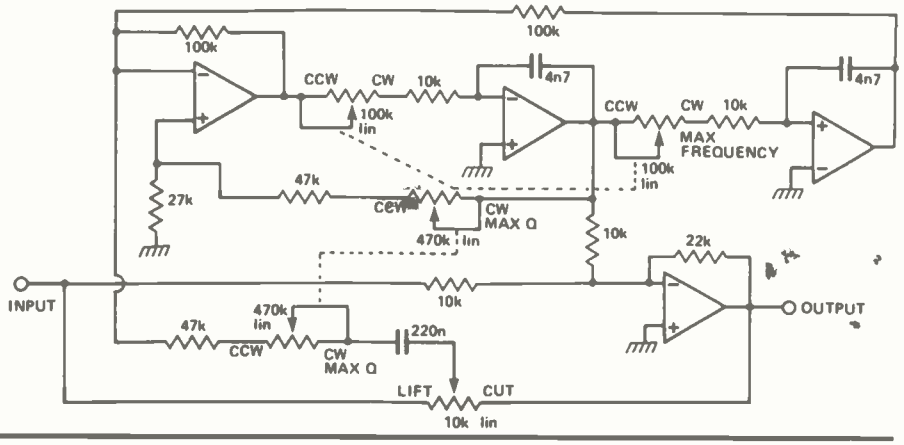


4 pole Butterworth

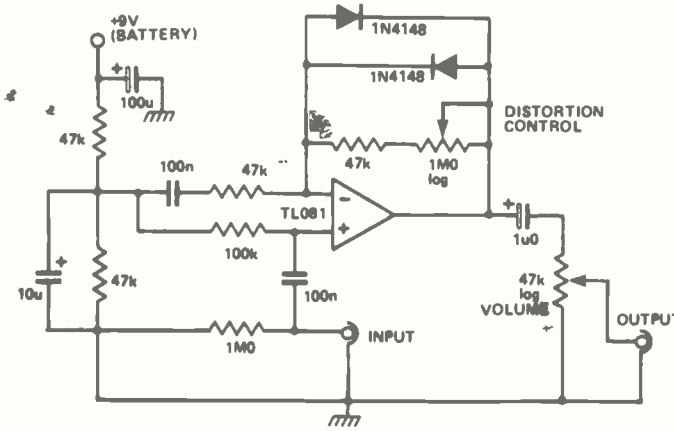


MUSICAL

Parametric Equaliser

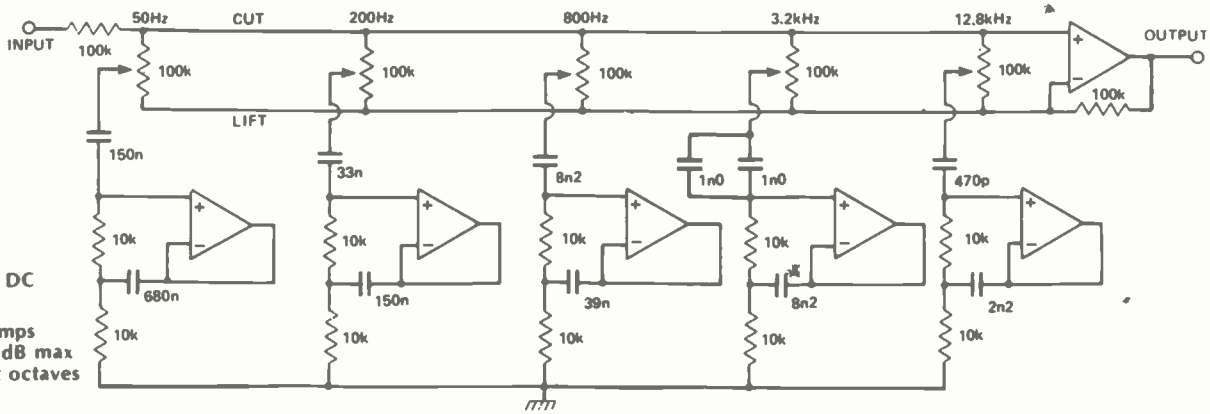


Fuzz Unit For Guitar



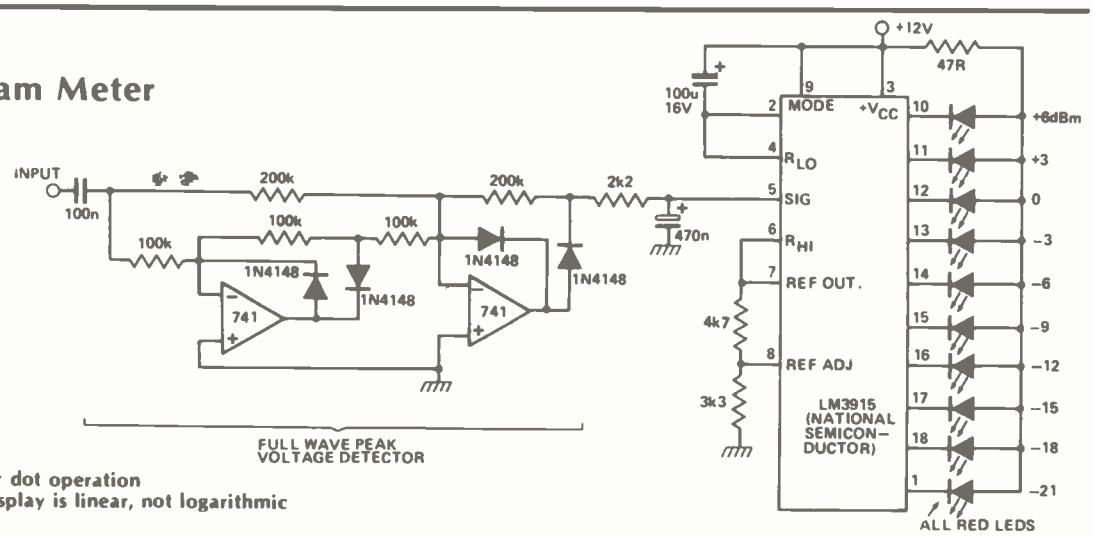
The battery can be switched on via the jack socket (a stereo jack can be used).

Graphic Equaliser



Input must have a DC path to ground
Use 741's for op-amps
Cut and lift = 13 dB max
Filter spacing = 2 octaves

LED Peak Program Meter

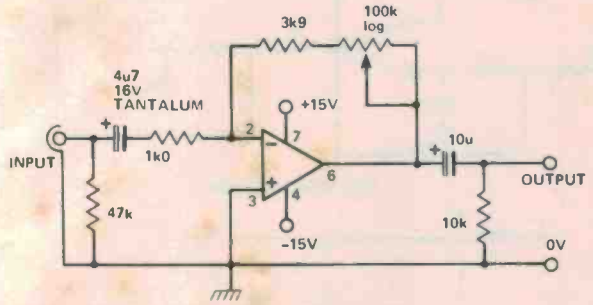


Leave pin 9 open circuit for dot operation
If an LM3914 is used the display is linear, not logarithmic

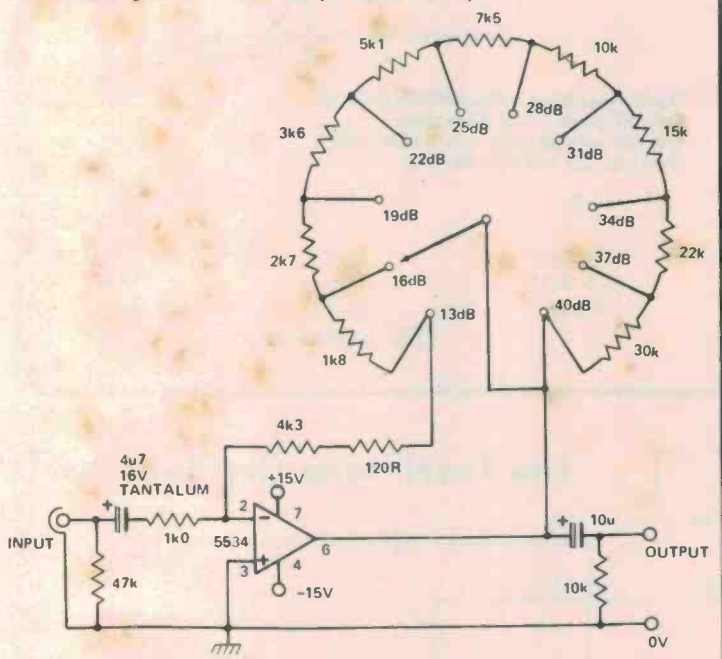
AUDIO

Low Impedance Source Preamp

Very low input noise
Input noise = 4 nV$\sqrt{Hz}$
Equivalent input noise voltage = 0.56 uV_{RMS} (20 kHz bandwidth)
Input impedance = 1k0 (suitable for microphone)



Variable gain; x 3.9 to x 100 (12 dB to 40 dB)

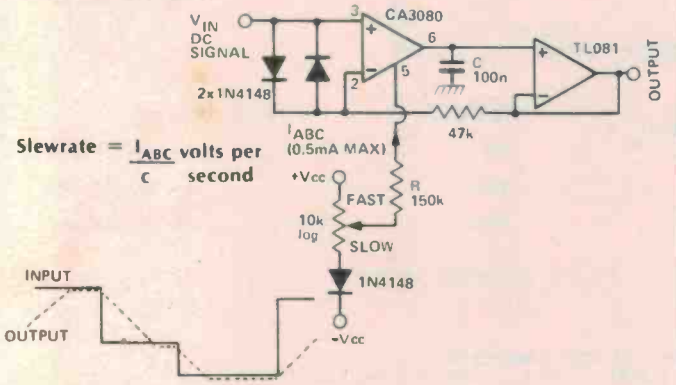


Switched gain; 3 dB steps

The NE5534N is a very low-noise op-amp specifically intended for audio applications. The device boasts one of the lowest noise figures of all op-amps combined with good slew rate and large signal bandwidth figures.

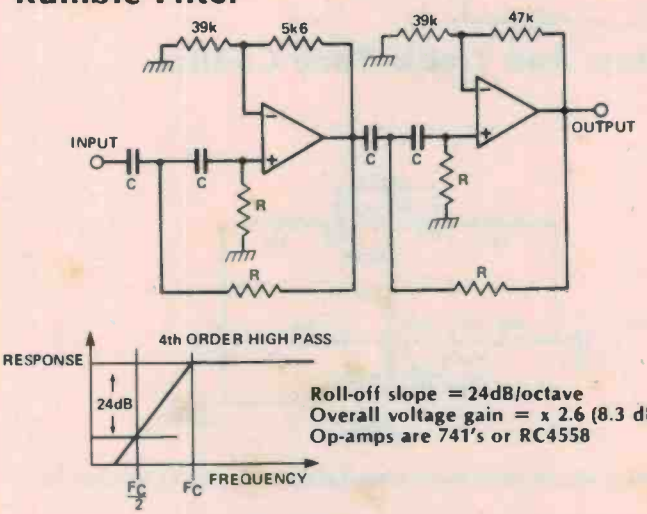
The lowest-noise devices have the designation NE5534AN. Suitable supply decoupling is essential if best results are to be obtained.

Slew Limiter



Slewrate = $\frac{I_{ABC}}{C}$ volts per second

Rumble Filter

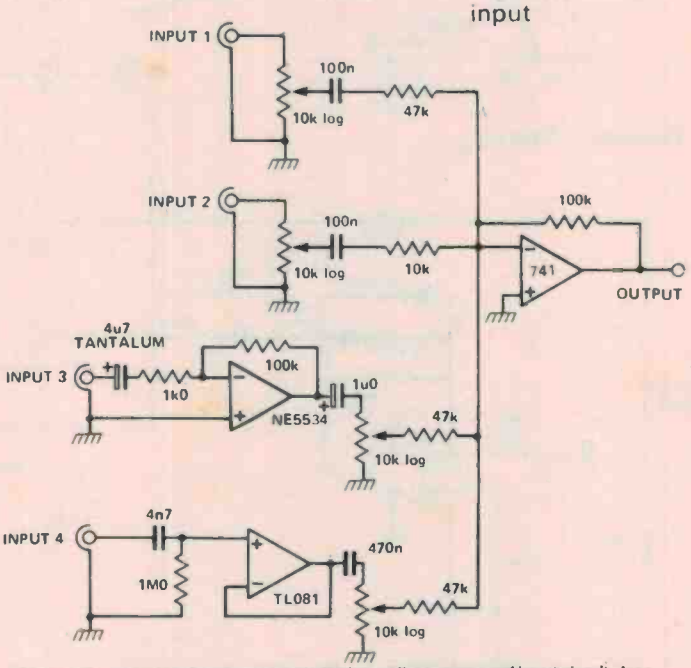


Roll-off slope = 24dB/octave
Overall voltage gain = x 2.6 (8.3 dB)
Op-amps are 741's or RC4558

F_C	C	R
25 Hz	100n	62k
50 Hz	100n	30k
100 Hz	100n	15k
200 Hz	100n	7k5
	(5% tolerance)	

Simple Mixer

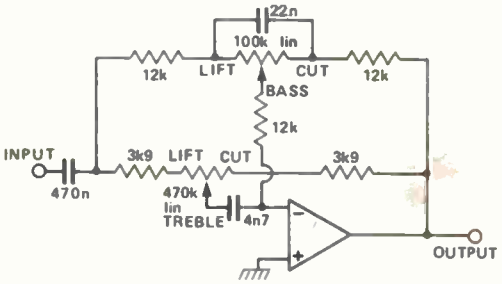
INPUT	MAX GAIN	INPUT IMPEDANCE	SOURCE
1	+6 dB	10k	line level
2	+20 dB	5 to 10k	line level
3	+46 dB	1k0	low impedance microphone
4	+6 dB	1M0	high impedance input



This simple mixer has been provided with four different types of input circuit. Any combination of these could however be used. Once again, the 741 limits the high frequency response and slew rate capabilities. To improve performance substitute the 741 for a faster device such as an NE5534N or TL071, etc.

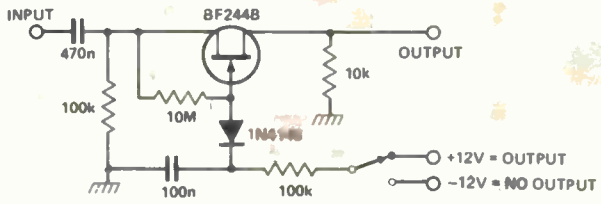
AUDIO

Bass And Treble Tone Control

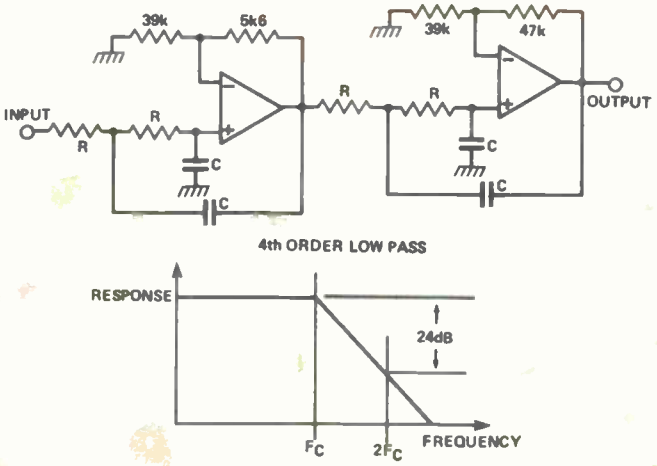


The op-amp can be any type suitable for audio work, e.g: TL071, NE5534N, etc.

FET Audio Switching



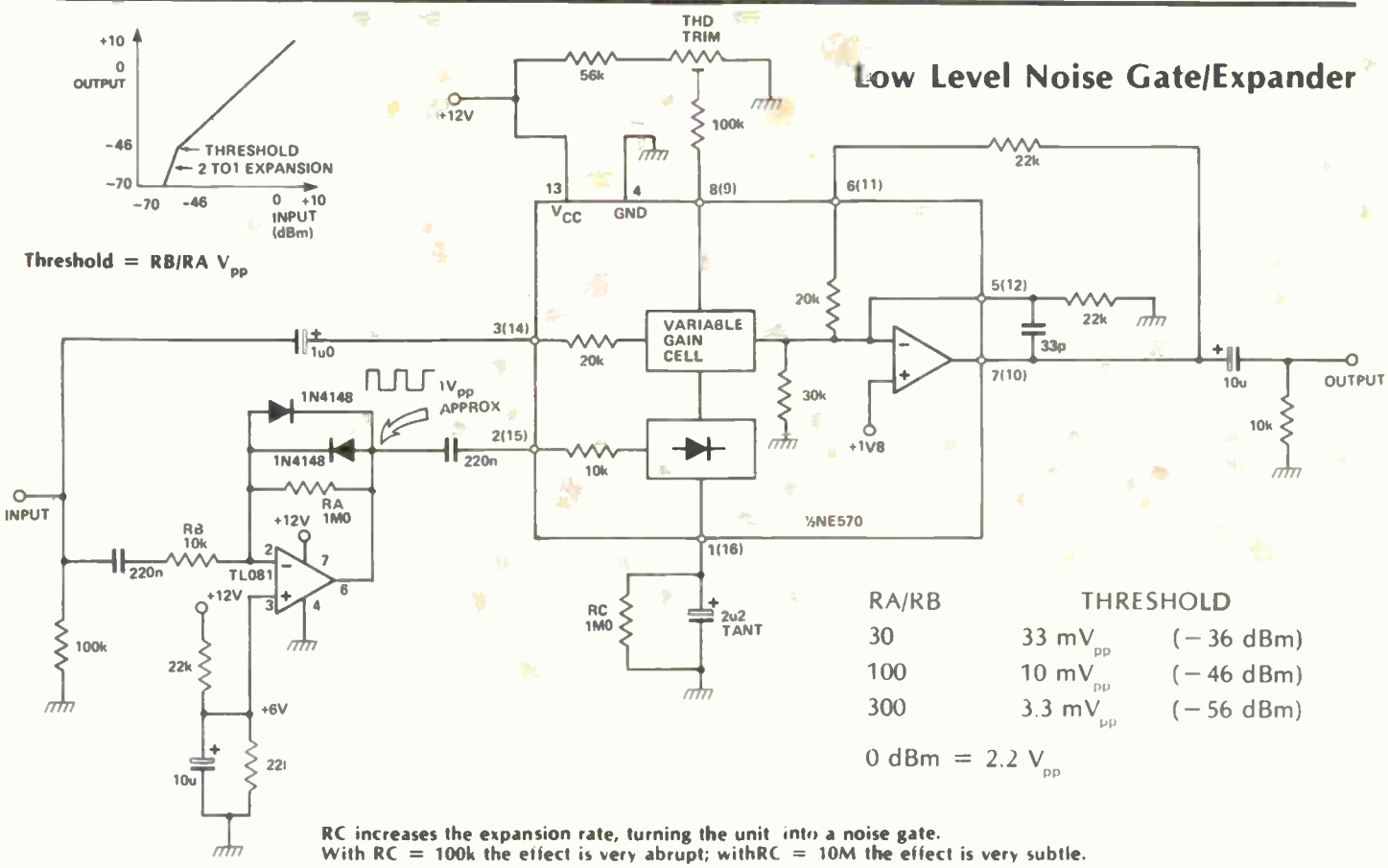
Scratch Filter



Input must have a DC path to ground
Roll-off slope = 24 dB/octave
Overall voltage gain = x 2.6 (8.3 dB)
Op-amps are 741's or RC4558

F_C	C	R
10 kHz	1n5	10k
7.5 kHz	1n5	14k
5 kHz	1n5	20k
	(5% tolerance)	

Low Level Noise Gate/Expander



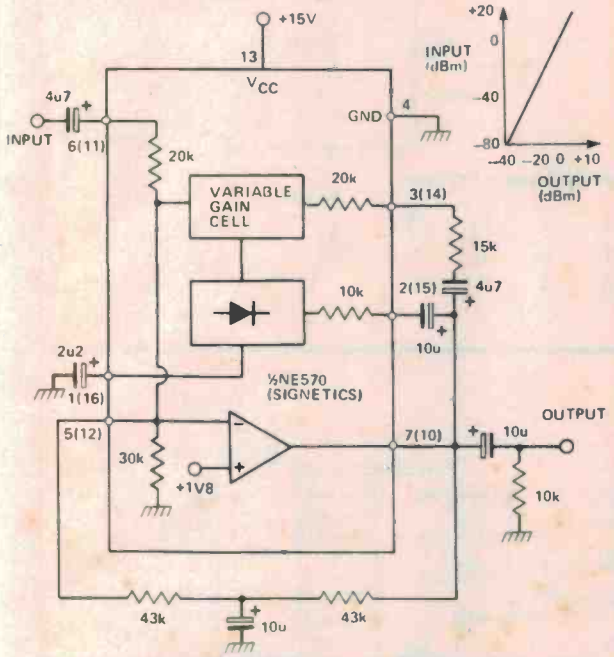
Threshold = RB/RA V_{pp}

RA/RB	THRESHOLD	
30	33 mV_{pp}	(−36 dBm)
100	10 mV_{pp}	(−46 dBm)
300	3.3 mV_{pp}	(−56 dBm)

0 dBm = 2.2 V_{pp}

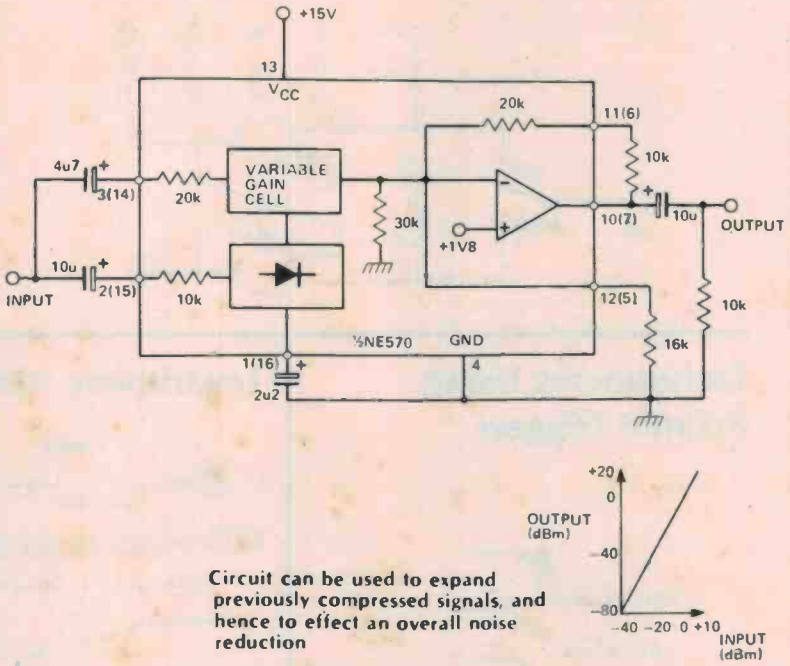
RC increases the expansion rate, turning the unit into a noise gate.
With RC = 100k the effect is very abrupt; withRC = 10M the effect is very subtle.

Two-to-one Compressor



The pin numbers in brackets refer to the second circuit in the IC. Circuit can be used as a preconditioner in a noise reduction system.

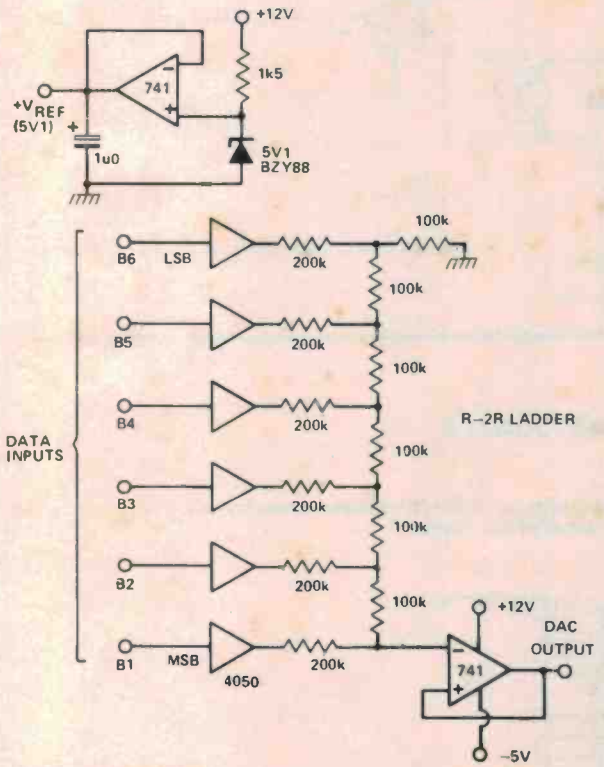
Two-to-one Expander



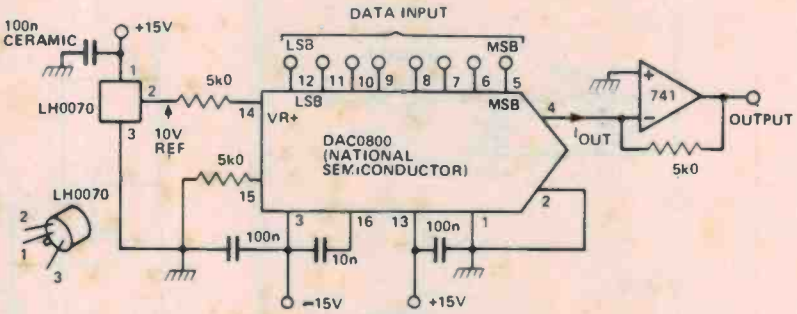
Circuit can be used to expand previously compressed signals, and hence to effect an overall noise reduction

DIGITAL

Six-bit DAC — 10-bit Precision

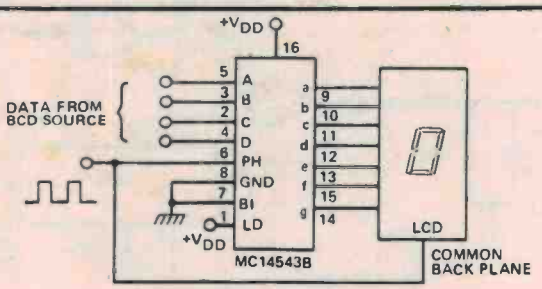


Buffers powered from 0 V and $+V_{REF}$
Resistors in ladder need 0.1% tolerance
DAC output has 64 steps



Standard Eight-bit DAC

The DAC08 is a multiplying digital-to-analogue converter (DAC). The data input selects a number that is multiplied by the input reference current to determine the output current. For accurate results it is therefore necessary to supply the DAC with a reference current. This role is filled by using the LH0070 precision voltage reference and generating a reference current by dropping this voltage across an accurate resistance, the 5k0. If this accuracy is not important or if the LH0070 is difficult to obtain a zener diode or three-terminal voltage regulator could be substituted.



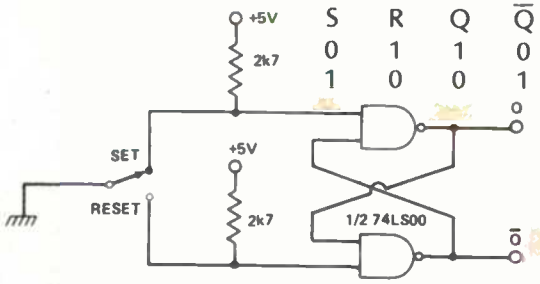
BCD-to-seven-segment Driver for LCD

The use of liquid crystal seven-segment displays is becoming increasingly popular due to their low power consumption when compared with LED displays. A problem with LCD arises, however, due to its inability to cope with dc drive. The common or backplane must be supplied with a square wave to ensure that the display is not damaged. This circuit provides this function as well as the necessary BCD-to-seven-segment decoding.

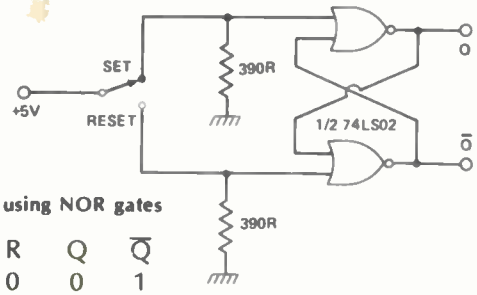
DIGITAL

Debouncing Using Flip-Flops

Flip-flop using NAND gates



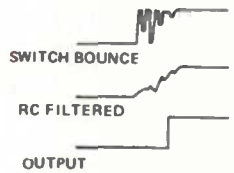
S	R	Q	$\overline{Q}$
0	1	1	0
1	0	0	1

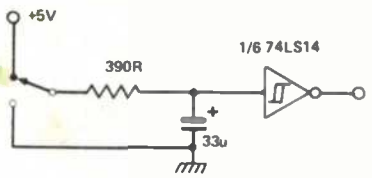


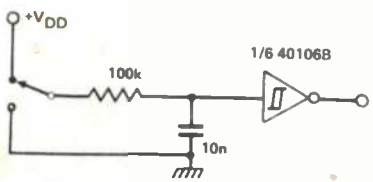
Flip-flop using NOR gates

S	R	Q	$\overline{Q}$
1	0	0	1
0	1	1	1

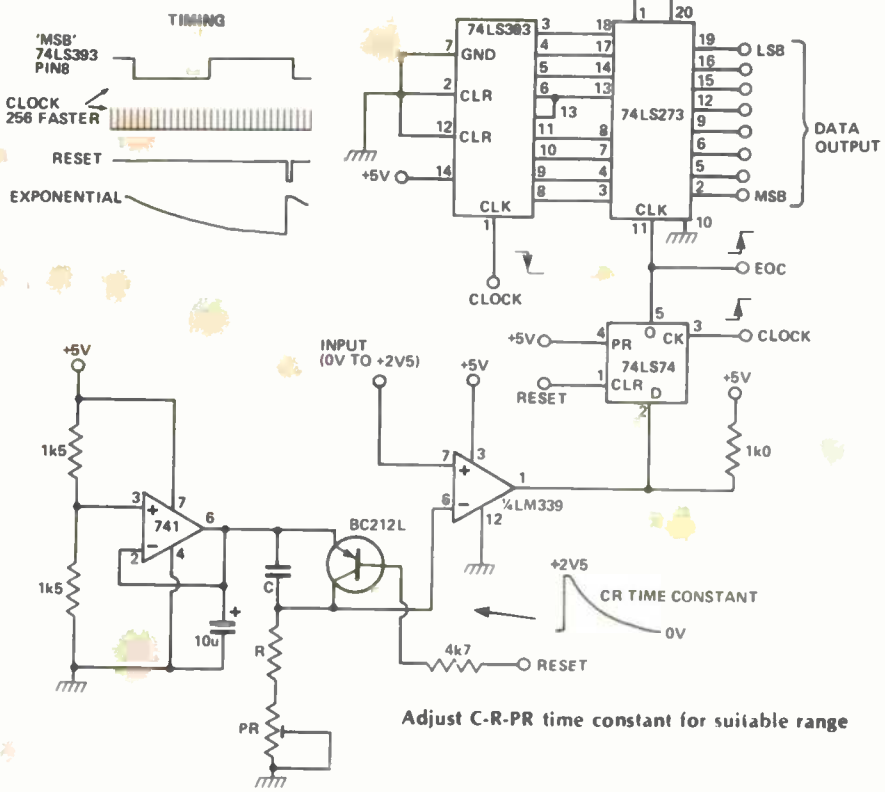
Debouncing Using Schmitt Triggers







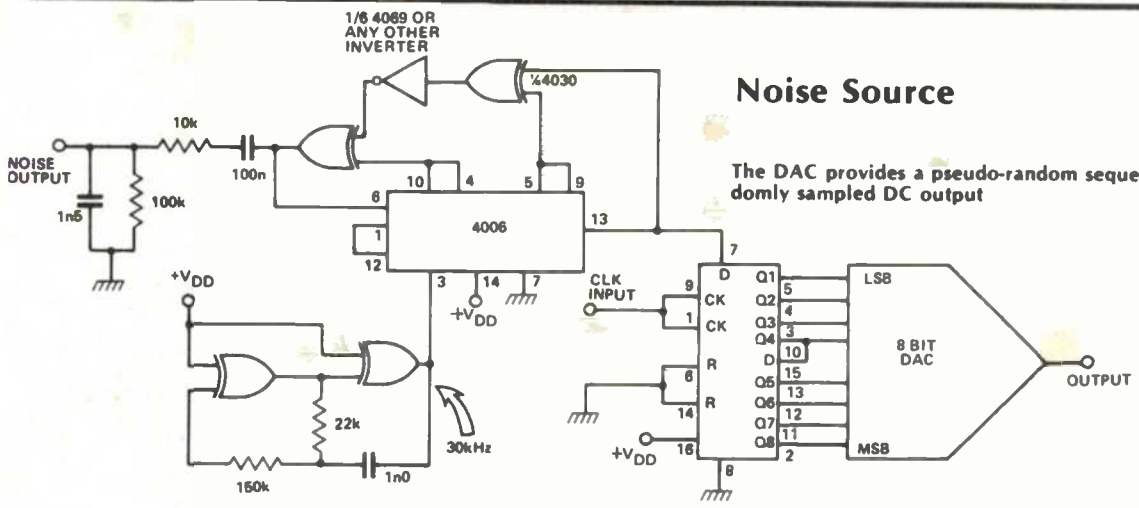
Logarithmic ADC

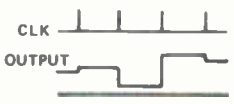


Adjust C-R-PR time constant for suitable range

Noise Source

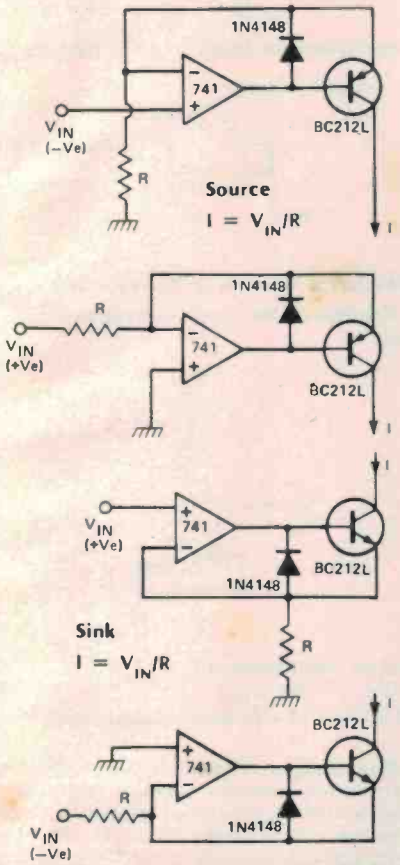
The DAC provides a pseudo-random sequence generator, with a randomly sampled DC output





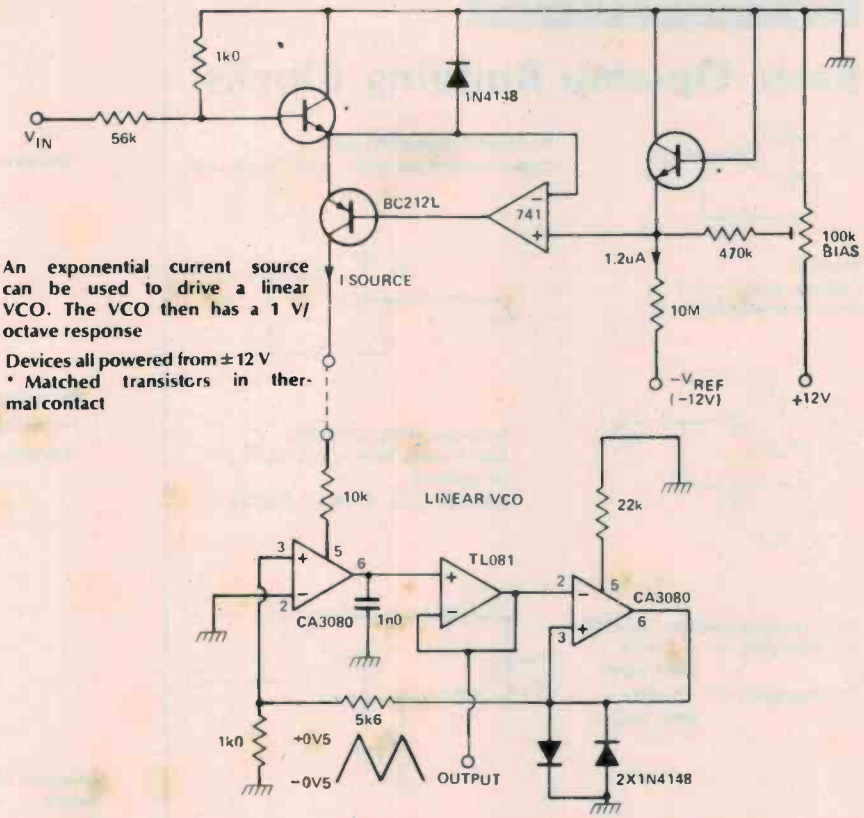
BUILDING BLOCKS

Voltage-to-current Converters



Frequency response of a linear VCO driven by an exponential current sink

Exponential Current Source

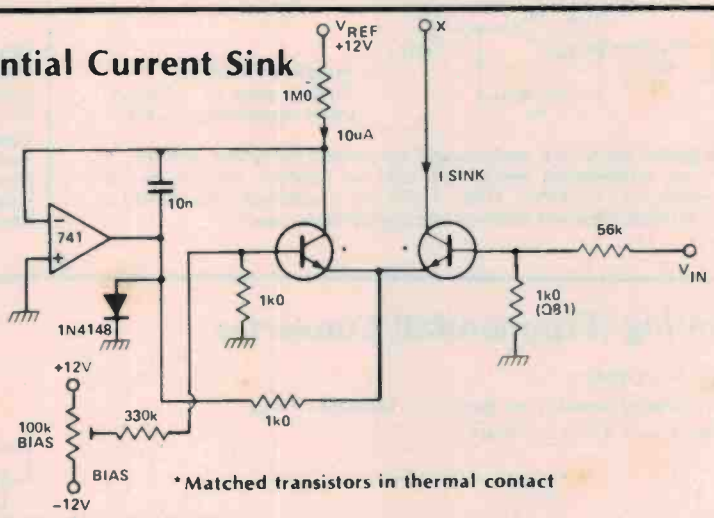


An exponential current source can be used to drive a linear VCO. The VCO then has a 1 V/octave response

Devices all powered from ± 12 V

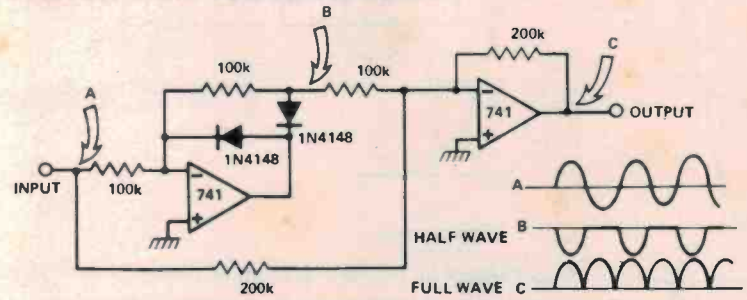
* Matched transistors in thermal contact

Exponential Current Sink

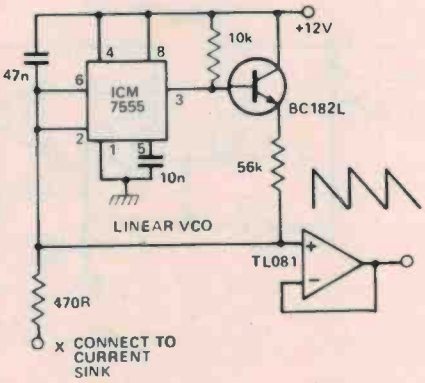


*Matched transistors in thermal contact

Precision Full Wave Rectifier

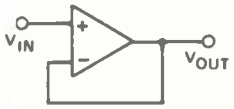


This is a simple full wave rectifier circuit suitable for many applications. The main limitation is due to the speed of the 741. For use above about 10 kHz an alternative op-amp should be used, such as the TL072.



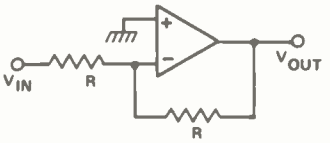
BUILDING BLOCKS

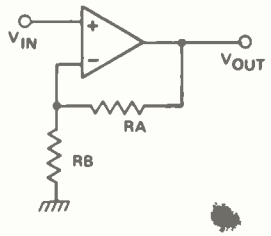
Basic Op-amp Building Blocks



Voltage follower/buffer
Input must have a DC path to ground

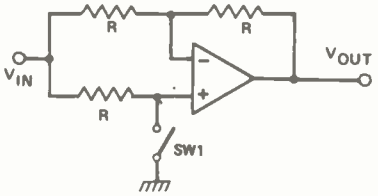
Inverter
Voltage gain = −1
input impedance = R

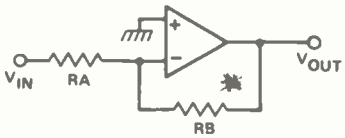




Non-inverting amplifier
Input must have a DC path to ground
Voltage gain = (RA + RB)/RP

Inverter/non-inverter amplifier
Voltage gain = +1 with SW1 open
Voltage gain = −1 with SW1 closed

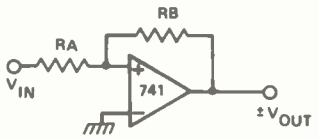




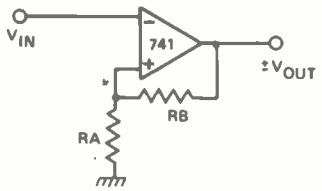
Inverting Amplifier
Voltage gain = −RB/RA
Input impedance = RA

The power supply and compensation are omitted from these diagrams. If internally compensated devices are used no additional compensation is necessary, i.e: 741, TL071, TL072, TL074, etc. If additional compensation is required consult the data sheets on the particular device used.

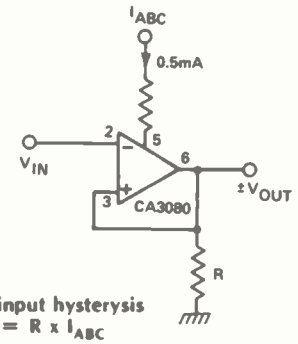
Schmitt Triggers



Non-inverting; input hysterysis levels = $\pm(RA/RB) \times V_{OUT}$



Inverting; input hysterysis levels = $\pm(RA/(RA+RB)) \times V_{OUT}$
Note that V_{OUT} depends on the supply voltage and the individual op-amp

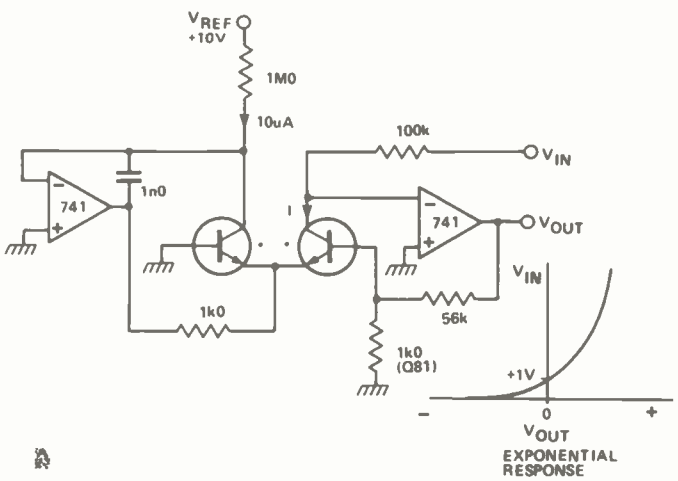


Transconductance type; input hysterysis levels = $\pm V_{OUT}$; $V_{OUT} = R \times I_{ABC}$
R can be replaced by two 1N4148 diodes back-to-back

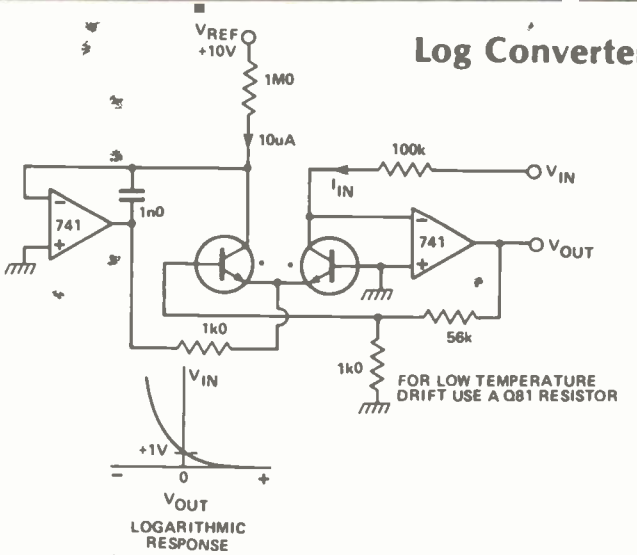
When trying to convert a slowly changing voltage into a step function with a well-defined leading edge a good Schmitt trigger is invaluable. This is a simple but effective trigger capable of good results in the audio passband. Once again, for higher frequency use substitute a faster op-amp for the 741. The Schmitt trigger works by using positive feedback to establish a 'deadband', a range of input voltages within which the output state will not change. The input voltage must exceed the higher limit in order to force the output high. Similarly, the input voltage must be taken below the lower limit to force the output low. The extent of this deadband is given in the equations.

Antilog (Exponential) Converter

$V_{OUT} = I \times 100k$
The current I doubles for every 1 V increase of V_{IN}
When $V_{IN} = 0$ V, I = 10 uA



Log Converter

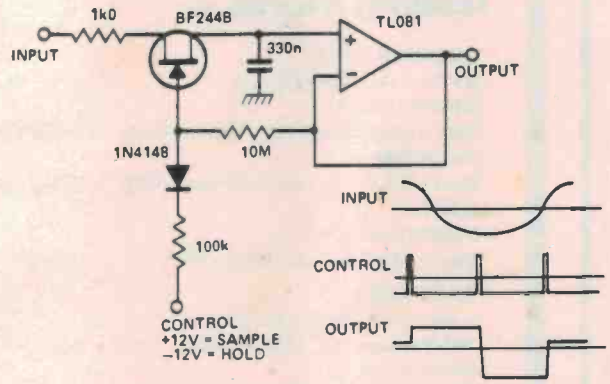


V_{OUT} changes by 1 V for every octave change of the I_{IN} current

*The matched transistors can be two BC212L in thermal contact, or a dual transistor (LM394), or pat of an array (CA3046)

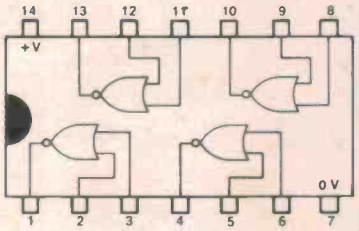
FET Sample And Hold

Control = +12 V; sample
Control = −12 V; hold

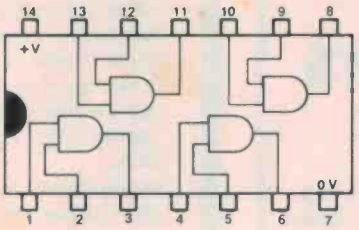


Use a printed circuit guard ring (connected to the output voltage) around the hold capacitor

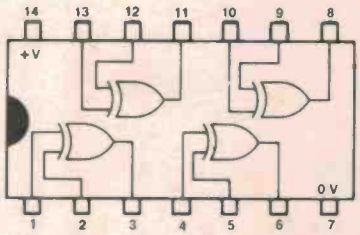
Pinouts



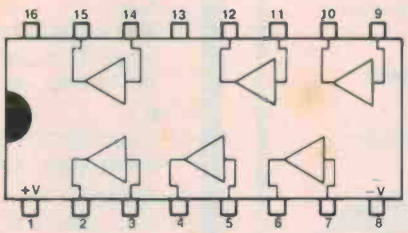
74LS02



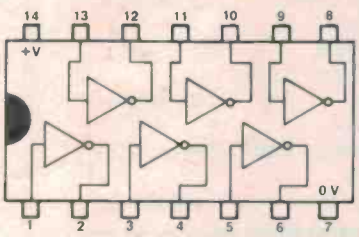
74LS08



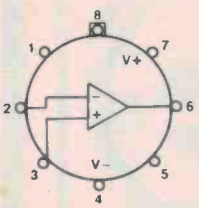
4030



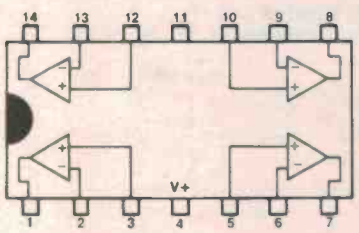
4050



7406 (TTL)
40106B (CMOS — SCHMITT)
74LS14 (LS — SCHMITT)
4069 (CMOS)

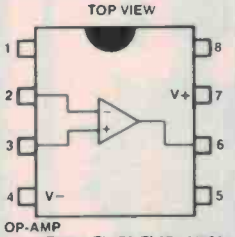


OP-AMP
741, LM108H, LM208H, LM308H, LM301



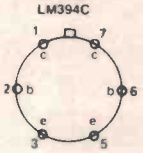
QUAD OP-AMP
LM324, TL074

TOP VIEW

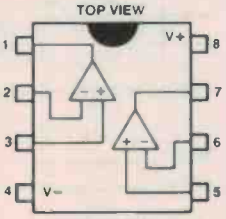


OP-AMP
741, NE5534, TL070, TL071, LM301

TOP VIEW
LM394C



TOP VIEW



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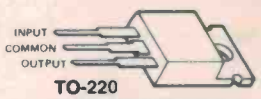

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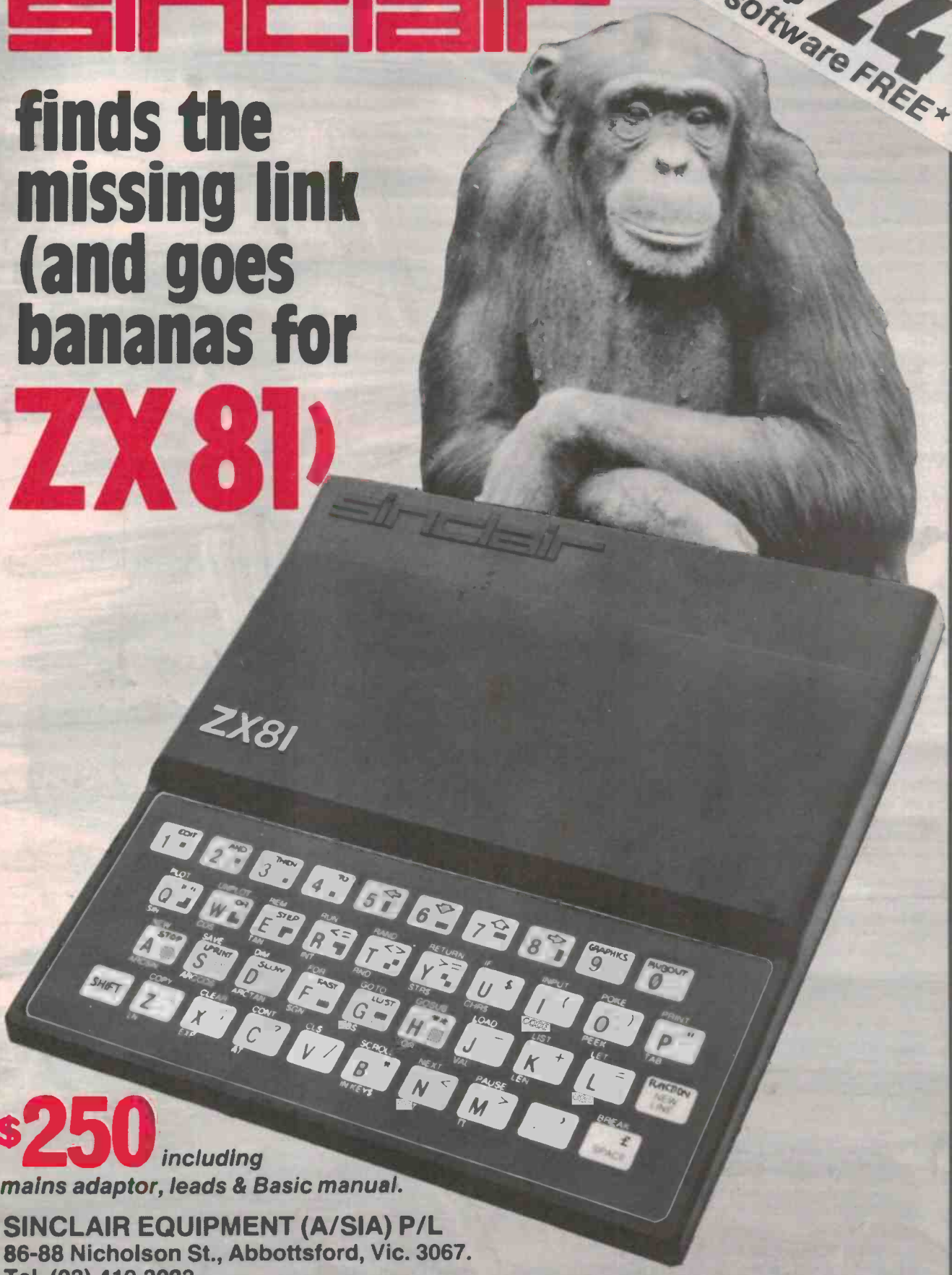

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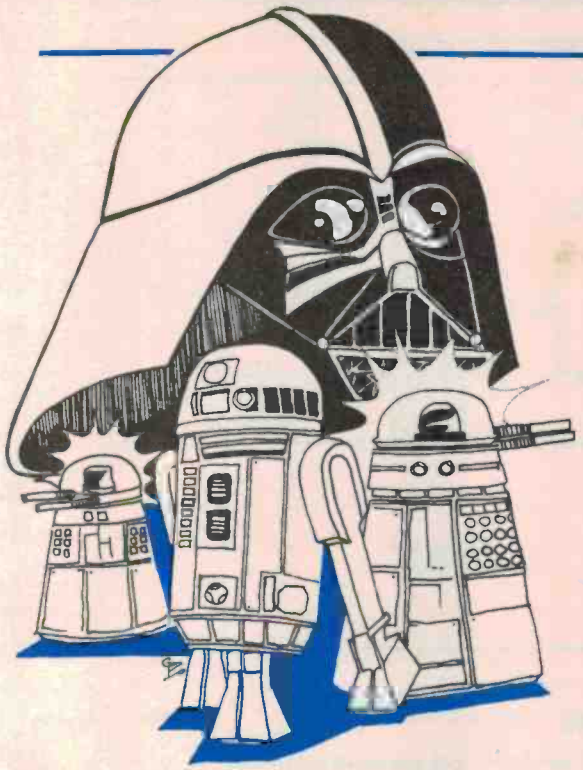


Tremolo to See-Threepio, Darth Vader to Daleks — all from our Sound Bender!

Based on a remarkably versatile function generator IC, the XR2206, this project is capable of modifying an audio signal to produce tremolo effects on music or those peculiar, metallic robot voices so abundantly found in shows like 'Dr Who', 'Star Wars', 'Star Trek', etc.

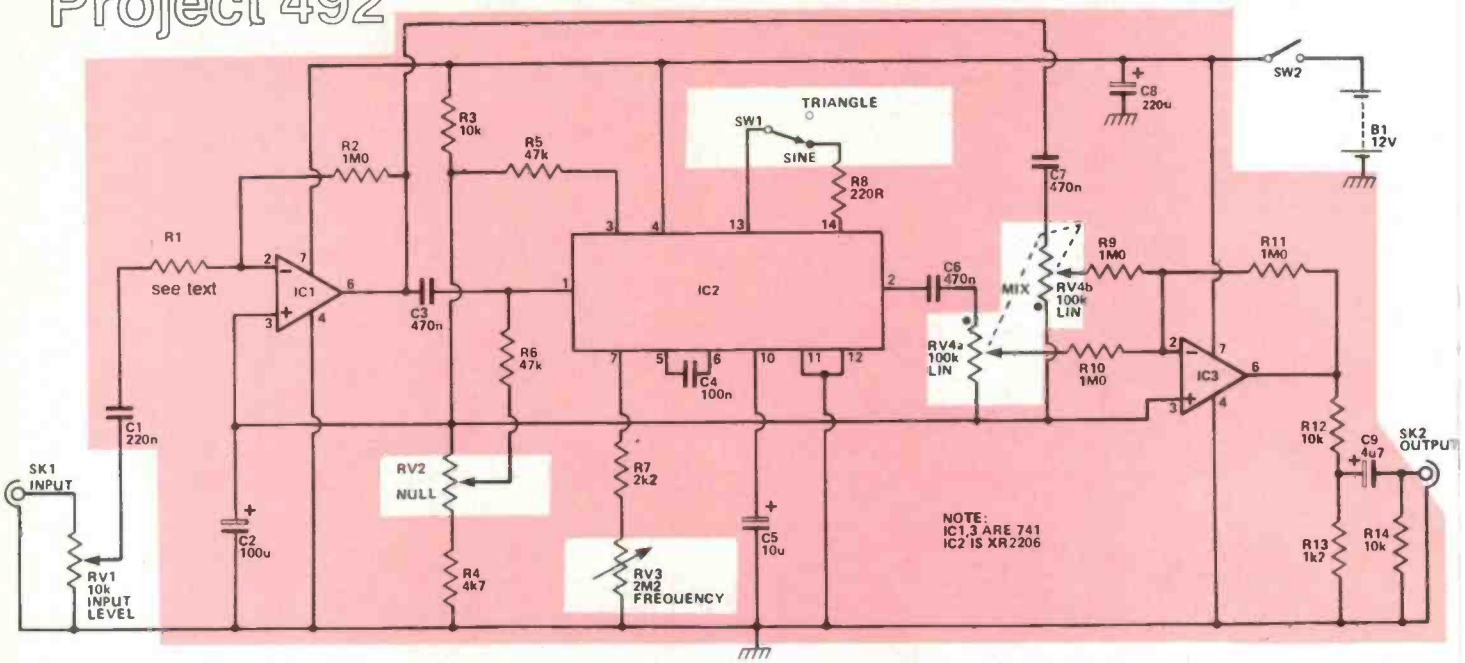
Design: **Ray Marston** Development: **Roger Harrison**

'VARIETY is the spice of life' goes a famous old saying, and when electronics entered the musical arena, engineers and musicians sought ways of extending the variety of available musical sounds, some by developing electronic 'instruments', others by developing circuits that modified the sound produced by the voice or an instrument. Deliberately introducing plain old distortion gave rise to the 'fuzz box', amplitude modulating the sound gave a 'tremolo' effect, etc.

Now, a device developed to permit more conversations per line on the telephone system was discovered to produce a range of 'intelligible', but highly modified, sounds from voice and music signals. Called variously a 'ring modulator' or 'four-quadrant multiplier', it is achieved by mixing an audio signal with an oscillator signal, and the output is the product of these two signals, containing both sum and difference frequencies. The oscillator or 'carrier' signal is reduced or suppressed. If, for example, the carrier frequency is 1 MHz and the audio signal is speech with a range of around 150 Hz to 3 kHz, the ring modulator's output would be two 'sidebands' — a 'lower' one (the difference) at 997 kHz to 999.85 kHz and an 'upper' one (the sum) at 1000.15 kHz to 1003 kHz. The 1 MHz carrier level could be 20 dB to over 40 dB lower in level than the sidebands, depending on how 'good' the ring modulator is. If the carrier is set at 1 kHz, though, the sum and difference frequencies at the output spread up and down the audio spectrum, and if speech is the input you get a jumble of voice sounds, some shifted up in frequency, some inverted and apparently shifted down in frequency. The best examples we can cite are the voices of Darth Vader from 'Star Wars', the Daleks from 'Dr Who' and the Cylons from 'Star Trek'. If the carrier is placed at a sub-audible frequency, then the result is a tremolo effect, where the audio signal is seemingly amplitude modulated at a slow rate.

The XR2206 function generator IC contains a voltage-controlled oscillator and a four-quadrant multiplier or ring modulator, so in one chip we have both the carrier oscillator and the modulator that can be combined in a circuit to produce the effects we seek. As the panel on page 40 shows, which explains the XR2206 and typical applications, the IC also includes internal control and signal shaping circuitry, making the circuit design job a whole lot simpler.

This project is designed to make full use of the functions incorporated in the XR2206 for this application, and the IC's VCO — used here as the carrier ▶



HOW IT WORKS — ETI 492

By mixing or 'multiplying' an audio signal with an oscillator or 'carrier' signal that may be varied from the sub-audible to the mid-range of the audio spectrum, the original signal may be altered in a variety of ways. Mixing an audio signal with a sub-audible carrier produces a tremolo effect — a form of amplitude modulation; mixing speech with a carrier around 1 kHz to 2 kHz produces 'robot' voices. That's just to name a few of the more familiar effects possible.

The heart of this unit is IC2, an XR2206 function generator chip that incorporates a multiplier — used to perform the modulating function — plus a voltage controlled oscillator (VCO), signal-shaping circuitry, and control circuitry that permits simple variable resistance control of the VCO. The signal-shaping circuitry permits generation of sine or triangle waveforms out of the VCO.

There are three sections to the circuit: the input amplifier (IC1), the mixer/carrier generator (IC2) and the output mixer/buffer (IC3).

The audio input signal enters via SK1 and RV1, the level control. The signal is coupled to the input op-amp IC1, which has a gain of 10 or 100 depending on the choice of value of R1. If R1 is 100k, the gain of this stage is 10, for 10k the gain is 100. The output of IC1 is coupled to the 'AM input' of IC2 and also to the input circuitry of the output buffer/mixer via C7 and RV4b.

In this application, the VCO in the XR2206 can produce either sine or triangle waveforms by means of switching a resistor in or out of circuit with SW1. A triangle waveform contains odd harmonics, which give a 'rough' or 'dirty' sound. A sinewave with little distortion has almost inaudible harmonics and thus sounds 'clean'. This is important, as we shall see shortly. The frequency of the VCO can be varied over the range from 3 Hz to about 5 kHz by means of RV3, the 'frequency' control. The frequency is determined by the values of C4, R7 and RV3. The AM input of IC2, pin 1, has a dc bias applied to it via R6, the bias voltage being determined by a divider network between the two supply rails consisting of R3, RV2 and R4. RV2 permits variation of the bias so that critical balancing of the XR2206's multiplier can be achieved to 'null out' the carrier signal (from the VCO). This 'null' control is normally adjusted to produce zero output with no audio signal input.

When an audio signal is applied, the multiplier in the XR2206 produces a *double sideband suppressed carrier* output signal. The output is taken from pin 2, via the internal buffer. Let's take a simple case to show what the multiplier does. Say the VCO is set to a frequency of 1 kHz. With the multiplier balanced there is zero output. Now, if a signal at 440 Hz ('A') is applied to pin 1 of the XR2206, the resultant output will be two frequencies: 1440 Hz and 560 Hz (the sum and the difference). Note, no trace of the carrier — this is a result of using a *balanced* mixer or multiplier. Now, say the audio input is 440 Hz (again), and the VCO is set to 5 Hz. The output will be 445 Hz and 435 Hz. Now, as every musician knows, two instruments tuned a few Hertz apart will produce a 'beat' when sounded together. The beat is perceived as an amplitude variation of the sound — if the effect is deliberately obtained, it is called 'tremolo'.

This applies for the case where the carrier is a 'pure' sinewave. If the carrier contains harmonics, then these too will produce sum and difference products when multiplied with the audio input signal and a complex output will result. Thus for a 'clean-sounding' output, switch SW1 to SINE, for a 'dirty-sounding' output, switch SW1 to TRIANGLE.

The output from the multiplier in the XR2206 is taken from pin 2 (from the internal buffer, as mentioned before). It is coupled to RV4a via C6. Now, RV4 is a dual-gang potentiometer with the 'bottom' end of RV4a connected to the 'top' end of RV4b. With RV4 at the fully anticlockwise position, no signal from pin 2 of IC2 is coupled to the input of IC3, while the full output of IC1 is coupled to the input of IC3. With RV4 at the fully clockwise position, the full output from pin 2 of IC2 is coupled to the input of IC3, while none of the output from IC1 is coupled to the input of IC3. Thus by varying RV4 from one extreme to the other you can obtain a varying proportion of 'direct' to 'modulated' signal.

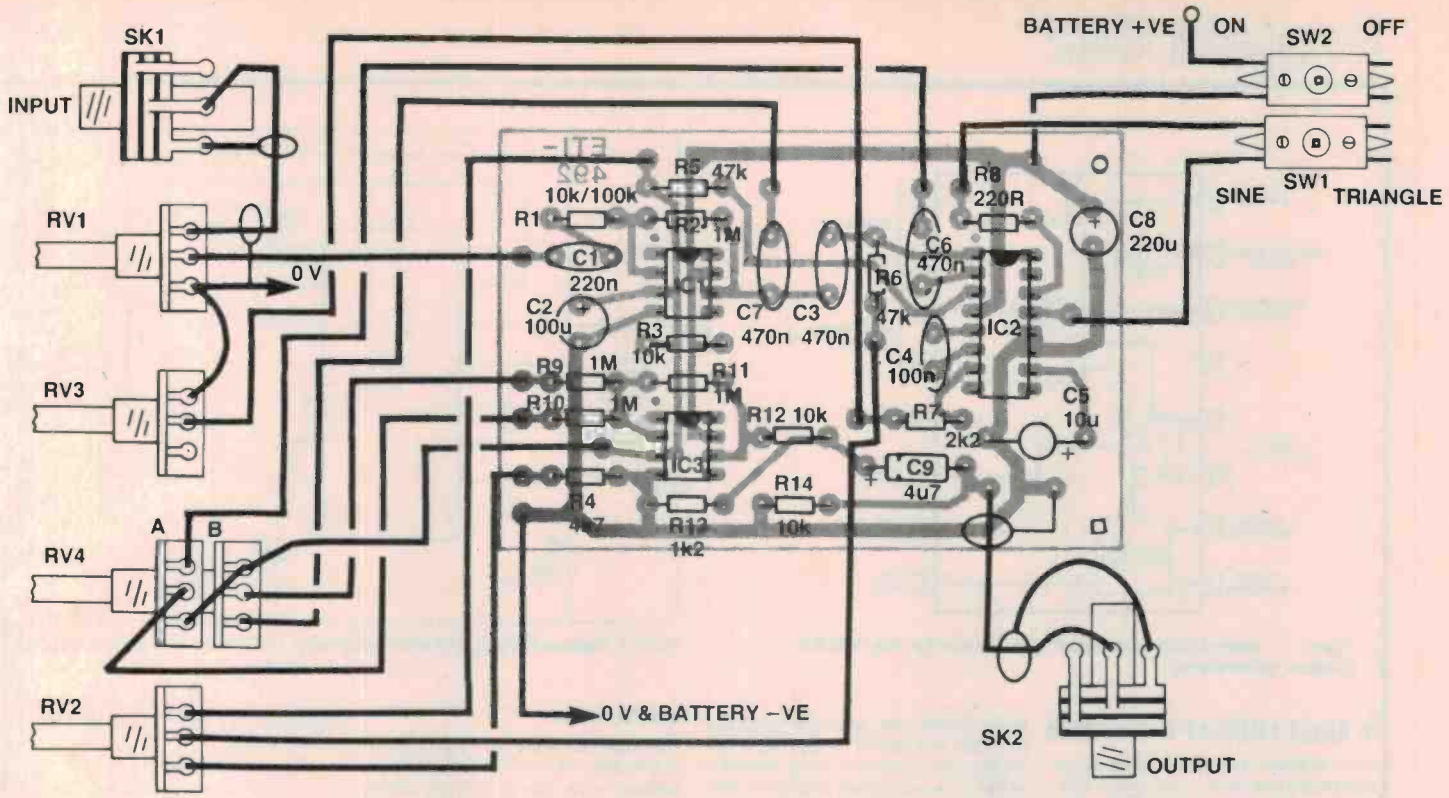
The output from IC3 is passed to SK2 first via an attenuator (R12, R13) that provides a division of 10 so that with the gain of IC1 set at 10 (R1 100k) the project has unity gain. From the attenuator the signal passes to SK2 via C9. R14 provides a dc return for the output circuit. If you wish, R13 may be omitted and R12 replaced by a link.

Capacitor C8 is a supply rail bypass, and capacitor C5 is a bypass for the internal reference of the XR2206. The non-inverting inputs of IC1 and IC3 are biased up to half the supply rail voltage by strapping them to the junction of R3 and RV2. This is done to provide a 'virtual earth' rail for these two ICs, which normally require a dual supply rail, whereas the XR2206 does not. Capacitor C2 serves as a bypass for this virtual earth rail. The multiplier direct output requires tying to the virtual earth rail also, as shown in the XR2206 application notes, and R5 does this. Note that the supply voltage can be anywhere between 9 V and 15 V. The circuit only draws a few milliamps (roughly, between 10 mA and 15 mA or so) and may be readily battery operated.

oscillator — spans a frequency range from 3 Hz to 5 kHz using a single control pot. To 'harden' or 'soften' the effect produced a 'triangle' or 'sine' oscillator waveform can be selected by a switch, and a two-channel mixer with a 'pan' control pot is incorporated on the output so that you can blend the 'direct' to 'modified' sounds to provide some control over the effect. In addition, a 'null' control has been provided as it is necessary to reduce the level of the carrier signal fed through to the output from the IC's modulator or multiplier.

The project can be operated from input levels as low as a few millivolts (e.g: microphone) or line levels of 100 mV or greater (e.g: preamp output, such as the 'effects send' on a mixer).

The Sound Bender may be powered from a supply ranging from 9 Vdc to 15 Vdc and draws typically between 10 mA and 15 mA current. A small dc plugpack would make an ideal power supply.



Alternatively, it may be battery operated.

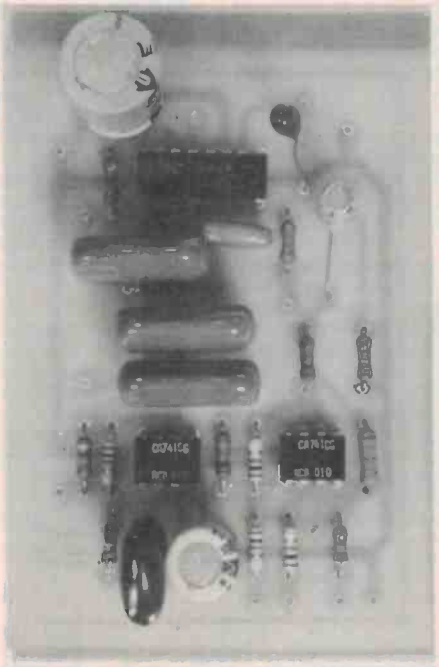
Construction

We have not described details of a case, front panel, etc, as this project will undoubtedly find a wide variety of uses and we leave it to individual contructors to arrange their own housing. Fortunately, housing is not critical, providing the controls are not mounted too far from the pc board. Leads from the board to the controls should be kept as short as possible, less than 300 mm preferably, as this avoids possible feedback and hum pick-up problems. If the unit is to be mounted in other equipment, keep it away from transformers and mains leads, or thoroughly shield it, again to avoid hum pick-up.

Construction should commence with the pc board. Solder IC1 and IC3 (the two 741s) in place first, taking care that you get them the right way round. They both face in the same direction. Next, insert all the resistors and solder them in place. You'll have to decide at this stage whether you use a 10k or a 100k resistor for R1, as noted with the circuit. The XR2206, IC2, may be inserted next. As it is a CMOS IC, remove it from its packing carefully, taking care only to handle the ends of the pack, not touching the pins. Carefully insert it in the board and solder pin 4 and then 11 and 12. Then solder all the other pins. Take care not to overheat any of the ICs when soldering them in place. Now all the capacitors may be inserted and soldered in place. Watch that you get the orientation of C2, C5, C8 and C9 correct.

Now you're ready to wire up all the external major components. These can be mounted in any order, to suit yourself, but keep the wiring to RV1 (input level) and RV4 (mix) separated to avoid possible feedback. Use shielded cable where indicated (input and output).

Our overlay and wiring diagram gives an overall guide as to assembly and wiring of the unit.



Using it

To try out the Sound Bender, connect a supply (battery, plugpack or bench supply — what-have-you) and connect the output to the input of an audio amplifier. We pressed the ETI-453 General Purpose Amp module (April '80) into service. As we wanted to use a microphone, a 10k resistor was used for R1. Set the Sound Bender's input level to zero, set the mix control fully clockwise, and turn up the audio amp's input gain. SW1 may be set to sine or triangle, it doesn't matter. If you don't hear a whistle, rotate the frequency control until you do. Then vary the null control until you obtain minimum output. This null will be quite sharp so take it slowly. A big knob on the pot shaft or a small vernier would assist. A 10-turn pot here might seem extravagant, but some users may find it useful. ▶

PARTS LIST ETI-492

Resistors	**all ½W, 5%**
R1	100k
R2,9,10,11	1M
R3,12,14	10k
R4	4k7
R5,6	47k
R7	2k2
R8	220R
R13	1k2
RV1	10k lin.
RV2	5k lin.
RV3	2M2 lin.
RV4	100k dual lin.
Capacitors	
C1	220n greencap
C2	100u/16 V electro.
C3,6,7	470n greencap
C4	100n ceramic
C5	10u/25 V electro or tant.
C8	220u/16 V electro.
C9	4u7/16 V axial electro.
Semiconductors	
IC1,IC3	741
IC2	XR2206
Miscellaneous	
ETI-492 pc board; two SPDT miniature toggle switches, two phono sockets; case to suit; wire; knobs; nuts and bolts, etc.	
Price estimate	**$28 — $35**

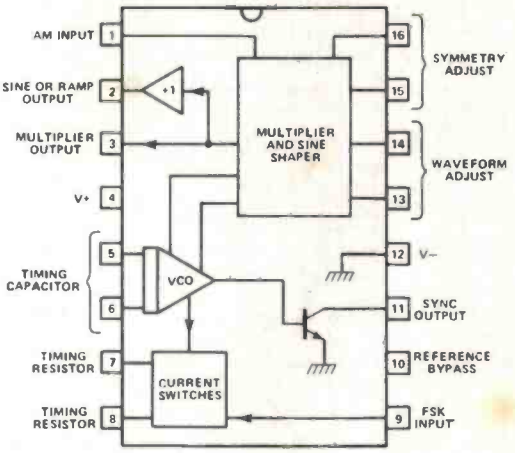


Figure 1. **Internal block diagram and pinout for the XR2206 function generator IC.**

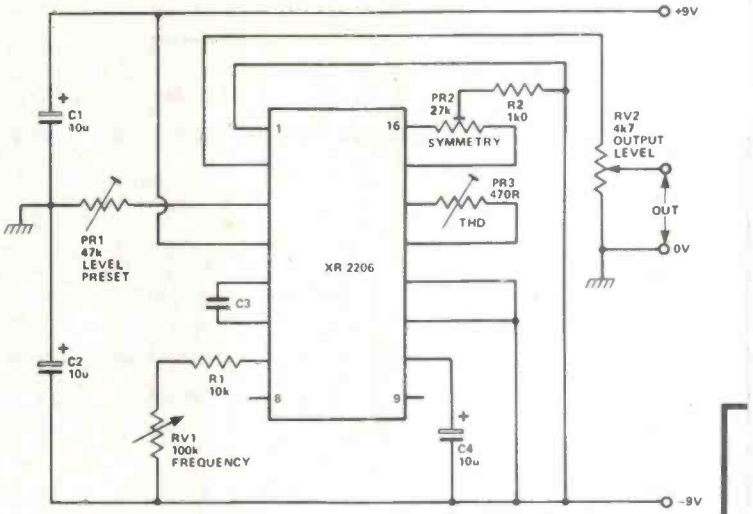


Figure 2. **High-performance sinewave generator. See Table 1 for values of C3.**

A BRIEF LOOK AT THE XR2206

The XR2206 integrated circuit is undoubtedly one of the most useful function generator or waveform generator chips available. It can generate sine, square, triangle, ramp and pulse waveforms at frequencies ranging from a fraction of a Hertz to several hundred kiloHertz, using a minimum of external circuitry. The frequency can be swept over a 2000:1 range using a single control voltage or resistance, and sinewave distortion can typically be as low as 0.5%. The chip incorporates special built-in modulation facilities that enable the generated waveforms to be subjected to AM or FM control, or to phase-shift or frequency-shift keying.

The XR2206 chip is housed in a standard 16-pin DIL package and can be powered from either single or split supplies in the range 10 to 26 V. The sinewave output of the device has maximum amplitude of about $2V_{RMS}$ and output impedance of 600R. The frequency stability of the IC is excellent, being about 20 ppm/°C for thermal changes and 0.01% V for supply voltage changes.

Figure 1 shows the pinout and internal block diagram.

WAVEFORM GENERATION

The XR2206 is a reasonably easy IC to use for basic waveform generation. A high-performance sinewave generator is shown in Figure 2. It requires a split supply rail, but total harmonic distortion at the output is typically less than 0.5%. Adjustment of trimpots PR2 and PR3 with a distortion meter connected to the output is necessary, but the THD holds over the frequency range. Trimpot PR1 requires setting for correct operation first, however. Disconnect PR3 (to obtain triangle output), then adjust PR1 until no clipping of the output waveform is visible on a 'scope hung on the output.

Note that the signal appearing on pin 3 of the IC is similar to that on pin 2, but has lower distortion and higher output impedance. Also, the signal on pin 3 is very nearly symmetrical about 0 V but that on pin 2 has an offset of several hundred millivolts. If desired, a slight dc offset may be applied to pin 3 to reduce the offset on the output signal from pin 2 — as shown in Figure 3.

The XR2206 will generate linear triangle waveforms by deleting PR3. A sine/triangle/square wave function generator is shown in Figure 4. Rise and fall times of the square wave output are typically 250 ns and 50 ns respectively, with pin 11 loaded by 10 pF.

C3	FREQUENCY RANGE
1u0	10 Hz TO 100 Hz
100n	100 Hz TO 1 kHz
10n	1 kHz TO 10 kHz
1n0	10 kHz TO 100 kHz

Table 1. Values of C3 for different frequency ranges.

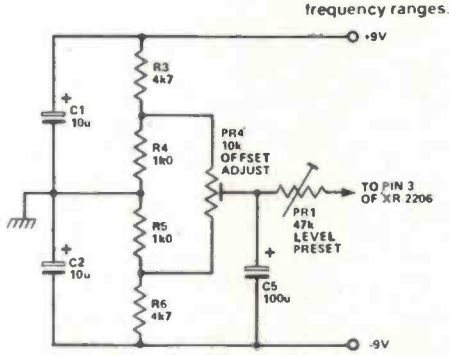


Figure 3. **Add-on modification for applying a limited dc offset for output signal dc nulling of the circuit in Figure 2.**

MODULATION

The amplitude of the pin 2 output signal of the XR2206 can be modulated by applying a dc bias and a modulating signal to pin 1 as shown in Figure 5. The amplitude of the pin 2 signal varies linearly with the applied voltage on pin 1 when this voltage is within 4 V of the half-supply value of the circuit; in split-supply circuits, of course, the half-supply value equals 0 V. When the pin 1 voltage is reduced below the half-supply value the pin 2 signal again rises in direct proportion, but the phase of the output signal is reversed. This last-mentioned phenomenon can be used for phase-shift keyed (PSK) and suppressed carrier AM generation.

The pin 1 terminal of the IC can also be used to facilitate gate-keying or pulsing of the pin 2 output signal. This can be achieved by biasing pin 1 to near half-supply volts to give zero output at pin 2, and then imposing the gate or pulse signal on pin 1 to raise the pin 2 signal to the desired turn-on amplitude. The total dynamic range of amplitude modulation is 55 dB.

The frequency of oscillation of the XR2206 is proportional to the total timing current (I_T) drawn from pin 7 or 8, and is given by:

$$f = \frac{320 \times I_T}{C} \text{ Hz}$$

where I_T is in milliamps and C is in microfarads.

The timing terminals (pins 7 and 8) are low-impedance points and are internally biased at 3 V with respect to pin 12. The frequency varies linearly with I_T over the current range 1 uA to 3 mA. Consequently, the frequency can be voltage-controlled by applying a voltage in the range 0 to +3 V between pin 12 and the timing terminal via a suitable resistor, so that the timing current is determined by the resistor value and the *difference* between the internal (+3 V) and external (0 to 3 V) voltages. This simple technique can be used to either frequency sweep the generated signals using an externally applied sawtooth waveform, or to frequency-modulate the waveforms with an external signal.

Figure 6 shows the basic method of applying FM to the standard XR2206 circuit. Here, the external modulation signal is applied to the junction of R1-RV1 via blocking capacitor C1.

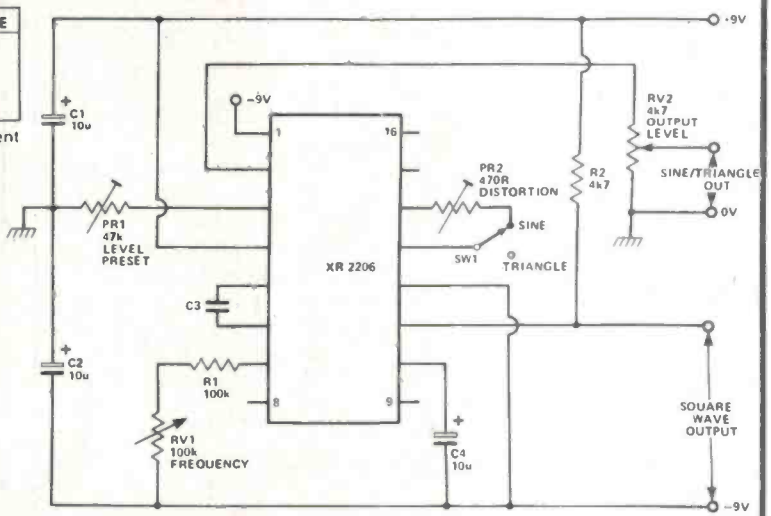


Figure 4. **Simple sine/triangle/square wave generator. See Table 1 for values of C3.**

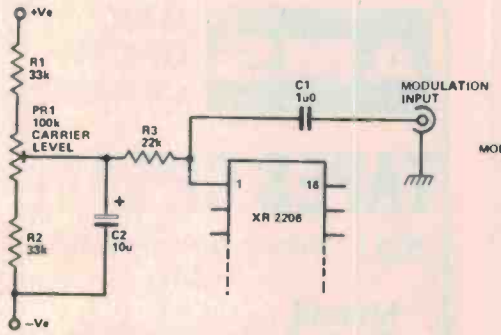


Figure 5. How to add an amplitude modulation (AM) facility (split-supply circuit, as per Figure 2).

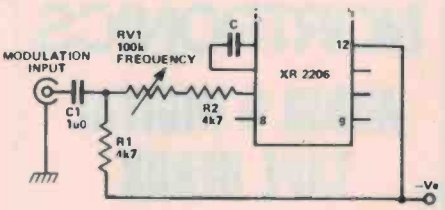
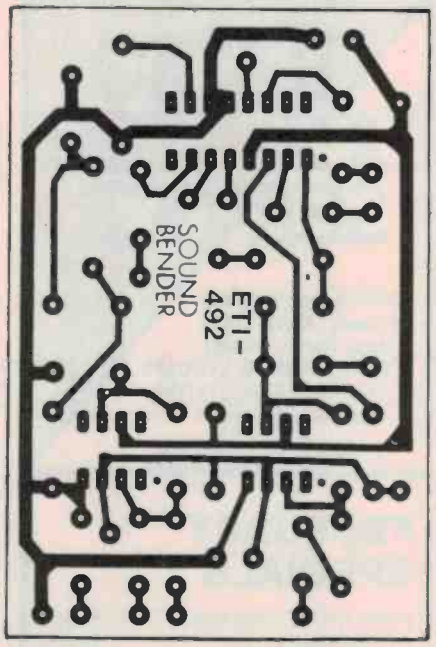


Figure 6. How to add a frequency modulation (FM) facility (split-supply circuit, as per Figure 2).



Note that the null is not perfect and there is some carrier feedthrough. However, this can be reduced and the effect-to-carrier leakage ratio improved by judicious adjustment of the mix and input level controls. Keeping the mix control somewhat back from the all-modulated end and the input level up does the trick.

Having nulled the multiplier, plug in a mike or signal source and advance the input level. Set SW1 to triangle for a 'dirty' sound. If the frequency is set to minimum (fully anti-clockwise), you will hear a tremolo effect. Setting the frequency control about two-thirds advanced you will be able to obtain 'Daleks', 'Darth Vaders', etc, with speech input. With the mix control you can 'fine tune' the effect quite well — we rarely used it fully clockwise (all modulated).

The unit performs best with a 'single signal' input — such as voice or one instrument (such as a guitar). Complex signals, such as from a band or orchestra, end up a confused jumble.

With SW1 set for a sinewave modulating signal, the effect produced is 'soft', while the effect produced when SW1 is set for a triangle wave modulating signal is 'hard'.

We noted that there seems to be some slight delay in the signal through the IC — or the modulator produces a similar effect — and the output sounds a bit 'echoey', especially when the frequency is very low, as on the tremolo effect.

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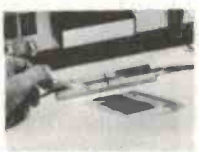

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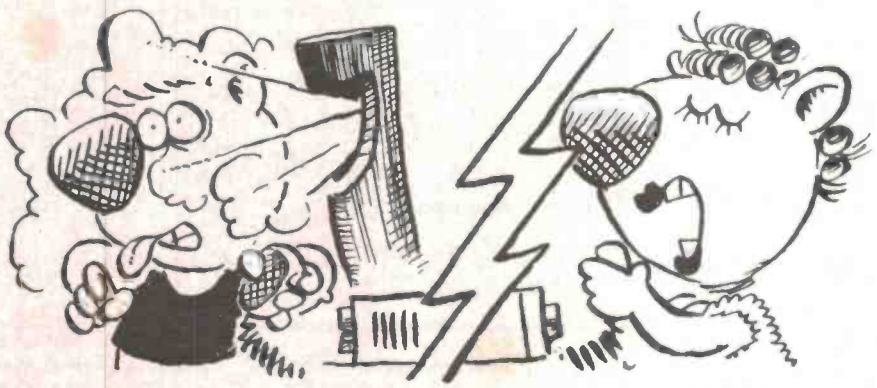
'Selectacall' add-on for ham/CB transceivers

Jonathan Scott VK2YBN

If you're listening on a channel for some particular station to call, but don't want to listen to the 'background chatter', then this simple accessory holds the mute shut until that 'certain party' calls — no tones or funny noises required.

ARRANGING occasional or regular contacts with a friend on-air is a pretty common practice, particularly on the VHF and UHF bands. The problem is that listening to the background chatter of other channel users — 'reading the mail', as they say — until the station you're listening for calls can be tedious. If your receiver could be muted until the wanted station calls, you wouldn't be distracted by the background chatter. Such a system was devised many years ago and became generally known as 'selective calling', which was abbreviated to 'selcall' or similar. The system employs a series of tones transmitted in a coded sequence. The listening station's receiver has a decoder fitted which detects that the correct tone code has been received and opens the mute. At least one commercially available CB rig has this as an optional extra (the Sawtron).

This project is a simpler version. No tones are employed. Instead, the 'calling' station simply keys his transmitter a pre-arranged number of times within a set period and the 'listening' station's receiver decodes this and triggers an alarm and an indicator. Optionally, the listening station's transceiver can be keyed by the decoder to indicate or acknowledge reception of the caller's code (QSL for the cognoscenti). As the decoder depends for its operation on the receiver mute detecting a carrier, it is only suited to AM or FM operation. ▶



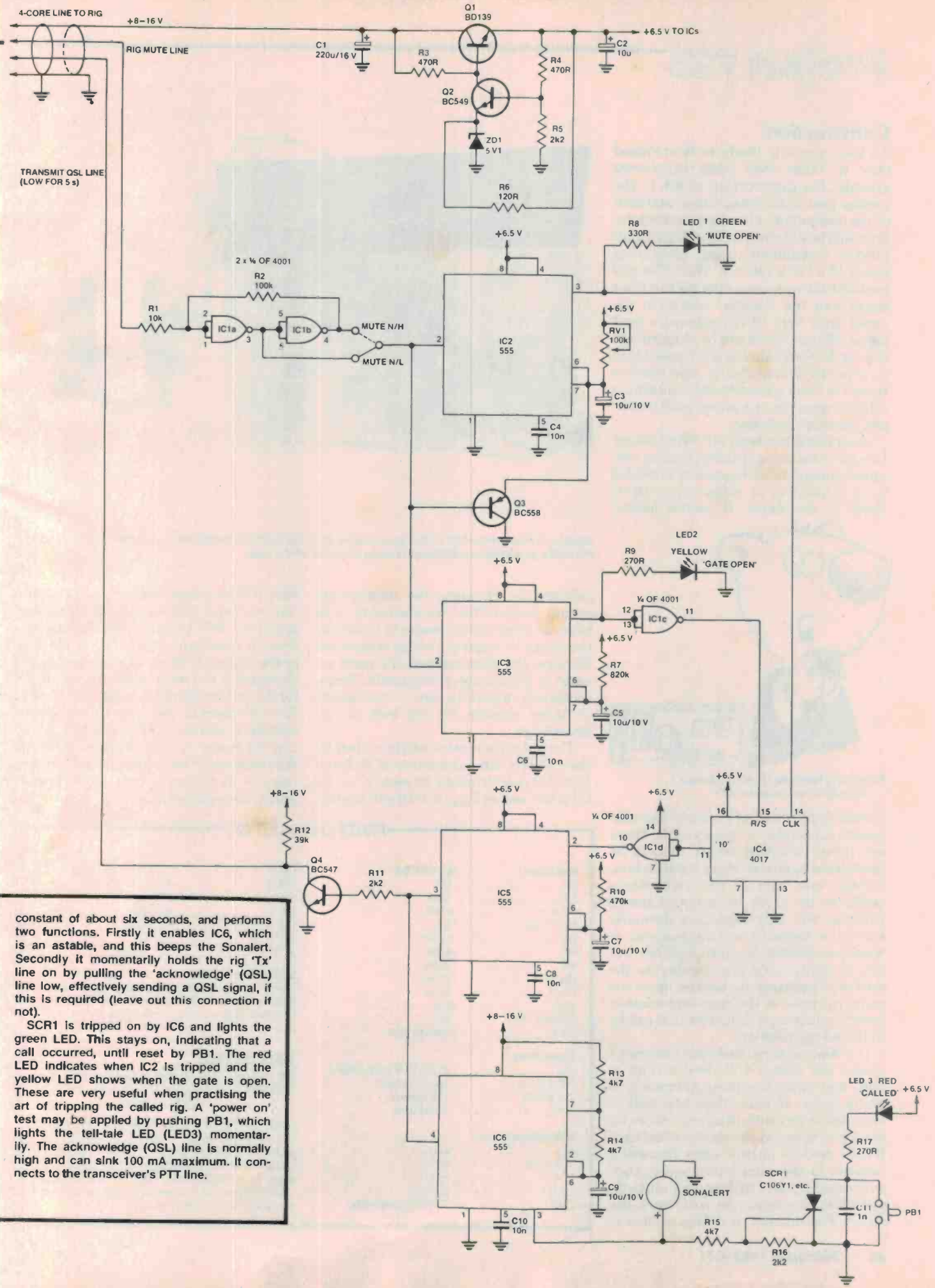
'Reading the mail' . . . can be tedious.

HOW IT WORKS — ETI-723

Basically, the device monitors the mute-lift signal in the receiver, searching for a string of nine (or other preset number) discrete mute-lift pulses occurring within a fixed period. The pulses must not occur too frequently (as set by a trimpot) nor may they be of too low a frequency, as they would not all be registered in the fixed period. With only a brief amount of practice, these pulses can be generated by manual depressions of the PTT button of another rig, and thus the unit will respond to a 'select-call' made without any specific hardware. The unit emits a distinctive beeping tone and sets a LED when it detects a valid call.

Initially, let us consider the idle state of the unit. ICs 2, 3 and 5 are monostable multivibrators, all of which are resting in their stable (reset) states. IC4, which is a decade counter/decoder, is held reset to 0. IC6 is disabled, and all LEDs are extinguished. IC1a and b form a Schmitt input buffer. Q1 and Q2 and associated components form a power supply regulator delivering 6-7 volts.

When the mute line shifts out of its 'closed' or 'reset' state (be this high or low, as set by an internal connection) IC1a and b send a low pulse to IC2 and IC3. Both of these monostables send their outputs high. IC3 has a time constant of about nine or ten seconds, and commences timing immediately. IC2 has a time constant of up to one second (set by RV1) and starts timing only when the mute line returns to its rest state, as a result of Q3 shorting C3. When IC2 times out as a result of the mute closing, and the period of its cycle passing, its output falls. Its cycle may be repeated by further openings and closings of the mute. Each time this occurs, IC4 is incremented by one count. Provided IC2 is triggered the required number of times before IC3 times out, IC4 will trigger IC5. IC5 has a time



constant of about six seconds, and performs two functions. Firstly it enables IC6, which is an astable, and this beeps the Sonalert. Secondly it momentarily holds the rig 'Tx' line on by pulling the 'acknowledge' (QSL) line low, effectively sending a QSL signal, if this is required (leave out this connection if not).

SCR1 is tripped on by IC6 and lights the green LED. This stays on, indicating that a call occurred, until reset by PB1. The red LED indicates when IC2 is tripped and the yellow LED shows when the gate is open. These are very useful when practising the art of tripping the called rig. A 'power on' test may be applied by pushing PB1, which lights the tell-tale LED (LED3) momentarily. The acknowledge (QSL) line is normally high and can sink 100 mA maximum. It connects to the transceiver's PTT line.

Construction

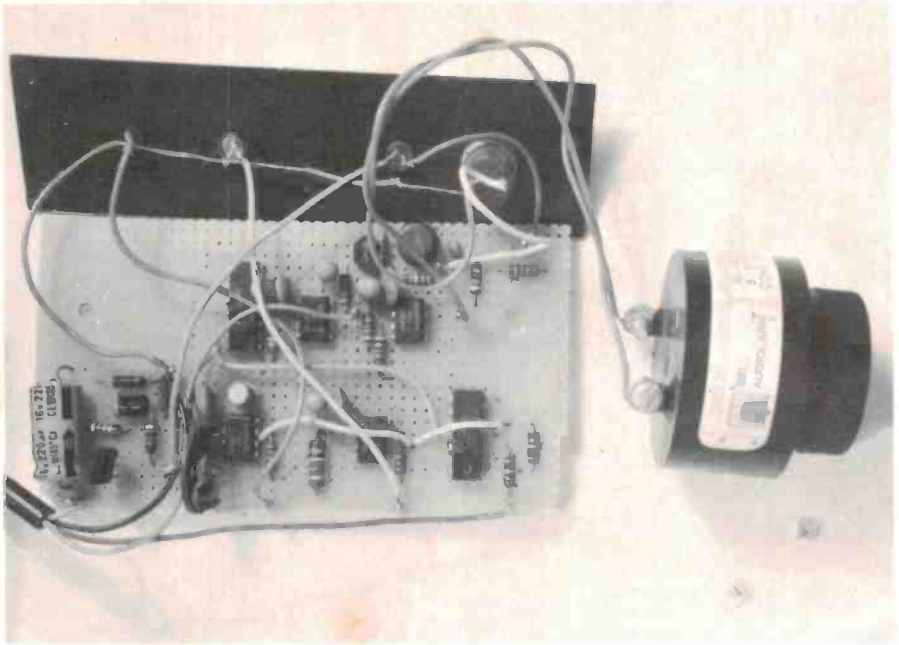
As this circuit is likely to be of appeal only to those with some experience already, the construction is left to the greater part to the imagination and skill of the individual. Our (pictured) prototype was built into one of PacTec's small plastic instrument cases measuring about 40 x 140 x 140 mm. The LEDs and pushbutton were mounted on the front panel and the Sonalert alarm in the upper case half. This produced a neat outboard unit which can be plugged into the rig. It would also be quite possible to incorporate it into the rig case itself or install it in an outboard unit containing other units such as a power amp or output monitoring device.

Our circuit was built on matrix board. Layout is not critical except that an adequate amount of RF bypassing is needed as it is likely to be subjected to strong fields in the shack. If trouble occurs,

How many times do I push the button?
. . . Why don't you answer me?

liberal application of ceramic and tantalum capacitors is prescribed. There are three variables which need to be considered before starting construction. Firstly, one only of two connections needs to be made in order to preset whether the unit expects a *normally high* or a *normally low* mute signal. It would be possible to put in a switch, but this is likely to be unnecessary as the unit will probably be hooked up to the same rig most of the time and another switch is just something else that can be in the wrong position.

It is also required to decide how many pulses the circuit will need to find to trip, and what the pulse frequency is going to be. If more than one unit is expected to be monitoring one channel it is wise to agree on the above beforehand. If two devices on the same frequency respond to the same pulse speed, they will interfere and at best be indistinguishable; at worst, one will mask the other. The number of pulses needed is



A piece of matrix board 63 x 115 mm is used to mount most of the components — layout is not critical — the LEDs, pushbutton and Sonalert being mounted on the case.

selected by choosing the appropriate output line on IC4. We elected to have nine, as there was no desire to minimise the count or separate caller sequences. Besides, the more needed, the more remote is the chance of misscalls. These, incidently, are quite rare — we had one in three months, to the best of our knowledge.

The pulse frequency 'window' is set by the relative time constants of IC2 and IC3; IC3 is set to about 10 secs ($T = 1.1 \times C5 \times R7$) and so $F_{min} = 1/10 \times 9$ (about 1 Hz). IC2 should be set by RV1 to about half a second. Allowing for the limiting speed of a PTT button finger, this represents a maximum frequency of 1½ Hz, or thereabouts. These must obviously be changed if you wish to have a very different pulse repetition range. Reducing R7 will shorten the gate time proportionately, and vice-versa. The pot., RV1, can be made to give wide or narrow windows with the values given but may require increasing if you increase the gate time significantly. ●

PARTS LIST — ETI 723

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R2	100k
R3,4	470R
R5,11,16	2k2
R6	120R
R7	820k
R8	330R
R9,17	270R
R10	470k
R12	39k
R13,14,15	4k7
RV1	100k trimpot

Capacitors

C1	220u/16 V axial electro.
C2,3,5,7,9	10u/10 V tant.
C4,6,8,10	10n ceramic
C11	1n ceramic

Semiconductors

IC1	4001
IC2,3,5,6	555
IC4	4017
SCR1	C106Y1
LED1	TIL220G green LED
LED2	TIL220Y yellow LED
LED3	TIL220R red LED
Q1	BD139
Q2	BC549
Q3	BC558
Q4	BC547
ZD1	5V1 zener

Miscellaneous

Matrix board; piezoelectric alarm (Sonalert, or similar); case to suit; pushbutton (PB1); 4-core shielded cable; cable clamp or clamp grommet, etc.

Price estimate

We estimate that the cost of purchasing all the components for this project will be in the range:

$21 — $28

Note that this is an estimate only and not a recommended price. A variety of factors may affect the price of a project such as — quality of components purchased, type of pc board (fibreglass or phenolic base), type of front panel (if used) supplied etc — whether bought as separate components or made up as a kit.

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Original design from the UK magazine "Electronics and Music Maker" April 1981. This self-contained unit can produce a variety of fixed and falling pitch effects triggered either by tapping the unit itself or striking an existing drum to which the unit is attached! The Jaycar "SYNTOM" Drum Synthesiser comes complete with a high quality PRE-DRILLED moulded all ABS box 152 x 80 x 47mm with professional silk-screened front panel.
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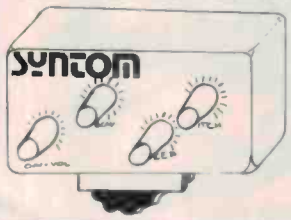

As used by WARREN CANN of "ULTRAVOX"
Send SAE for more information.

$36.50 *

programmable master rhythm generator
FULLY IMPORTED

This project was originally described in the UK publication "Practical Electronics". We have fully imported "Clef" kit
This attractive kit is presented in an attractive metal cabinet with silkscreened front panel.
The Master Rhythm can be programmed (in RAM) to play back:
– 24 Rhythm patterns 8 parallel tracks 12 instruments
It is also capable of sequence operation – the ULTIMATE UNIT

complete $199

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8 channel mixer *kit*

Due in stock before end of January
Basic functions of 19"x14" rack mountable mixer panel:
- 8 balanced inputs line/mic switch
- Input attenuator
- Bass/Mid/Treble equalisation
- Foldback & effects send
- Stereo pan
- 60mm slides
- Professionally formatted panel
- VU's on master monitors
- 5 band graphic on monitors
- Master effects send/receive
- Effects stereo pan
- Master foldback

Total cost of all above including all electronics, knobs, professional black heavy guage prepunched & silkscreened front panel – $495

Console mount chassis and power supply ONLY $98.00

Set of Cannons included in the price. (worth over $30!!!)

only $495

chorus generator kit

This kit consists of a PCB measuring 115x130mm and all components including Bucket-Brigade Delay lines and instructions. (A –15V power supply is required at an extra $14, if purchased from us). The Chorus Generator creates an apparent multiplicity of sound sources (i.e. 'Chorus') from a single-phase signal. Sophisticated but straightforward circuit using 2 BBD's, 2 VCO's, fast & slow modulator, low pass filters etc. Add new effects to your music!

only $59

"Blueprint" 5000 preamp

$275

We have produced a vast number of kits for this fantastic preamp and we have subsequently learnt a lot about them.
To celebrate our first years trading and as a tribute to the perfectionists amongst you we are offering a very special kit.
THE "BLUEPRINT" 5000 PREAMP.
This kit is individually assembled with only the highest quality components including:
- Gold plated RCA jacks on ALL phono inputs.
- 1 x pair of Gold plated RCA line plugs.
- Military specification LM194 in lieu of the commercial grade LM394.
- Low capacitance screened cable used throughout – over 12 metres total.
- All I.C. sockets provided (high quality sockets).
- Special multi-coloured LED display no cost optional extra.
- All metal film resistors used.
- Pretinned PCBs.
- Special black anodised rear panel with silkscreened white lettering and format borders.

The standard kit is still available at only $245.00.

Ref: ETI July '81-Oct '81

5000 POWER AMPLIFIER

PERHAPS THE PERFECT REALISATION OF THE CLASSIC POWERFET AMP DESIGN.

The Jaycar kit of this project is being continuously updated in quality so that the constructor will benefit. We now supply metal film 1% 50ppm resistors in place of carbon film types. All Aluminium hardware (including heatsink bracket) is now anodised in black. (Incidentally there has never been a problem with instability with Jaycar kits. We have ALWAYS used high quality capacitors).
The original square-section chassis bars are used. And then there is the Superfinish frontpanel!

Specifications: Power Output – 100 watts r.m.s. into 8 ohms x2 Frequency Response – 8Hz to 20kHz, +0 –0.4dB. Noise – 116dB below full output. Input Sensitivity – 1V r.m.s. for 100 watt output. For full specifications see magazine article on this amplifier.

Ref: ETI Jan '81-April '81

With Superfinish front panel $299

Lyrebird Piano

This fantastic kit is now available ex-stock. If you prefer the full 88 note 7¼ octave version we have this also. Each kit is complete down to the last screw and washer! Buy the complete kit or buy the individual modules. Modules start from $47 for the hardware pack through to the full 73 note keyboard at $169.50.
The 'Lyrebird' covers 6 octaves from F-F. The controls include: normal voice, mellow voice, bright voice, harpsichord voice, honky tonk voice selects. Plus many other features. A great kit for the piano enthusiast.

6 OCTAVE $525
7¼ OCTAVE $589
Ref: EA Oct '81-Jan '82

EXCLUSIVE!!!
- Metal film 1% resistors used
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DISPLAY:
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b. Unit and Sign: mV, V, mA, A (Model SK-6330 & SK-6440), K AUTO, BATT, ADJ, LO, –, AC
OPERATING PRINCIPLE: Dual Slope Integration
RANGE SELECTION: Autoranging on VOLT and OHM Manual range selection is also available on Model SK-6300 and SK-6330 by Range Keyswitch
POLARITY: Autopolarity, (–) sign when minus
OVERRANGE INDICATION: MSD "1" blinks Buzzer Warning on Model SK-6300 and SK-6330 only
ZERO ADJUSTMENT: Zero Adjustment by ZERO ADJ. Keyswitch
LOW POWER OHM RANGES: for in-circuit resistance measurements at voltage levels below 0.3 volts.

☆☆☆☆

• MODEL SK-550: with AUTOMATIC RESET OVERLOAD PROTECTIVE RELAY and OVERLOAD WARNING BUZZER/LED for safety measurements and easiest operation. Internal circuit returns ON in every 5 second while receiving overload.

DC Voltage	0.06(60mV), 0.3, 3, 12, 60, 120, 300, 600, 1200V
AC Voltage	6, 30, 120, 300, 600, 1200V
Decibels	–20 +17, 31, 43, 51, 57, 63dB
Accuracy	DC ±3% AC ±4% Resistance ±3%(full scale length)
Overload Protection	Overload Protective Relay, one pair of Diodes, one Fuse

☆☆☆☆

		TRADE	TAX	TAX INCL.
DIGITAL MULTIMETERS (3½) L.C.D.				
SK6100	Auto Range – Range Hold Overload Buzzer.	$108.00	14.18	122.18
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SK6200	Auto Range – 20 Ranges	69.50	9.13	78.63
SK6220	As SK6200 + 10 Amp AC/DC Range	79.50	10.44	89.94
ANALOG METERS				
SK550	100K Ohm/V – Overload Relay and Buzzer	89.50	11.75	101.25
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SK110	30K Ohm/V – Transistor/Diode Test	42.00	5.52	47.52
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SK2	5K Ohm/V – 12 Ranges	16.00	2.10	18.10
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SK7000*	Clamp Meter 0-300A/0-600V 8 Ranges	69.00	9.06	78.06
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CARRY CASES				
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The 400 features 4 independently programmable sound synthesizers and a built-in speaker.

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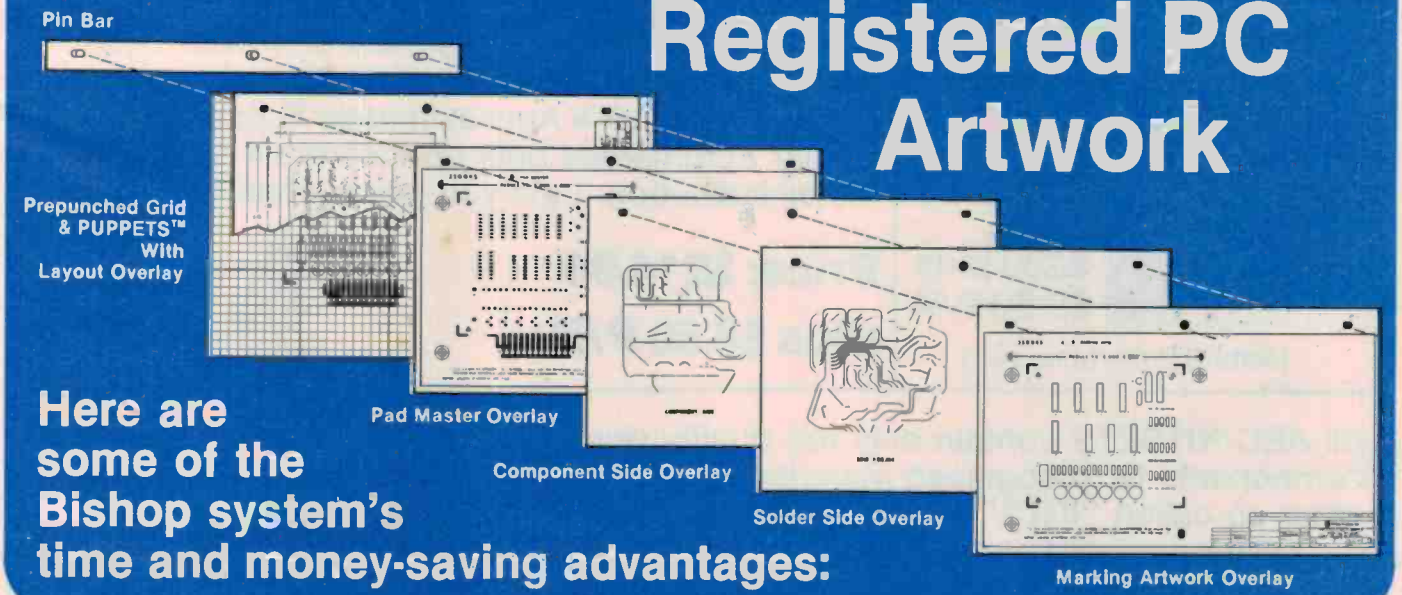

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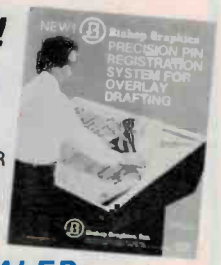

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Refer ETI October 1981

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● Tune and discriminate ● 4 modes of operation ● VLF/TR design ● Ground balance ● Auto balance push buttons ● Pre-wound search heads ● Very professional unit ● Approximately ⅓ price of many similar commercial built up locators ● Audio and meter indication. Lets you know when to rejoice

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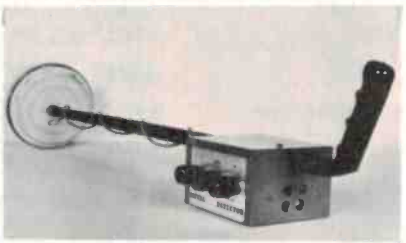
ETI 561 KITSET



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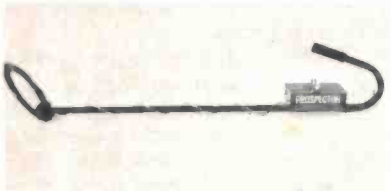

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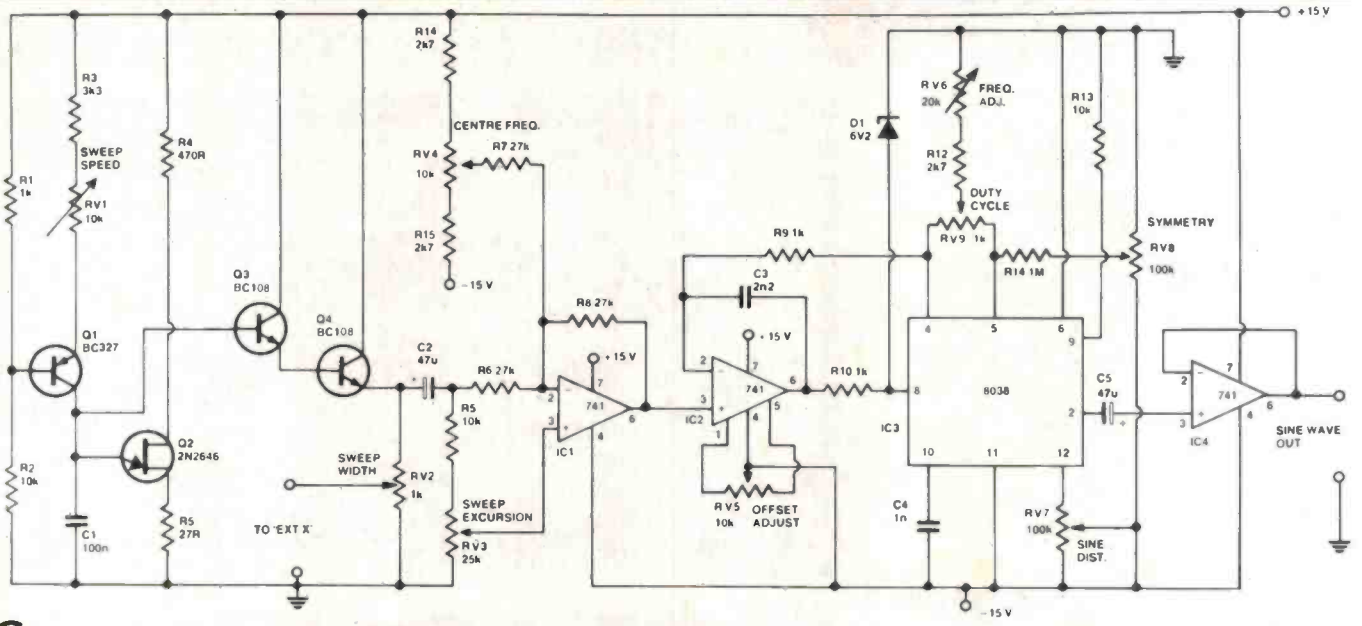

Sweep generator

Barry K. Ward CSIRO Division of Applied Physics

AN INTERSIL 8038 voltage-controlled oscillator can form the basis for a highly accurate sweep frequency generator when driven by a sawtooth waveform.

In the circuit, Q1 and Q2 form a linear sawtooth generator, with Q1 providing a constant current source charging capacitor C1 until the unijunction transistor Q2 conducts, discharging C1 through R5. Potentiometer RV1 adjusts the period of the waveform, normally about 20 ms, and hence the sweep speed.

Q3 and Q4 are a Darlington pair which reduce the non-linearity of the sawtooth due to loading. RV2 is a sweep width adjustment for the external X-input of an oscilloscope. IC1 enables the amplitude and average dc level of the sawtooth to be varied independently, thus varying the sweep excursion (RV3) and the centre frequency (RV4).

IC2 provides a buffered input to the function generator and also compensates for the non-linear voltage-to-frequency characteristics of the 8038 by applying feedback through R9 from one of the two current sources on the 8038. IC4 provides a buffered sinewave output.

With zero volts applied to pin 8, i.e: RV4 set to mid-range and RV3 at ground, the frequency of oscillation is given by:

$$f = 0.15/((RV6 + R12) \times C4)$$

For the component values shown this ranges from approximately 6 kHz to 55 kHz. RV6, R12 and C4 may be chosen to provide a centre frequency from 1/1000 Hz to 1 MHz. However, for optimum performance the charging current through RV6 and R12 should be in the range 20 uA to 2 mA. Once RV6 is set, further variation of the centre frequency is obtained with RV4.

The duty cycle may be varied over a range of 50% by RV9, and a sweep excursion of up to 1000: 1 is obtained by adjusting RV3. RV8 adjusts the symmetry and RV9 adjusts the distortion of the sinewave output. The output distortion was found to be less than 1% with a linearity of better than 0.1%. ●

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Are you fed up with 'built up' projects? Why not build this very high quality kit computer and save over 50% on equivalent built up units!

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Any extra parts shown in illustration are sold as separate, chargeable items.

ALL THIS FOR ONLY $295

Cat. K-3600

OUR MOST POPULAR KIT EVER!

Construction details and a full copy of the EA article is supplied with each kit. We also have available two very comprehensive manuals to assist in construction and programming:

SUPER 80 Technical Manual (B-3600) $12.50
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This book has over 50 separate versatile commands. Features arithmetic and integer functions, user-defined functions, machine language routines, text editing, string operations. Also contains 25 error codes to assist you in programming.

OPTIONAL EXTRAS

Transformer (M-2325)	$23.00
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See our other advertisements in this publication for address details

DSE/A163/PAI

Ideas for Experimenters

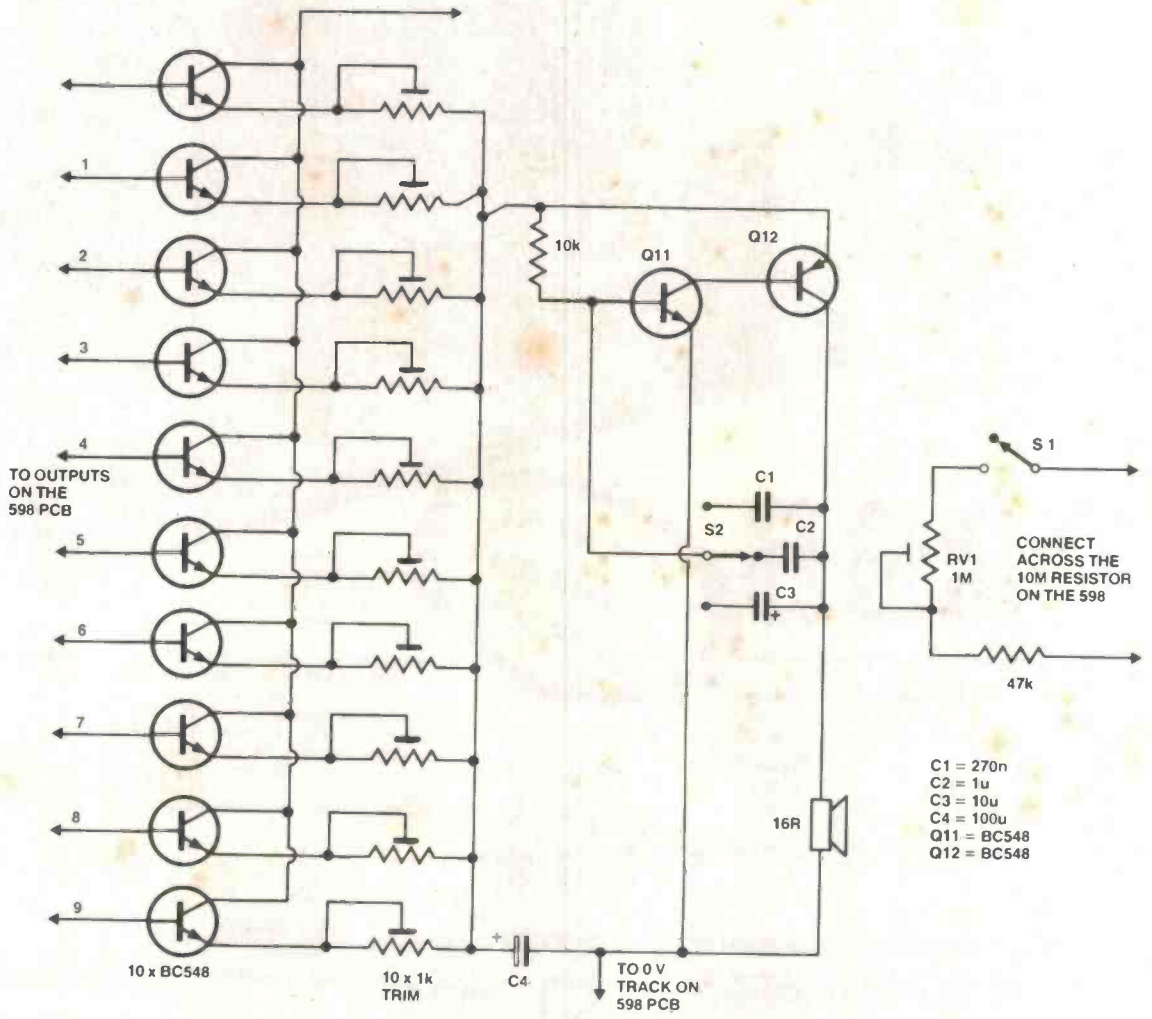
These pages are intended primarily as a source of ideas. As far as reasonably possible all material has been checked for feasibility, component availability etc, but the circuits have not necessarily been built and tested in our laboratory. Because of the nature of the information in this section we cannot enter into any correspondence about any of the circuits, nor can we produce constructional details.

Sequential tone generator add-on for the ETI-598 touch switch

Fourteen-year-old **Jamie Rogers of Glenelg in South Australia** turned his ETI-598 sequential touch switch (ETI February '81) into a 10-tone sound generator with the addition of this simple circuit.

Transistors Q11 and Q12 are connected as a non-inverting amplifier with feedback directly from output to input, via a capacitor selected by S2, so that it forms an oscillator. The frequency of oscillation is determined by whichever capacitor is selected and the 10k resistor, plus one of the 1k trimpots at a time. Each trimpot is selected in sequence by a transistor, which is turned on by an output from the ETI-598. Each trimpot is adjusted to give the desired pitch note.

You can play a 10-note tune by having S1 open. You can make a 'Space Wars laser' sound by first setting S2 to C1 and adjusting each trimpot (commencing with the 'top' one driven from the '0' output) so that the first note is a high pitch and all the notes descend in pitch, with the lowest trimpot set to a suitable low note. Close S1 and adjust RV1 to give the 'right' sound.



you can have all the features of expensive commercial amps at a fraction of their price

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Playmaster Mosfet Amp

This is it: the new Playmaster Power Mosfet Stereo Amplifier, as described in January 1981 issue of Electronics Australia. It's the latest in the incredibly successful series of Playmaster Amplifiers (over 10,000 Twin 25's and 40/40's built!) but this one really has everything!

- State-of-the-art POWER MOSFETS!
- Low-noise FET input pre-amps!
- Over 50 watts per channel!
- Speaker switching plus loudness & muting controls!
- And a brand new professional styling!
- Complete with our famous step-by-step instruction manual!

OUR MOST POPULAR KIT EVER!

Cat. K-3515

DSE/A166/PAI

SAVE OVER $10.00: This kit INCLUDES the optional loudspeaker protector circuitry: AT NO EXTRA CHARGE!

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The DICK SMITH professional Frequency counter

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500MHz, 7 digit resolution plus period measurement feature.

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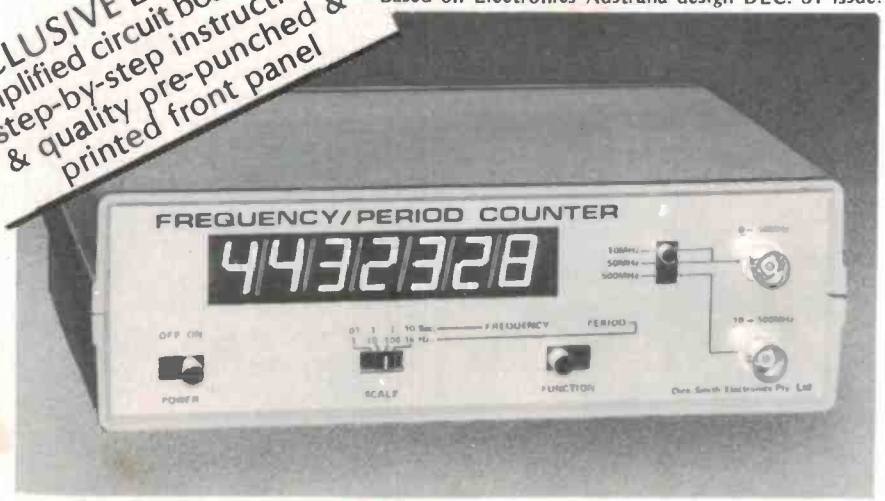
Based on Electronics Australia design DEC. 81 issue.

With EXCLUSIVE DICK SMITH Simplified circuit board wiring, step-by-step instructions & quality pre-punched & printed front panel



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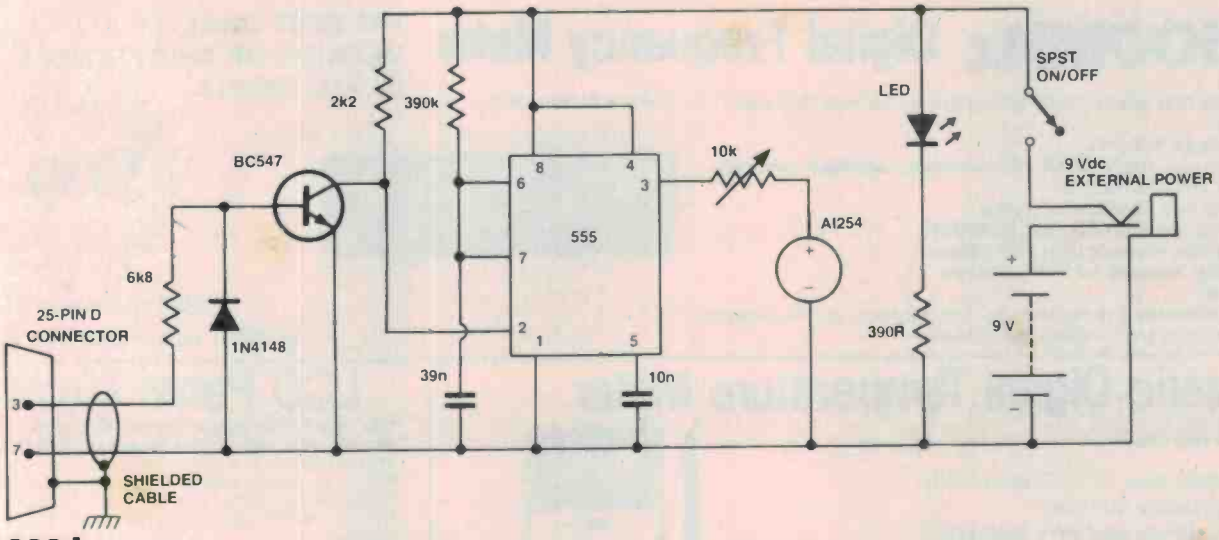
Ideas for Experimenters



RS-232 beeper

This circuit was devised to provide audio indication of data signals on an RS-232 interface, and was sent in by **Ian Hogan of St. Peters in South Australia.**

The device was built to provide audio feedback when using a digitiser table connected to a VDU. The time required to digitise a drawing is considerably increased if the operator has to continually refer to the VDU to ensure that a cursor key has registered correctly. Using this device, connected to the printer interface of the terminal, the operator can hear if the key has registered. Also, because the duration of the sound is related to the length of the data string received, it is even possible to hear when a new prompt or error message is sent to the terminal.

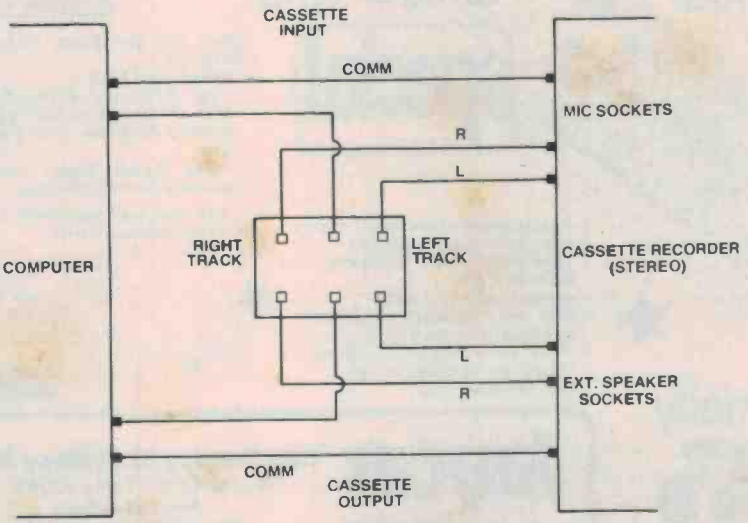
The circuit operation is as follows: the 6k8 and 2k2 resistors, 1N4148 diode and BC547 transistor act as the RS-232 interface for the circuit. The 555 timer, 390k resistor, 39n and 10n capacitors form a monostable multivibrator.

When no data signal is present, pin 3 of the D connector is between −5 and −25 volts with respect to pin 7 (signal ground), so pin 2 of the 555 is held high by the non-conduction of the BC547; hence the 555 is reset. When a positive-going pulse occurs in a data stream, the BC547 conducts, sending pin 2 of the 555 low, thus triggering a pulse in the 555 output, turning on the AI254 audio indicator. The duration of the pulse is given by 1.1xRC, where R and C are respectively 390k and 39n in this circuit.

The 10k potentiometer provides volume control of the audio indicator. The LED is simply for power-on indication. The external power socket allows a 9 Vac plug pack transformer to be used. The circuit was constructed on a small piece of Versa Strip board, and enclosed in a small zippy box.

Double density computer cassette storage

This very smart idea came from **Murray Van Syn of Ardross in W.A.** By using a portable stereo cassette recorder for computer program storage, the program density can be conveniently doubled by employing all four tracks independently. A cheap DPDT switch, connected as shown, is used to select the appropriate track. Shielded wire is recommended for the interconnections.



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Refer EA Feb 1982

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LCD Panel Meters

The illustration below shows the display with all segments and annunciators actuated. The unit is housed in a neat plastic escutcheon as shown in the illustration on the left. The DPM measures 72x36mm overall. Digital height - 15mm (can be read at distances up to 10 metres).

Specs:
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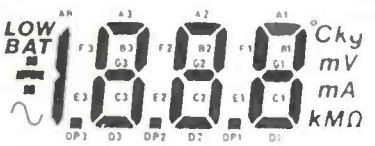
- Accuracy 0.05% of reading ±1 digit
- Power supply: 5-15VDC 50uA
- Sample rate: 3/sec
- Auto polarity, auto zero, over-range warning

Full data sheet supplied with each unit.



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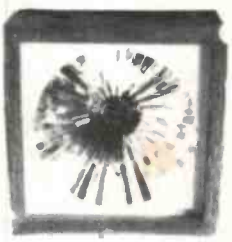

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Ioniser Kits

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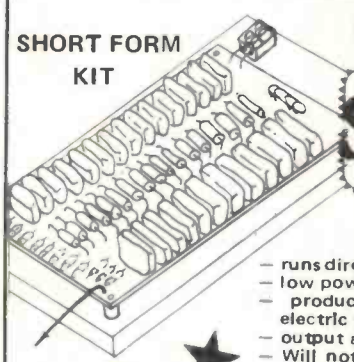

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Ideas for Experimenters

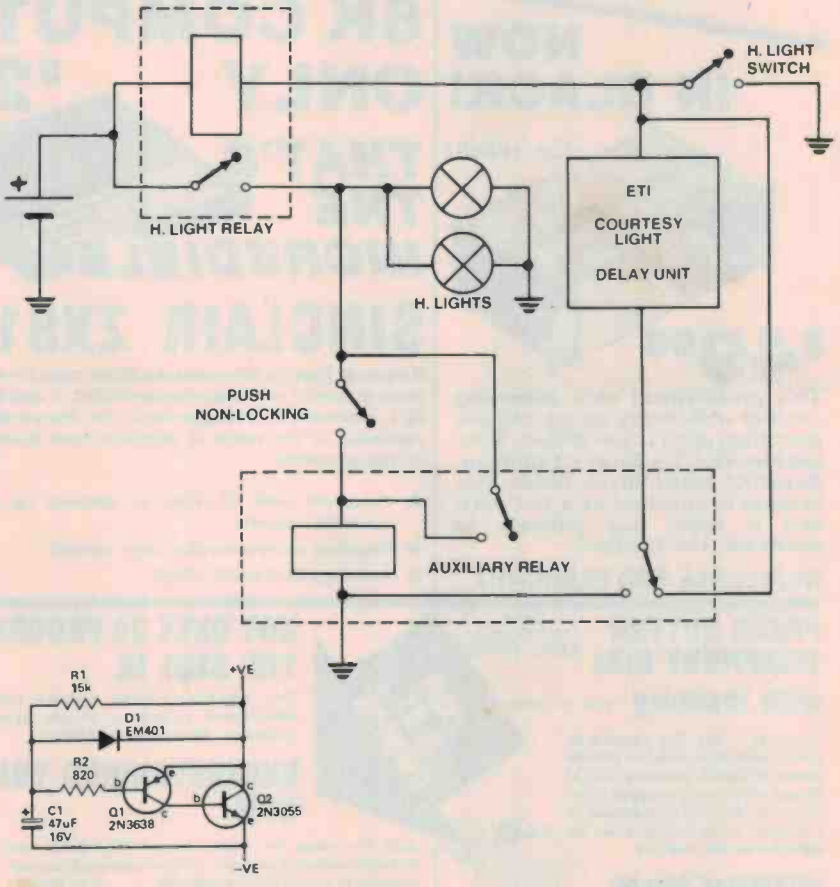
Headlight delay

Ever driven home late at night and had to risk life and limb walking in the dark from the car to the house? Well, the problem is easily and cheaply solved by adding this circuit to your car, says **Stephen Mann of Forrestfield, W.A.**

The system is built around the ETI-232 courtesy light delay unit (or extender) from the October 1974 issue and Simple Projects Vol. 2.

Coupling this to the headlight relay as shown provides a particularly good turn-off delay for the headlights. Operation is simple. Whilst the headlights are still on, operate the pushswitch. The headlight switch may now be turned off and the delay unit and auxiliary relay will keep the headlights on. The length of time the headlights remain on is dependent on the value of C1 and the headlight relay dropout voltage.

The unit was installed on a Toyota Corolla and a value for C1 of about 300 uF gives a delay of about 60 seconds. The auxiliary relay is simply a 12 V type with double changeover contacts.



✸ 'IDEA OF THE MONTH' CONTEST ✸

Scope Laboratories, who manufacture and distribute soldering irons and accessory tools, have offered to sponsor a contest with a prize to be given away every month for the best item submitted for publication in the 'Ideas for Experimenters' column — one of the most consistently popular features in ETI. Each month we will be giving away a Scope Panavise pc board holder, model 333 — as described in News Digest, p.8, October '81 issue. Selections will be made at the sole discretion of the editorial staff of ETI Magazine. Apart from the prize, worth about $70, each winner will be paid $10 for the item published. You must submit original ideas of circuits which have not previously been published. You may send as many entries as you wish.

RULES

This contest is open to all persons normally resident in Australia with the exception of members of the staff of Scope Laboratories, Murray Publishing, Offset Alpine, Australian Consolidated Press and/or associated companies.

Closing date for each issue is the last day of the month. Entries received within seven days of that date will be accepted if postmarked prior to and including the date of the last day of the month.

The winning entry will be judged by the Editor of ETI, whose decision will be final. No correspondence can be entered into regarding the decision.

Winner will be advised by telegram the same day the result is declared. The name of the winner, together with the winning idea, will be published in the next possible issue of ETI.

Contestants must enter their names and address where indicated on each entry form. Photostats or clearly written copies will be accepted but if sending copies you must cut out and include with each entry the month and page number from the bottom of the page of the contest. In other words you can send in multiple entries but you will need extra copies of the magazine so that you send an original page number with each entry.

This contest is invalid in states where local laws prohibit entries.

Entrants must sign the declaration on the coupon that they have read the above rules and agree to abide by their conditions.

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"I agree to the above terms and grant Electronics Today International all rights to publish my idea in ETI Magazine or other publications produced by them. I declare that the attached idea is my own original material, that it has not previously been published and that its publication does not violate any other copyright*".

* Breach of copyright is now a criminal offence.

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Signature .....

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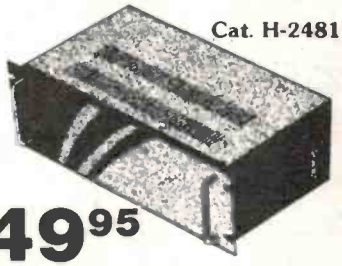

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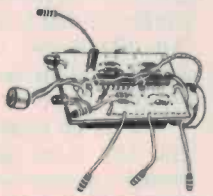

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DICK SMITH Electronics

You'll find all our stores and resellers listed on another page of this magazine!

DSE/A164/LM

Shoparound

THIS PAGE is to assist readers in the continual search for components, kits and printed circuit boards for ETI projects. If you are looking for a particular component or project — check with our advertisers if it is not mentioned here.

ETI-492 Sound Bender

None of the components for this project should be difficult to obtain. The XR2206 function generator IC is widely stocked — even in Dick Smith stores! — and most kit and component suppliers have indicated they will be stocking the project as a kit or stocking pc boards, the rest of the components being stock lines.

If you require an audio amplifier to drive a speaker, then we suggest you use our ETI-453 General Purpose Amplifier module. This is also known as the HE105 Bench Amplifier, from Hobby Electronics, and is widely available as a kit for around $10. Try Jaycar in Sydney, All Electronic Components and Rod Irving in Melbourne or Altronics in Perth.

For those assembling the 492 and/or the 453 from parts on hand, then pc board suppliers were listed on page 63 of the January issue.

WELL, BLOW ME DOWN!

This Sunon rotary fan from Dick Smith Electronics is designed for power supply and transmitter systems, but its uses are as limited as your imagination, so they say.

The fan, cat. no. Y 8500, is 110 mm in diameter and is fixed with four mounting holes and can be mounted either internally or externally. The seven plastic fan blades are encased in metal for rigidity.

It operates on 240 Vac and is available for $16.90 from all Dick Smith Electronics stores.

ETI-723 Selectacall

If you can't get 555s for this one, boy are you in trouble! Again, all parts should be readily available as most stores carry them as stock lines, the piezoelectric buzzer (Sonalert) included. No pc board was produced for this project, as explained in the article.

ICs for Circuit Source Guide

A number of unusual ICs are specified in this feature so we have dug up supply sources to help those interested in lashing together some of the circuits. Firstly, there is a number of suppliers who stock a *wide* range of semiconductors — and if you're not familiar with them, you should be. In Melbourne, there's Ellistronics, All Electronic Components, Rod Irving Electronics, Radio Parts and Tasman Electronics. In Sydney there's Applied Technology, Radio Despatch Service and Electronics (Distributors). Note also that VSI stock a wide range of semiconductors from the major manufacturers, and they're in Adelaide, Brisbane, Melbourne, Perth and Sydney. Sorry, but there's just not enough space to list all the addresses and phone numbers here. Look in your local phone book.

Fine, now for some specific sources. This may not be exhaustive, but it's a starting point. The **LM331** and **RC4151** (p.16) are both stocked by Tasman Electronics. The **LM108/208/308** is widely stocked but if you have difficulty, try Applied Technology, Tasman and Rod Irving. Same goes for the **723** regulator. The **LF351** we understand is stocked by Rod Irving. The **LM3915** is widely stocked, and apart from those already mentioned you can try Jaycar and Altronics. The **CA3080** may be found at Radio Despatch Service, Rod Irving and Tasman. The National Semiconductor digital-to-analogue converter **DAC0800** is stocked by Rod Irving Electronics, but we don't know who else. The Analog Device's **AD536A** should be obtainable through Parameters Pty Ltd (02)439-3288 or (03)90-7444. The **ICL7106** is widely stocked — you can even get it through Dick Smith stores!

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ET 467	6.90	4 Input Mike Preamp	Jly 80	$27.50
ET470	2.90	60 Watt Amp Module Series 4000	TPV 6	$26.00
ET 471	9.90	Audio Preamp Series 4000	TPV 6	$45.50
ET 472	2.90	Power Supply For Series 4000	TPV 6	$24.00
ET 473	5.90	Moving Coil Preamp Series 4000	TPV 6	$54.00
ET 474	2.90	Interface 60W Amp	Jan 80	
ET 475	4.90	AM Tuner	Spt 80	$89.00
ET 476	6.90	Series 3000 AMP 25W Stereo	Nov 80	$84.00
ET 477	4.90			
SERIES 5000 POWER AMP COMPLETE KIT				
ET 478MB	15.00	Series 5000 Preamp Main Board	Oct 81	
ET 478MC	3.90	Moving Coil Preamp (5000)	Spt 81	$24.50
ET 478MM	3.90	Moving Magnet Preamp (5000)	Spt81	$19.50
ET 478SA	2.50	Series 5000 Preamp Switch Brd	Oct 81	
ET 478SB	1.90	Series 5000 Preamp Switch Brd	Oct 81	
ET 478SC	1.90	Series 5000 Preamp Switch Brd	Oct 81	
ET 478SD	1.90	Series 5000 Preamp Switch Brd	Oct 81	
SERIES 5000 PREAMP COMPLETE KIT				$236.00
ET 480	2.90	50 Watt Amp Module	30 Ap	$17.50
ET 480	2.90	100 Watt Amp Module	30 Ap	$22.00
ET 480PS	2.90	50-100 AMP Module Pwr Supply	30 Ap	$22.50
ET 481M	2.75	Hi-Power P.A/Guittar Amp Mod.	30 Ap	
ET 481PS	4.90	12V / 100 P.A. Inverter	30 Ap	
ET 483	3.90	Sound Level Meter	Feb 78	
ET 484	4.90	Expander Compressor	Jly 77	
ET 485	4.50	Graphic Equaliser	Jne 77	
ET 486	3.90	Howl Round Stabilizer	Nov 77	
ET 489A	3.50	Audio Spectrum Analyser No2	Apl 78	
ET 489B	3.50	Audio Spectrum Analyser No2	Apl 78	
ET 496		Series 4000-1 Speaker Kit	Feb 80	$829.00
ET 528	2.90	Intruder Alarm	Jan 75	
ET 539	2.90	Touch Switch	Mar 76	
ET 541	2.90	Train Controller	May 76	
ET 547	3.50	Telephone Bell Extension	Jne 77	
ET 549A	2.90	Metal Detector	May 77	
ET 560	1.90	240V Mains Locator	May 80	
ET 561	2.90	Metal Detector	Mar 80	$34.00
ET 562	3.90	Geiger Counter	Apl 80	
ET 563	3.50	Nicad Fast Charger	Jly 80	$84.00
ET 566A	2.90	Pipe & Cable Locator	Apl 80	
ET 566B	3.90	Pipe & Cable Locator	Apl 80	
ET 567	3.50	Core Balance Relay	Apl 81	$42.00
ET 568	2.90	Photo Flash Trigger	Oct 80	$25.90
ET 570A		Infrared 'Trip' Relay TX	Jan 82	
ET 570b		Infrared 'Trip' Relay RX	Jan 82	
ET 572	4.90	Digital PH Meter	Dec 80	$98.50
ET 573	3.50	Universal Timer	Oct 79	
ET 576	5.90	Electromyogram	TPV 6	$89.00
ET 577	3.50	General Purpose Power Supply	TPV 6	$30.50
ET 578	2.90	Simple Nicad Charger	Jne 80	
ET 581	2.50	15V Dual Power Supply	Jne 76	$9.50
ET 583	2.90	Marine Gas Alarm	Aug 77	
ET 585R	1.90	Ultrasonic Receiver	TPV 6	$16.95
ET 585T	1.90	Ultrasonic Transmitter	TPV 6	$9.95
ET 585	3.90			
ET 591A		Up/Down Digit Counter	Jly 78	
ET 591B		Up/Down Digit Counter	Jly 78	
ET 596	2.90	White Noise Generator	Nov 81	$8.007
ET 598		Touch Switch	Feb 81	$10.00
ET 598B	2.50	Touch Switch	Feb 81	
ET 599A	2.50	Infra Red Remote Control TX	May 80	
ET 599B	2.50	Infra Red Remote Control	May 80	
ET 599C	2.90	Infra Red Remote Control	May 80	
ET 599D	2.20	I.R. Remote Cntrl Power Supply	May 80	
ET 603	4.90	Music Synthesizer Sequencer	Aug 77	
ET 604	604	Metronome	Spt 77	
ET 606	3.90	Electronic Tuning Fork	Nov 79	
ET 607A	2.90	Sound Effects Generator	Aug 81	
ET607mf	2.90	Sound Effectis Generator	Aug 81	
ET607mf	2.90	Sound Effects Generator	Aug 81	
ET631-2	7.50	Keyboard Encoder	Apl 77	
ET 635	3.90	Train Steam Whistle	Apl 81	
ET 636	16.90	7 Slott S100 Mother Board	May 80	
ET 637		Cassette Interface	Jan 78	
ET 638A	4.90	Eprom Programmer	Jly 78	
ET 640	65.00	Memory Mapped VDU		$149.00
ET 650A	4.50	Stac Timer	Nov 78	
ET 650B	4.50	Stac Timer	Nov 78	
ET 650C	4.50	Stac Timer	Nov 78	
ET 660	19.00	Learners Microcomputer	Oct 81	$99.00
Key Set (18) To Suit ET660				$30.00
Colour Option Kit to Suit 660				$14.50
ET 682	69.00	Versatile Eprom Card	Mar 81	$115.00
ET 708	2.90	Aerial Amp	Mar 76	
ET 713	4.90	FM Tuner add on	Spt 77	
ET 717	4.50	Crosshatch Generator	May 78	
ET 726	3.50	R.F. Amp 70W 6/10 Meter	Feb 80	
ET 729		UHF TV Masthead amp	Apl 81	$38.00
ET 730		UHF TV Converter	May 81	$37.50
ET 731	4.50	Teletype Modulator	Oct 79	
ET 735	3.90	UHF to VHF Convertor	May 81	
ET 760	2.50	Video Mod. To Suit 660 Micros	Spt 81	$14.50
ET 824	2.90	Slot Car Power Supply	Dec 81	$16.00
ET 825	5.90	Slot Car Controller	Dec 81	$70.00
		Without Case		$55.00
ET1501A	2.50	Negative Ion Generator	Apl 81	$30.00
ET1501B	2.50	Negative Ion Generator	Apl 81	
ET1501C	1.50	Negative Ion Generator	Apl 81	
ET 1503	3.90	Battery Charger	Aug 81	
E.A				$109.00
Dream 6800	12.50			$106.00
Dream 6802	12.50			$29.50
Power Supply to Suit Dream Micro Kit				$29.50
HEX Keypad 19 keys				
75CD7	3.50			
75L11	2.50			
76E04	1.00			
76PC9	5.50			
78TM8	2.90			
78C5	4.90			
78A06	3.90			
78N6	3.50			
78T3	4.50	Photo Timer	Mar 78	
78NG4	2.90	Pink/White Noise Gen.	Apr 78	
78UT4	4.50	Low Cost VDU Keyboard	Apr 78	
78UP10	9.50	2650 Extra Ram	Oct 78	
79SB10	3.90	Bass Filter	Oct 79	
79FE11	2.50	Photo Flash Exposure MTR	Nov 79	
79PC9	3.90	Pulse Generator	Sep 79	
79SE3	3.90	Train Model Sound	Mar 79	
79TI11	2.90	Transistor Assisted Ign	Nov 79	$34.00
79PS11	2.90	Experimentors Power Sup.	Nov 79	
79PC12	2.90	Fan Speed Control	Dec 79	
79SF10	2.50	Photo Slave Flash	Oct 79	
79SF9	2.90	Photo Sound Trigger	Sep 79	
79UPS6	2.50	Universal Power Supply	Jun 79	$29.50
80ST10A	3.50	Stylus Timer	Oct 80	
80ST10B	2.50	Stylus Timer	Oct 80	
80TC12	2.90	Bipolar Train Controller	Dec 80	$29.50
80CM3A	4.50	Digital Capacitance MTR	Mar 80	$52.50
80CM3B	2.50	Digital Capacitance MTR	Mar 80	
80PG6	6.50	T.V. Pattern Generator	Jun 80	$52.50
80TV8	3.90	T.V. Cro Adapter	Aug 80	$29.00
80F3	3.20	Audio Prescaler	Mar 80	
80PP3	2.50		Mar 80	
80LL7	2.90	Leds & Ladders	Jul 80	$19.50
80B7	2.50	Beat Frequency Oscillator	Jul 80	
80BM10	2.90	Car Battery Monitor	Oct 80	$8.50
80SA10	9.90	Stereo Amp. Mosfet	Jan 81	$160.00
80DC10	6.50	Digital Storage Cro Ad.	Nov 80	$78.00
80GA12	6.50	Guitar Amplifier	Dec 80	
80HLA5	2.90	Car Headlight Alarm	May 80	
80LS12	3.50	SELECTALDTT	Dec 80	$22.50
80LBR12	2.90	Light Beam Relay	Nov 80	$13.00
80MA4	2.50		Apr 80	
80PC4	2.90	Power Heat Controller	Apr 80	
80HHS6	2.50	Hee Haw Siren	Jun 80	
80PC7	3.50	Power Saver Induction MTR	Jul 80	
80FB12	2.90	Guitar Fuzz Box	FEB 81	$19.50
80G6	5.90	Musical Tone Generator	Jun 80	
80GPS3	2.90	Voltage Regulator Multi	Mar 80	
80AD12	3.00	Autodim Light Dimmer	Dec 80	
80AU3	3.50	Hi Fi Auto Turn Off	Mar 80	
80AW4	4.50	Receiver All Wave	Apr 80	
80TM8A	5.90	Digital Engine Analyser	Aug 80	$48.50
80TM8B	2.50	Digital Engine Analyser	Aug 80	
80PP7A	6.50	Eprom Programmer	Jul 80	$72.50
80PP7B	2.50	Eprom Programmer	Jul 80	
80RF5	2.90	Rumble Filter	May 80	
80RM12	2.90	Cylon Voice Simulator	Dec 80	$18.50
80SA3	4.90	Playmaster Stereo Amp.	Mar 80	????
80CH7	6.50	240 V.A.C. Light Chaster	Jul 80	
80RAM12	3.90	Ram Expansion for Dream	Dec 80	30.00
80PA6	7.50	Playmaster 300W amp. Module	Jun 80	$83.00
80CL4	3.50	Time Controller	Apr 80	
80TRS11	2.90	TRS 80 Printer Serial In.	Nov 80	$15.00
81DC2	2.20	Le Gong Doorbell	Feb 80	$16.00
81DT5	3.00	Dream Tape Controller	May 81	
81GA3	11.50	Colour Graphic Analyser	Mar 81	$99.00
81UC8	4.50	Universal Timer and Stopwch.	Aug 81	
81MP6	2.90	Microprocessor Power Sup.	Jun 81	
81IR4A	4.50	Infra-Red Relay	Apr 81	$39.00
81IR4B	2.90	Infra-Red Relay	Apr 81	
81SP1	2.90	RS232 TRS80 System 80 In.	Jan 81	
81S13	7.90	TRS80/System 80 Serial In.	Mar 81	
81SW1	3.90			
81MC7	2.90	Moving Coil Preamp	Jul 81	
81RM2	2.50		Feb 81	
81DC3B	8.50	Digital/Analog Store. Cro.	Mar 81	$169.00
81DC3A	9.50	Digital/Analog Store. Cro.	Mar 81	
81WS10	2.90	Wind Speed Indicator	Oct 81	$43.50
				$43.50
81P6	2.90	Pool/Lotto Selector	Jun 81	$24.50
81A010	3.50	Audio Test Unit Cass.Deck	Oct 81	
81A010	3.50	Audio Test Unit Cass.Deck	Oct 81	$47.50
81MC8	9.50	Musicolour IV	Aug 81	$79.00
81SG9	4.20	Led Sandglass	Sep 81	$22.50
81P19			Sep 81	
81C19		Digital Clock Thermometer	Sep 81	$80.00
81SS11	4.90	Slide Cross Fader	Nov 81	$80.00
81GA9	3.90	Photon Torpedo Game	Sep 81	$23.50
81UC8		Universal Timer	Aug 81	
81MC7	9.50	Moving Coil Preamp	Jul 81	
81SW7		Train Steam Whistle	Jul 81	$17.50
81SM7	2.90	Bagatelle	Jul 81	
81VM2	2.90	High Impedance DC Voltmtr	Feb 81	
81HB4A	7.50	Heart Rate Monitor	Apr 81	$84.00
81HB4B	2.90	Heart Rate Monitor	Apr 81	
81MA4	2.50	Touch Sensitive Alarm	Apr 81	
81RC4A	3.50	Infra Red Remote Control	Apr 81	
81RC4B	2.50	Infra Red Remote Control	Apr 81	
81RC4C	2.75	Infra Red Remote Control	Apr 81	
81SP5	2.50	Sound Pressure Meter	May 81	$37.00
81OR7	9.50	Electronic Organ	Jly 81	$58.00
81CH12	3.50	Christmas Decoration	Dec 81	$15.00
81fm10a	4.90	500 MHZ Digital Freq.Mtr.	Dec 81	$135.00
81fm10a	4.90	500 MHZ Digital Freq.Mtr.	Dec 81	$135.00
81fm10b	3.50	500 MHZ Digital Freq.Mtr.	Dec 81	
811d12	3.90	Led Bar Graph Display	Dec 81	
82epl	3.90			
82epl	7.90	Easy to use Eprom Programmer With Plugpac	Jan 82	$39.00 $51.50
81mill	2.50	Metronome (Low Current)	Jan 82	$19.90
81wd12a	2.50	Wind Direction Indicator	Jan 82	$24.50
81wd12b	2.50	Wind Direction Indicator	Jan 82	

HOBBY ELECTRONICS				
HE102	2.50	Guitar Phaser	Jun 81	$25.00
HE103		Transistor Tester		$9.40
He104	2.20	A.M. Tuner	May 81	$7.50
HE105	2.50	Basic Amplifier	May 81	$9.50
HE106	2.90	F.M. Radio Microphone	May 81	$9.50
HE107	3.50			

HOBBY ELECTRONICS				
HE102	2.50	Guitar Phaser	Jun 81	$25.00
HE103		Transistor Tester		$9.40
HE104	$2.20	A.M. Tuner	May 81	$7.50
HE105	$2.50	Basic Amplifier	May 81	$9.50
HE106	2.90	F.M. Radio Microphone	May 81	$9.50
HE107	3.50	Electronic Dice	Jun 81	$5.95
HE108	2.90	Power Supply		$11.95
HE110		Umistakabell		$6.90
HE110		Ohmeter		$10.90
HE112	2.20	Micromixer		$11.90
HE113	2.50			$9.45
HE115	2.50			
HE117		House and Car Alarm		$10.90
HE121	2.50	Scratch and Hiss Filter		$3.00
HE123	3.90			
HE128	2.50			
HE126	2.50			
HE127		Siren		$3.90

THIS MONTH'S KITS

ETI-723
SELECTACALL

No more listening to the boring background chatter on the CB/ham channels while waiting for a particular caller. Add this simple accessory to your rig — no tones or funny noises. P.O.A.

ETI-492
SOUND BENDER

For guitar effects or voice 'distortion' (Daleks, Darth Vaders, Cylons, etc). Simple, versatile, low-cost ring modulator. P.O.A.

TO ORDER: Heavy items sent Comet Freight on. Mail Order phone 481-1436. Wholesale Customers phone: RITRONICS WHOLESALE 489-7094.
Mail Orders to P.O. 235 Northcote 3070 Minimum P&P $2. Add extra for heavy items, registration and certified mail.
Prices spec. subject to change without notice.

Russian 'robot birds' in orbit!

The six Russian satellites, RS3 through RS8, reported here in the January issue, were launched on December 17 and are now in a nearly circular orbit around the Earth at an average altitude of nearly 1700 km.

The six are steadily moving away from each other with slightly different orbits, and by December 28 their equatorial crossing times were spread over more than an hour and their crossing points over nearly 20 degrees.

All six have been transmitting telemetry data, with each series preceded by the spacecraft's call (e.g: 'RS3'). RS3, 5 and 7 all have 'robot transponders', and at least one has been worked by a number of stations around the world.

Robot availability is indicated by a 'CQ', stopping when a signal appears in its input passband. Sending (for example) 'RS5 de VK2ETI AR' should bring the response 'VK2ETI de RS5 QSO nr xxx'. It may also respond 'QRZ', 'QRM', or 'RPT' if it misses a call, or 'QRQ' or 'QRS' to calls made below or above its 10-25 wpm acceptance range.

Beacon frequencies for the even-numbered birds are: RS4, 29360/29403 kHz; RS6, 29411/29453 kHz; and RS8, 29461/29502 kHz. Their 40 kHz-wide OSCAR-style transponders have apparently not yet been activated. One indication of transponder status in any of the six is the first, or 'K', group telemetry number, which indicates power output. A reading of anything other than 'K00' should mean the transponder is on.

Interference to the RS satellites from terrestrial stations is becoming a real problem, with their covering so much of the 29.3 to 29.5 MHz spectrum. SSB, AM and FM signals have all been heard in recent weeks on top of or breaking over onto the new satellites. Non-satellite users should try to stay below 29.3 MHz or above 29.5 MHz to avoid the problem.

OSCAR 9 is still in its test phase, but all problems with the command station have been remedied. All testing should be concluded by mid-January, when experiments should begin.

Ariane was launched successfully on December 20 from French Guiana, with no problems reported. This should clear the way for the L5 launch in the spring, and L6 (with the AMSAT Phase 3A bird aboard) on July 6. (Thanks to HR Report).

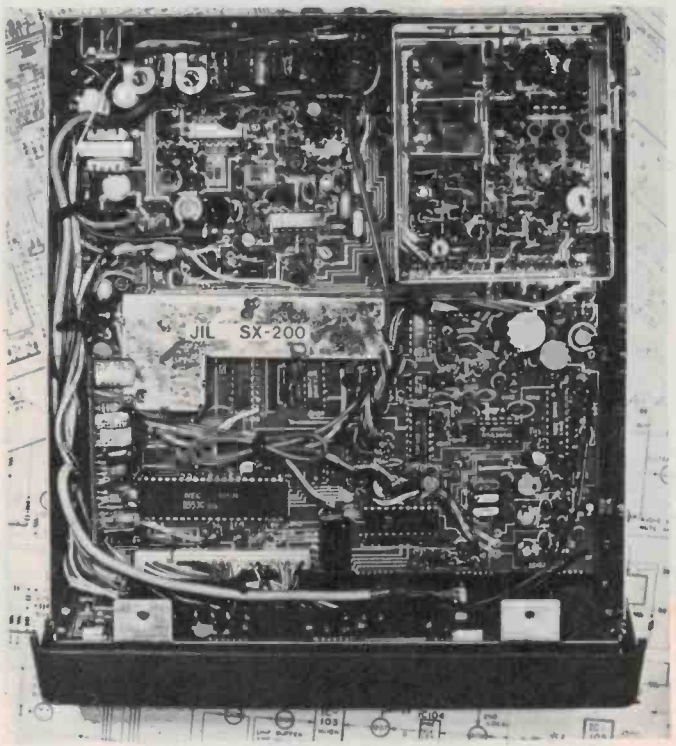
24-hour quartz world clock

Know the time anywhere in the world at a glance! The new Yaesu 24-hour quartz world clock, available from all Dick Smith stores, enables you to do just that.

It is ideal for anyone who makes international phone calls, giving you the time in any city in the world at a glance, and for amateur radio enthusiasts — no more guesswork when trying to contact people overseas.

The clock has a simulated walnut finish and can be hung on the wall or used with its supplied stand. Cost is $49.50.

The Yaesu 24-hour world clock uses one 'C' cell battery (supplied) and is quartz-controlled for accuracy.



Scanner manual

GFS Electronic Imports of Mitcham, Victoria, Australian distributors of the JIL SX-200 HF/VHF/UHF programmable scanning receiver, recently announced the availability of a comprehensive Service Manual for that unit.

The SX-200, a keyboard-entry programmable scanning receiver covering 26-88, 108-180 and 380-514 MHz, owes most of its performance and flexibility to a 4-bit microprocessor which has its own on-board ROM and RAM. Extensive use is made of CMOS LSI phase-locked loops plus shift registers, counters, etc. JIL recognised that such sophistication made it almost mandatory for personnel servicing the SX-200 to have available to them well laid-out and comprehensive service details.

To cater for this JIL have produced the SX-200 Service Manual, which includes block diagrams, circuit diagrams, wiring diagrams, printed circuit board layouts (both sides), component list, alignment procedure, list of voltages for each IC and transistor, as well as a wealth of other useful service information.

The manual is available from GFS Electronic Imports, 15 McKeon Road, Mitcham Vic. 3132, (03)873-3939, or their distributors in various states. Price is $10 plus $2 post. For further information on this or the SX-200 contact GFS.

Club Call

The **Keilor Radio Amateur Group (KRAG)** serves the western suburbs of Melbourne, and meets on the second Thursday of every month. Meetings are held at the Keilor Heights High School in Quinn Grove, East Keilor, starting at 7.30 pm. New members are welcome, and are invited to address all enquiries to P.O. Box 122, Avondale Heights Vic. 3034.

The **Townsville Amateur Radio Club** recently held its annual general meeting, and the office bearers for 1982 include Roger Cordukes (VK4CD), President; Bill Sebbens (VK4XZ) and Peter Renton (VK4PV), Vice Presidents; Don Bowman (VK4ZYZ), Secretary; and Ken Telford (VK4ZOC), Treasurer. During 1981, membership rose from 58 to 86, mainly due to good enrolment in the novice instruction class. You can contact the club through the Publicity Officer, Peter Renton (VK4PV) on Townsville 71-9211 (bh), 72-1236 (ah).

YAESU

"MY CHOICE OF BEST MUST BE THESE UNITS"

The ever popular

FRG 7

0.5/30 MHz Receiver

20,000km RANGE!

The most widely used communications receiver IN THE WORLD! Yaesu's famous FRG 7 covers all MF & HF bands (from 500kHz through to 30MHz) with outstanding selectivity and sensitivity. It uses the famous 'Wadley Loop' principle for superb stability. And now you can really save with the FRG 7! Our huge bulk buying has enabled us to slash the price! But hurry: This special price can only last for the current shipment.

Cat.No D 2850 **NOT $395**

STILL ONLY $359

SAVE $40

The brilliant new

FRG 7700SW

If you want the most up-to-date shortwave communications receiver in the world, you want the Yaesu FRG 7700 SW. Complete short wave coverage with ease of operation the others only dream about.

- Digital frequency display (also shows the time!)
- One dial pre-selector
- Timer for recording etc.
- Optional memory unit for instant popular frequency recall (up to 12 channels)
- Can be operated from 12 volts DC (240V AC normal)

If you're serious about short wave monitoring, you can't go past this superb piece of solid state craftmanship.

Cat.No D 2841

ONLY $499

Optional memory unit: Store and instantly recall up to 12 channels.
Cat D 2842 ..... $149.50

Optional Antenna Coupler/ Attenuator. Get the most from your receiver.
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VALUE OUTSTANDING

Dick Smith

the brilliant YAESU FT-ONE

No longer in the "luxury" category, Yaesu's new FT-ONE is very affordable - especially when compared to other general coverage transceivers. The FT-ONE — a transceiver that commands the bands! Buy your Yaesu from Dick Smith Electronics: Australia's leading factory-approved Yaesu agent .. the ones who give you a full 12 month guarantee AND guarantee to match or better any genuine Yaesu price offered by other suppliers.

look at these features . . .

- ALL mode — even FM* — so you can 'go anywhere' — on its own, or teamed up with a transverter. It's brilliant!
- ALL band — it receives from 150kHz to 30MHz continuous, with resolution down to 10Hz! And the transmitter includes all the new WARC bands.
- ALL microprocessor controlled — which makes operation nice and easy for you (including keeping track of the FT-ONE's 10 memories!)
- ALL area operation: run it from 100-120 or 200-240V AC in the shack, or 13.5V DC when mobile!
- ALL solid state (of course!) with a massive complement of 659 semiconductor devices, including over 70 IC's!
- ALL performance — with better than 0.3uV sensitivity and more than 100W PEP output (SSB).

Cat. D 2852

*FM is optional at extra cost.

Chosen by Dr David Lewis for the 1982 Antarctic Scientific Expedition

$1795

NEW

FT 208R
VHF Handy FM Transceiver

The Ft 208R transceiver brings a new flexibility to today's active 2M operator. An easy to read LCD display is coupled with a 4-bit microprocessor, bringing 10 memories & a scanning function. Only with Yaesu can you get these features at such an economical price. Check it out NOW!

*Price includes charger!

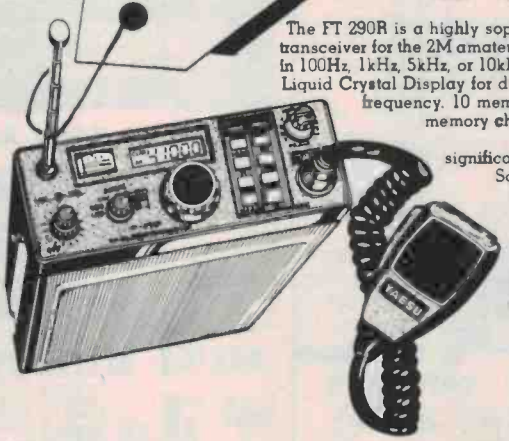
$368

Cat. D 2889

NEW

2 METRE PORTABLE FT 290R

The FT 290R is a highly sophisticated compact multimode transceiver for the 2M amateur band. Featuring PLL sythesis in 100Hz, 1kHz, 5kHz, or 10kHz steps. The FT-290R utilizes a Liquid Crystal Display for digital readout for the operating frequency. 10 memories, scanning of the band or memory channels, two VFO's & receiver offset tuning makes a significant breakthrough in technology. So be quick, these are not going to last! Don't miss out!



Cat. D 2885

$395

DSE/A160/PAI

DICK SMITH Electronics

See our other ads for address details

FEBRUARY FANTASTICS

FABULOUS FEBRUARY SAVINGS

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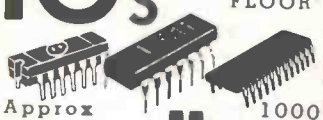
ROTATING EMERGENCY LIGHT
$25
12v DC OPERATION WITH CAR CONNECTOR CORD. WERE $29

12V DC ROTARY SOLENOID STEPPING SWITCH
U.S.A. Made!
$19.99
12 POSITION, SINGLE POLE, SHORTING.

IC's
"SWEEPINGS OFF THE FACTORY FLOOR"



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1000 for $100

UNIVERSAL VIDEO MONITOR

12" Black and White TV can be changed at the flick of a switch to a high resolution VIDEO MONITOR for use with most computers. Operates on 12V DC/240V AC for portable use. Usually $149 NOW SAVE $20 AT THIS SPECIAL PRICE!
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PRESIDENT GRANT 40 Chan $279
INCL. TOP-QUALITY AERIAL AND BASE, LEAD ETC, PLUS SWR METER.
WAS $299 SAVE $20

HEADSETS WITH MIC
WERE $49

from SONY
$25
Electret Condenser Microphone

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For all Australian made HF communications aerials - ensures good ground contact - rugged and reliable - easy to instal on cars, boats, etc. Usually $4.50,
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27MHZ CB AERIAL

This HEAVY-DUTY, FULLY-ADJUSTABLE, HELICAL Aerial is the one the "Truckies" LOVE! Aussie-made for standard black HF bases. No post, rail freight only. WAS $23.50.
$16

CB, HAM RADIO ACCESSORIES

MIKE for CB

GENERAL PURPOSE REPLACEMENT
$8.99

1KW TVI FILTER SHINWA "BIG-GUN" DE-LUXE MODEL

$17

COMMUNICATIONS POWER MICROPHONE

Leson high quality with compression. LOW NOISE
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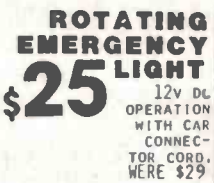

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TV PCB'S

From AWA, these new circuit boards have over 80 parts incl. 8 trans. (2SC1014, 2SC711, 2SA673, 2SA628, 2SC620), 10 diodes, caps, resistors, tripots, etc. GREAT VALUE HERE!
$1 EACH 10 FOR $8.00

Push-Button TUNER BOARDS

$3 EACH 10 For $25.
Comprises 2 boards, one has 8xDPDT push-button switches, similar to Isostat - the other has 8x100K multi-turn tripots with 3 position band-change switches, LTO. QTY.

WANTED TO BUY

- ALL TEST EQUIPMENT
- ELECTRONICS MAGAZINES
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- TRANSCEIVERS
- VIDEO TAPE RECORDERS ETC

NEW RCA KEYBOARDS
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LATEST TOUCH TYPE KEYBOARD IS READY TO PLUG-IN AND USE. NOW AVAILABLE AS A DE-LUXE MODEL WITH EXTRA NUMERIC KEYPAD.

DE-LUXE MODEL ONLY $119

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As used in Pye, Philips, Kriesler and most German colour TV's.

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Brand new Philips EHT transformers. NOW REDUCED $1.50
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NT3100
NT3101
NT3122

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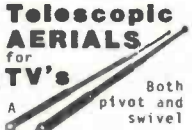

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E. (ON)-OFF-(ON) mom. 70¢ (3P)
F. ON-OFF standard $1.35
G. ON-(ON) momentory $1.00 DPDT
J. (ON)-OFF-(ON) mom. 90¢ (6P)

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CHOICE OF- 100, 470, 1K, 10K, 25K, 50K, 220K, 500K, 2M

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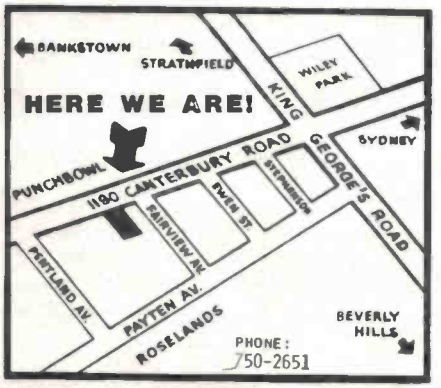
SPDT 8 TO 15V DC, 225 OHMS, PCB MOUNTING
DPDT 24V, 700 OHMS, 5A CONTAC
240V AC HEAVY DUTY 10A CONTACTS 4 CHANGEOVER
Great value, worth over $5 $2.50
huge purchase enables us to sell for less than HALF!
Buy 10+, $2.25
Take your pick, great value, limited quantities avail.



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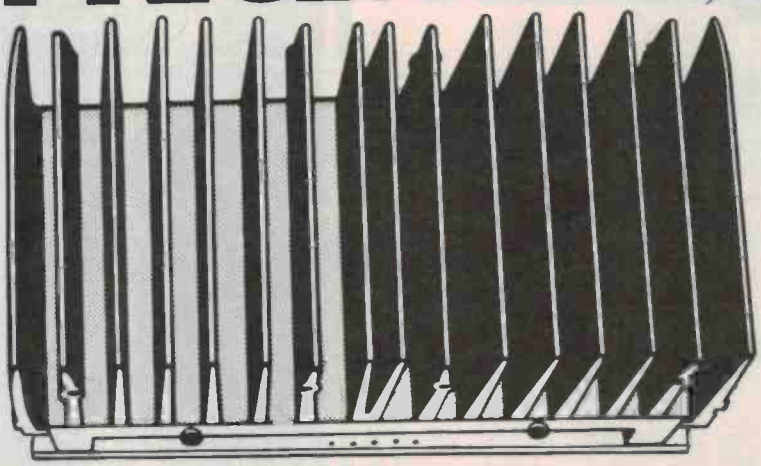


FIRST QUALITY ONLY

POWER AMPLIFIER MODULE

You can see the quality of this kit in the huge, heavy-duty heatsink - no additional heatsinking! The module is self-contained with the PCB at rear. Of course, you need 2 for stereo. Supply +60V and -60V at about 1.5A each channel. PRICE $54.90

120 WATT RMS STEREO AMPLIFIER

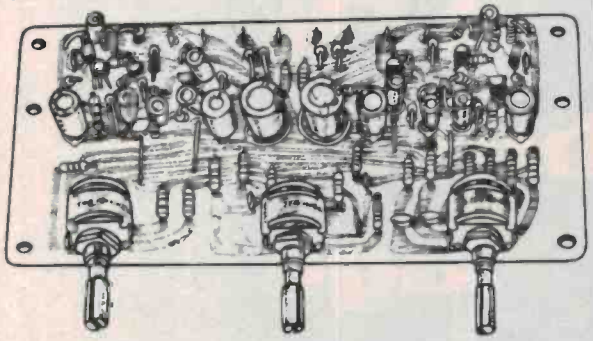
The accompanying data sheets provide-

- Full amplifier specs.
- Module connection and wiring diagrams.
- Suggested layout diagrams for a stereo amplifier.
- Accessory wiring diagrams eg. output power meters.
- Full circuit diagrams.
- Written instructions.

quality that sells itself

SPECIFICATIONS OF THE 120W x2 STEREO AMPLIFIER KITS

Music Power Output	400 Watts (8 ohms)
Continuous Power (both channels driven)	120 Watts (8 ohms)
Total Harmonic Distortion	Less than 0.1%
Power Bandwidth	20Hz-20KHz @ 120 Watts
Frequency Response	10Hz-50KHz
Signal to Noise Ratio	More than 87dB (Tuner, Aux)
	More than 64dB (Phono)
Input Sensitivity and Impedance-	Aux. 150mV 50K Ohms
Phono 2.8mV 50K Ohms	Tape In 150mV 50K Ohms
Tuner 150mV 50K Ohms	Mic. 0.3mV 50K Ohms
Tape Output Level and Impedance	30mV 50K Ohms
Phono Equalizer (NFB type RIAA Standard)	1dB
Phono Overload Level	100mV (1KHz)
Tone Control - BASS 10dB @ 100Hz	MIDDLE 6dB @ 1KHz
TREBLE 6dB @ 1KHz	



TONE CONTROL MODULE

BASS, MID-RANGE and TREBLE CONTROLS for effective tone control with up to 10dB boost or cut. If you agree 3 Way Speakers are the best, then why should you have to have 2 Way tone controls? And these have that "professional feel" of gradual stepped adjustment. You supply only the knobs and a 250K log. volume control. PRICE $17.40

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This module provides a regulated plus and minus 22V DC to power all modules except the main power amplifiers. (These require unregulated power using a 5A bridge rectifier and 2x 10,000uF 65VW, or higher, electrolytic capacitors. PRICE $4.90

COMPLETE STEREO AMPLIFIER KIT

ACTUAL PRICE:

$98 WITHOUT SALES TAX or **$125** INCLUDING SALES TAX

TRADE ENQUIRIES: DISTRIBUTOR PRICES ARE AVAILABLE FOR MINIMUM PURCHASE OF 10 COMPLETE STEREO KITS.

MODULES ALSO AVAILABLE SEPARATELY-

	WITHOUT SALES TAX	INCLUDING SALES TAX
☐MICROPHONE PRE-AMP	$3.10	$3.75
☐PHONO PRE-AMP	$6.25	$7.55
☐TONE CONTROL UNIT	$14.40	$17.40
☐POWER AMPLIFIERS	$45.40	$54.90
	$45.40	$54.90
☐SPEAKER PROTECTION	$8.45	$10.20
☐POWER SUPPLY	$4.05	$4.90
TOTALS	$127.05	$153.60

PACK/POST: 10% OF ORDER OR $5 FLAT.

AS YOU CAN SEE, YOU SAVE AROUND 20% BY BUYING THE COMPLETE KIT.

ORDER FORM:
PLEASE SUPPLY TO-

NAME.....

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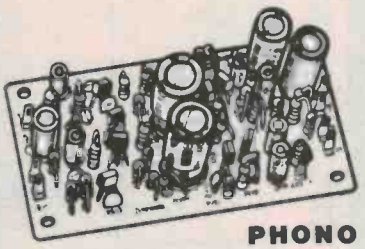
☐COMPLETE STEREO KITS, OR AS INDICATED ABOVE. PAYMENT IS ENCLOSED OR CHARGE-

BANKCARD.....

SIGNED.....

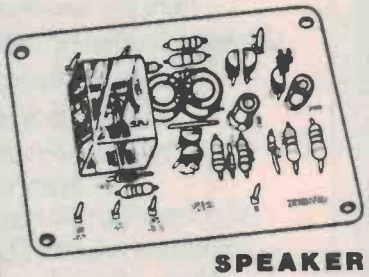


PHONO PRE-AMP MODULE

Designed for magnetic cartridge, this pre-amp requires only 2.8mV for full output, yet easily handles the peak output of music passages up to 35 times greater. Uses the latest low-noise transistors for clean, clear sound. PRICE $7.55

MICROPHONE PRE-AMP MODULE

This module adds versatility to a stereo amplifier for party announcements, sing-alongs, etc. Also for genuine PA use; high sensitivity 0.3mV input. PRICE $3.75



SPEAKER PROTECTION MODULE

Anyone can accidently short the speaker leads, so this module is an "essential". Gives delayed speaker switch-on to allow the power amplifiers to stabilise and it cuts out in an emergency. PRICE $10.20

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COMPUTING TODAY

Colour or color — who cares?

Tandy's new TRS-80 has it!

Latest machine on the colour home computer bandwagon is Tandy's TRS-80C 'Color' computer designed to make "... computing fun for all the family".

Featuring full colour graphics, programmable sound output, colour BASIC language, ROMpak software with games as well as applications and expandability from 4K to 32K, the TRS-80C is to be released here this month.

It has enjoyed phenomenal sales since its release in the US (reportedly in excess of 70 000) and non-Tandy software support is huge. Even the Tandy range of software is very extensive, including everything from arcade games to financial programs and colour word processing. It plugs directly into any colour TV (channel 3 or 4).

Although designed to appeal as a games/home computer for computer fun and frolics at low cost, taking Atari and Commodore head on, Tandy think the TRS-80C will appeal to the education market here also.

The 'basic' machine comes with 4K of RAM, eight-colour capability and a very comprehensive teach-yourself manual. All for just $599, which pitches it fair and square between the Commodore VIC and the Atari 400.

Attachments include joysticks (for games playing) at $39.95 the pair and a disk drive that plugs into the ROM cartridge port (takes up to four disk drives) for $699 per drive.

The 16K version with extended colour BASIC costs $849 while the 32K version is $1099. The extended colour BASIC features advanced graphic capability and easy programming with such commands as CIRCLE, LINE and PAINT.

Program ROMpaks available from Tandy cost either $49.95 or $59.95 and include such goodies as 'Project Nebula', a space game with superb graphics and simulated 3-D movement; 'Skiing', which simulates a downhill race against the clock where you are the skier and the screen shows the scene you would 'see' — very realistic; 'Dino Wars' where two players control a dinosaur each (Tyrannosaurus Rex, no less!) complete with sound effects (the monsters roar and go 'cark, cark' when they die!); plus a filing system, personal finance manager, etc.

For those with extended colour BASIC, Tandy offer a 'Color SCRIPSIT' word processor ROMpak with menu and labelled function keys plus powerful editing features like string search and replace, block move or copy, variable line widths. It also has automatic word wraparound.

There's an RS-232 interface port and of course you can attach a printer.

We're right in the middle of an extended evaluation of a 16K machine and a host of software at the moment, so watch for a full review in an upcoming issue.

See your nearest Tandy dealer for more details or traipse along to a Tandy Computerama show: Feb 7-8 at Lennons Plaza in Brisbane, Feb 28 — March 2 at Centrepoint in Sydney, March 7-9 at the Southern Cross in Melbourne, March 23 at the Parmelia Hilton in Perth and March 27 at Adelaide's Festival Centre. Take your Bankcard!

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	I/OS-MULTI/OS	**CP/M-MP/M**
SOFTWARE SUPPORT OR HARDWARE:	Large device and Disk Driver Library	Nil from Digital Research
EASE OF IMPLEMENTATION:	Easy due to Driver Type structure and dialogue menu configuration	Difficult due to BIOS structure and limitations
MIN SIZE FILE ON HARD DISK:	1K	16K
MAX LOGICAL UNIT SIZE:	65 MEG	8 MEG
MAX STORAGE CAPACITY:	975 MEG	128 MEG
MAX NO. OF FILES:	63,000+	1024
MAX NO. OF DIRECTORIES PER UNIT:	252	1
SUB DIRECTORIES:	YES	NO
DISK MANAGEMENT:	On Disk, shelf checking	In memory, easy to Glitch
MULTIUSER/SINGLE USER COMPATIBILITY:	TOTAL	POOR

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MULTI USER

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WITH CP/M & CDOS AS WELL AS MANY OTHERS!

GRAMMERS IN THE U.S.A. AND ARE THE ORIGINAL WRITERS OF MOSTEK **M/OS/-80** DIGITAL CORP'S **TDOS**

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For Sorcerer Apprentices

A short one this month; I'm off to a well-earned rest in the mulga, away from all technicalities and computers. If I survive it without any major side effects, I shall dig into the real stuff in the next issue again.

Speaking of technology, I'm ever grateful for all the fantastic inventions today's society cooks up for us. While television has taught me to eat on my lap in the lounge room rather than the dining room (the dining room is now the computer room!), my eternal thanks really go to the developers of home computers.

My computer has given me countless hours of joy and/or frustrations, but it has also aroused some deep-seated primeval properties I never even dreamed I possessed. I have learned to eat junk food on my lap, keeping two fingers totally free of grease, tomato sauce or whatever else might be dribbling off. I know exactly how many cups I can wash between compilations. I learned to converse on absolutely unrelated matters while keying in programs or whatever with a minimum of errors in both areas. I can blame the computer for the moods I'm in, be they good ones (the program finally worked), or bad ones (someone gave me another one of those programs!). I made lots of friends with a minimum of effort; we have a common interest known to us on the first meeting. If we run out of conversation we can always go back to talking computers. And, as a passive, not so innocent bystander, I can blame the computer for any hassles I may have with personal relations. All in all, I would not be without it. Computers make the ideal Christmas gift. The unfortunate part is that computer stores do not appear to have after-Christmas specials.

And now to a completely unrelated subject: piracy of programs has been a problem in the industry from the very start. While some people spend hour after hour writing programs and hope to get some remuneration for their troubles, there are others who spend hour after hour copying these programs, but not without first removing the copyright notice and author's name and inserting their own primitive little slogans. This of course is illegal. I do not pretend for one moment that every program in my possesion has been legally obtained, nor do I pretend to understand the copyright laws, which are currently under review and will be upgraded in the near future. Reports on the subject I've heard and read seem to suggest that the proposed changes will be just as incomprehensible as the current ones are, the act appearing to concentrate on the music industry and on photocopying. Since there is no self-regulating body within the industry and no one can guarantee that individuals are never going to pirate programs, authors have been locking their programs.

Locked programs are a good indication of the quality of a program you buy. Obviously, the author must have an above-average understanding of the Sorcerer to be able to achieve the locking in the first place. A locked program simply means that you won't be able to re-record it. Thus the authors make sure that there are no errors in the programs, since you would not be able to fix them. There is no more damaging advertising than having faulty programs in circulation which cannot be repaired by the frustrated owners. I own about 30 programs, of which nine are locked programs. 21 of my 30 programs have some kind of an error somewhere. Give me locked programs any time!

"What about backup copies?", I hear you ask. Recording of locked programs is generally excellent for obvious reasons. Unless you are a complete moron and treat your tapes the way you should not, there is no need for backup copies. Also, you'll find that most suppliers will replace your copy for a reasonable fee. After all, if you buy a diamond you take care of it; when you lose it you'll have to pay for a replacement. I cannot agree with anyone complaining about locked tapes; to me they indicate quality.

Lately more and more programs use the ability to generate sound effects on the Sorcerer. To date I'm aware of three different types of sound-generators: the System Software (AUS) Soundplug, the Arrington Software (US) D/A converter and Software Source's (AUS) Soundbox. Soundplug plugs into the parallel port, so does the D/A converter. Soundbox connects to the cassette motor control unit.

The most sophisticated sound generator is, without a doubt, Howard Arrington's A/D converter. You need an amplifier for this unit; the stereo at home will do fine. As with all Arrington Software, documentation and programming style are excellent. A screen editor allows easy entering of tunes straight from musical sheets. Four-part harmonies, different tempos, etc, are all easily handled by this sound system. The A/D converter is highly recommended for anyone with serious musical applications.

Soundplug's main feature is its ability to drive a speaker without the need for an amplifier. I am a bit concerned, though, about one statement in the leaflet supplied with Soundplug asking the user to turn the volume down if the screen happens to flicker at the time of sound generation. I do not have enough hardware knowledge to tell if it could possibly damage my Sorcerer if I ignore this warning, but the power supply for the speaker obviously is being drained from the Sorcerer.

Soundbox is the lowest priced and is intended for the hobbyist to insert his/her own sound to their own programs. The leaflet supplied in conjunction with the box does not contain a tune, but at least the machine language program is listed as Basic Data statements. Soundbox requires a nine volt battery and has its own internal speaker.

Well, my fishing rod is packed, the billy is in the boot and I'm off. See you later . . .

A.P.F. Fry

First public videotext order goes to IBM

West Germany has picked IBM above other tenders (including British Prestel) for its public videotext system. The official reason given was that Prestel was too expensive, but it is also rumoured that Prestel's hardware and computer language (the little-known BABBAGE), which are not widely used outside Britain, contributed to its not being chosen.

Prestel had been on trial in West Germany in two centres since 1979, whereas IBM launched its first videotext product (software for linking videotext terminals to IBM processors) only in August last year. This software forms the basis of the IBM system to be used in Germany, and will run on a mainframe computer and 70 minicomputers, allowing all owners of IBM computers to hook into the 'Bildschirmtext', as the videotext system will be called.

A telling point in IBM's favour in the STG£12 million tender may have been the fact that it already dominates the German computer market and has sold the Bundespost (Post Office) three mainframe computers.

Prestel is currently being used by five countries on a trial basis — Austria, Hong Kong, Italy, Holland and the USA. After a trial in Switzerland, Prestel was rejected in favour of a rival system from the German will make their decisions by the end of 1983.

Despite the setback in West Germany, GEC (a member of the consortium involved in Prestel), believes it can still win contracts for Prestel overseas, claiming that Prestel is the most advanced videotext system and is still the only system actually in use in a public service network. A disadvantage overseas is of course that national telecommunications authorities will naturally favour home-based suppliers.

Telecommunications authorities are finding that videotext is not as attractive to home users as was first imagined. In Britain sales targets for Prestel TV sets have been adjusted downwards several times, and British Telecom have now decided to concentrate on business users, who are more likely to pay for and use this type of information system. There are at present only around

firm Standard Electric Lorenz. It is expected that most countries evaluating videotext systems worldwide 1800 home users of Prestel in Britain, compared with about 11 000 business users.

Software survey

The National Chairman of the Australian Computer Society's Software Industry Committee, Mr. Karl Reed, said today that the Committee was conducting a repeat of its software industry survey early in 1982.

"This nationwide survey is being funded by the National Council of the ACS and will be the only authoritative source of data on this growing industry," Mr. Reed said.

The ACS is particularly concerned with obtaining detailed information about the activity of microprocessor software providers, since this is a growing segment of the general software industry. "Our 1978 survey showed that the software industry was a major, growing, high technology one, but we targetted primarily the suppliers of software and services to the traditional EDP industry. Our concern on this occasion is to obtain an accurate picture of the microprocessor segment," Mr. Reed said. "Microprocessors will become an increasing part of the computer scene, and supplying appropriate software will become an important industry. As a result the ACS survey must catch as many suppliers of microprocessor software as possible."

When asked, Mr. Reed said that the results of the ACS survey would be used in submissions to State and Federal Government on the industry and its needs. The results should also play an important part in bringing about an awareness of the impact of technology on the Australian economy.

"The computer-related electronics industry is booming in this country, and may be as large as the minerals boom," Mr. Reed said. "Surveys such as this are the only means by which the size of this industry can be reliably estimated. Politicians are usually amazed to find that the survey will go to more than 800 companies."

Companies marketing microprocessor software, services and packages should write to the ACS-SIC team, c/o Louise Cheung, Dept. of Computing, RMIT, P.O. Box 2476V, Melbourne 3001. Telephone enquiries should also go to Miss Cheung on (03)341-2348.

Mr. Reed said that both the Department of Overseas Trade and the Department of Industry and Commerce were already taking interest.

Interfacing the PC1211 to another computer

In the article reviewing the Sharp CE-122 dot impact printer in the November '81 issue of ETI ('You'll have a Shandy, then . . .?') we mentioned the possibility of interfacing the Sharp PC1211 computer (alias the Tandy pocket TRS80) to another microcomputer system, to allow the PC1211 to make use of a printer attached to the other system. Reader Andrew Wood of Sydney wrote to tell us that he had managed to do this, and is able to use a printer connected to a 6809-based system. Here's how he did it:

"The hardware required is minimal. I used a CD4049 CMOS IC to buffer the output from the PC1211, and connected it to a PIA on the ▶

At last - the no com

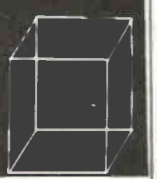
With the release of the MicroBee, Applied Technology brings you a state of the art computer you can build yourself. MicroBee is unique among kit computers in its price range. It offers facilities which make it comparable to machines costing 2 to 4 times its price. Brilliant, cost effective design and new technology have come together to make this machine possible.
MicroBee is a complete computer. It is physically complete.
You get a full case and chassis. You get the power supply. You get full manuals for assembly, BASIC programming and software development. IC sockets are supplied. The advanced 16K basic is supplied in ROM (not on cassette). There are no extras to buy with MicroBee.
In terms of performance, MicroBee comes standard with features which come as extras on SYSTEM 80 and APPLE. Such as upper/lower case and RS232 interface. And things not available on either of these machines. Like continuous memory and built in sound.
MicroBee achieves this at its incredibly low price by using the latest technology. The huge price drops in ICs in recent years have also aided us in bringing you the MicroBee at such a down to earth price.

16K ROM BASIC

MicroBee has been developed as the finest instructional computer on the market. Its superb 16K BASIC in ROM makes this possible. Whether you are a novice or advanced enthusiast, MicroWorld BASIC is a delight to use, with its advanced error reporting and powerful graphics facilities. Just to give you some idea of its power, its gives you:-

- Advanced error reporting with 33 comprehensive error mesages and a feature packed program editor. This BASIC is so 'friendly' that anyone can master the computer and establish computer literacy, so vital in today's technological world.

```
05000 REM This subroutine draws a square of lengths l1,l2
05005 REM with the bottom corner at a1,b1
05010 VAR(A1,B1,L1,L2)
05020 REM Draw left side, then top, then right, then bottom
05030 GOSUB [ A1,B1,A1,B1+L2 ] 4000
05040 GOSUB [ A1,B1+L2,A1+L1,B1+L2 ] 4000
05050 GOSUB [ A1+L1,B1+L2,A1+L1,B1 ] 4000
05060 GOSUB [ A1+L1,B1,A1,B1 ] 4000
05999 RETURN
65000 END
```



- Powerful PLOT facility and high resolution graphics can be combined with alphanumerics to give the MicroBee unparalled graphic display and educational capability.

```
Portions of lines may also be underlined for another effect,
e.g. This procedure must be followed at all times.
or in case of special notation ...
  r = a cos(w) + b sin(w)
                o
The verb in this sentence is swim
```

And with Microworld BASIC you have the support of a great software base. Your MicroBee will run the whole range of MicroWorld BASIC software. This includes a wide range of games and utilities. And the range is increasing all the time thanks to the enthusiasm of the Microworld Users Group.

Full constructional details as well as a BASIC manual and program development ideas are available this month as an article in

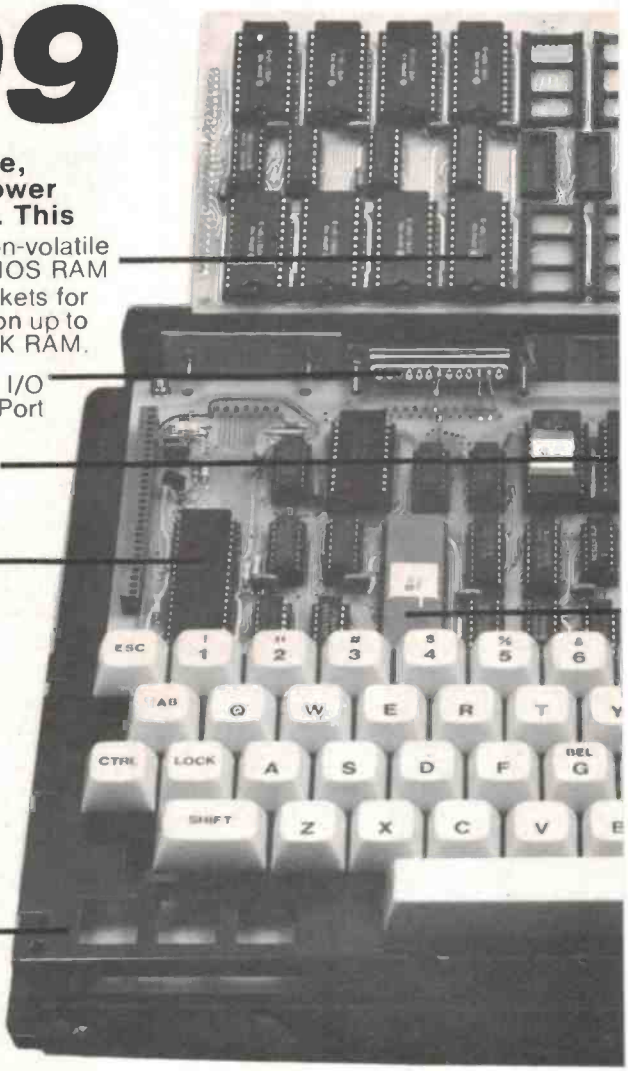
your computer

Due for Release mid February

Complete Kit

$399

Includes manuals, case, 16K BASIC in ROM, power supply,and IC sockets. This kit is complete.



romise kit computer

MicroBee Brief Specs.

CPU	Z80A
VDU	Memory Mapped 16x64 format.Upper/lower case.
Graphics	Under BASIC. Hires 512x256 Low res 128x64.
Keyboard	Full size 60 key QUERTY standard layout.
Cassette Interface	Interface loads and saves at 300, 1200 BAUD.
Serial Interface	RS232.With connector. Suits printers, modems etc.
Parallel Interface	Optional 8 bit I/O. Fully programmable.
Audio Output	Internal speaker. BASIC control. 2 octaves, semi-tones.Period resolution ¼ sec. Max. period ¼x255sec.
Power	12VAC at 1 amp (supplied).

How Good is MicroBee?

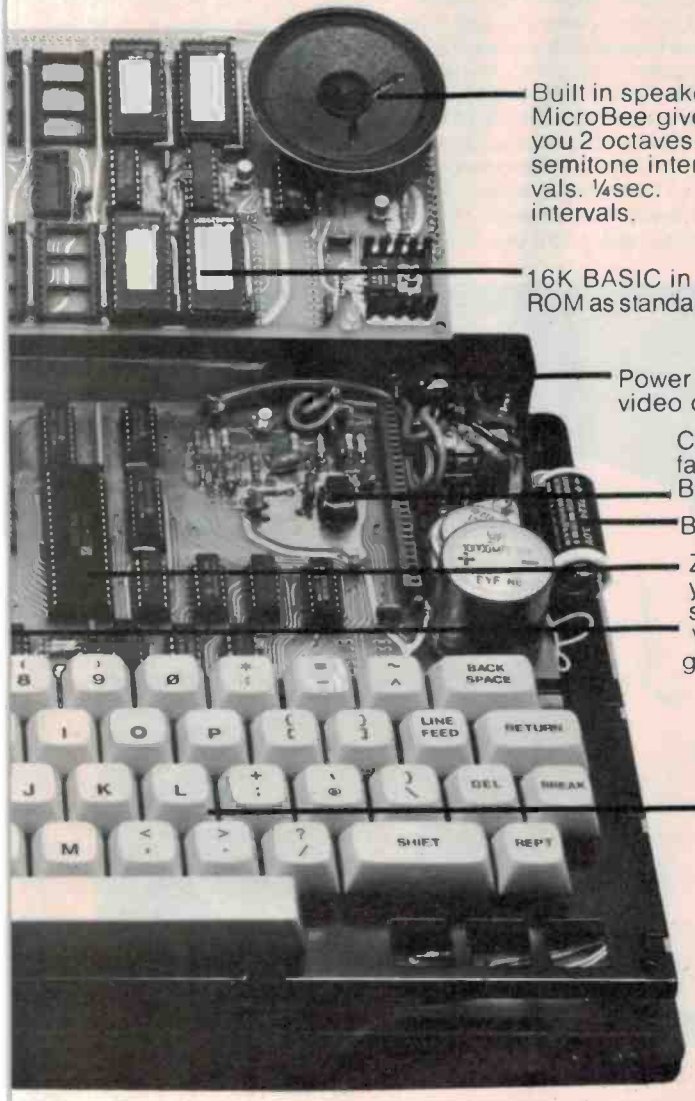
Compare MicroBee feature for feature with imported built-up Micros. Only then will you appreciate what a bargain it is. At last you can buy an Australian designed computer incorporating all the best features of TRS80, APPLE and SORCERER. But at a fraction of the price.

NON VOLATILE CMOS MEMORY

The use of the latest CMOS RAM chips (6116), has made battery backup of memory possible. With MicroBee, you can store a program or data in RAM, switch off, come back later (or move the machine to a new location) switch on again, and your program or data is still there.

No Apologies Service Coupon

With our easy step-by-step assembly manual, solder masked PC boards and socketing throughout, assembly is very straightforward. If you do have any trouble getting your MicroBee going, just fill in the NO APOLOGIES coupon supplied and return your kit to us for service.



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other system. The main problem was the lack of information about the signals which are present on the 9-pin connector on the PC1211, and the format in which the data is transmitted.

"For those who would like to get such an interface working, the following information may be useful. This information is by no means complete, and cannot be guaranteed to be completely accurate.

"Numbering the pins on the PC1211 connector 1 to 9 from bottom to top (i.e: pin 9 is the one nearest to the LCD display): pin 1 is ground, pin 5 is Vcc (approx. +5 V), pin 9 is the serial data output line, pin 7 is the PRINTER/LCD DISPLAY select. If pin 7 is held high (Vcc) and the CA/BREAK key is pressed a few times, the PC1211 will subsequently send the output from LIST and PRINT commands out on pin 9 of the connector, instead of to the LCD display. Pin 8 may optionally be used to stop the PC1211 from transmitting, in the event that the printer cannot keep up. A high level on pin 8 will cause the PC1211 to pause.

"The data is transmitted asynchronously on pin 9, at a rate of about 500 bits per second (2 ms per bit), and is sent a nybble (four data bits) at a time, with the low order bit first after the start bit. It would seem that nybbles are always sent in pairs, to make up 8-bit bytes. The first byte transmitted is an indication of what is to follow:

80 — File name, from CSAVE command
8D — Program line, from LIST command
8E — Print line, from PRINT command
8F — Data block, from PRINT # command.

(All values given are hexadecimal.)

"Data to be sent to the cassette interface, i.e: from the CSAVE or PRINT # commands, has a checksum byte every eight bytes, while data intended to be printed, i.e: from the LIST or PRINT commands, does not have this checksum.

"The code used is not ASCII, and unfortunately the encoded values of keywords are used; for example, the value D8 represents the keyword 'GOSUB'. Values 11 to 1D are special characters, as are the values 30 to 39. Values 40 to 49 are the numbers 0 to 9; 4A is the '.', and 4B is the exponent sign. 'A' to 'Z' are represented by values 51 to 69. The encoded keywords fall into the range 70 to DF, but many values in this range do not seem to be used. Values E1 to FA are used for 'reservable' keys. The end of a line is marked by a value of 00.

"Obviously the values associated with each character depend on which logic level you decide to call '0'. The above values are based on a low level on pin 9 representing a '1' — this at least gives a character set with numbers and letters in the usual order. ▼

"If anybody is interested, I could provide them with further information, including a full translation table."

Thanks very much, Andrew, and if anyone is interested, Andrew can be contacted via P.O. Box C294, Clarence Street, Sydney NSW 2000.

DGZ80 sales top 1000

The DGZ80 single-card computer, based on the S100 and Z80, has now exceeded sales of 1000 in Australia. Designed by local computer man David Griffiths, the DGZ80 is now in use in all major universities and many CAEs and schools.

The DGZ80 is said to be so popular because it is just about the most powerful and flexible S100/Z80 card on the market. It has 2K of on-board RAM, Zilog PIO, switchable power-on-jump and optional interrupt control, and parallel and serial ports are all on-board. This makes it ideal as the basis of a very powerful personal computer system or as a stand-alone process controller.

The DGZ80 also has an optional monitor program, DGOS. Full source listings are available for DGOS, and it is claimed to have become practically an industry standard. It incorporates very powerful block move, examine and replace routines, and has introduced hundreds of Australians to Z80 machine language programming.

Applied Technology, distributor of the DGZ80, felt that congratulations were in order on reaching the 1000 mark, and presented David Griffiths with a double-size DGZ80 card. He's said to be still looking for some double-size ICs to go with it!

Acorns taking root

The UK-designed Acorn microcomputer, which has achieved outstanding sales successes in the past year, is to be introduced to the Australian schools market, backed by a leading Melbourne-based building company, Glenville Homes Pty Ltd.

The BBC in Britain recently placed an order for 22 000 Acorns for an on-air computer teach-in series, and the Acorn was also one of two machines selected to qualify for a 50% Government grant if installed in secondary schools in the UK.

A key factor in the choice of the Acorn system by the UK Government is believed to be its Econet, said to be the lowest-cost network in the world. This networking capability can be extended up to 255 units, although to date in Australia the largest network supports ten Acorn 'Atoms'.

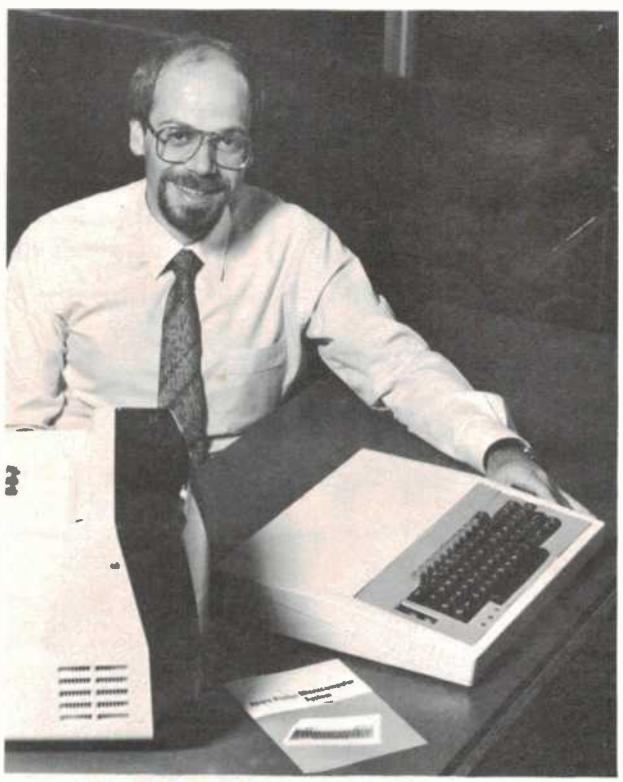
The basic Acorn 'Proton' features 16K of main memory, a 32K ROM and a keyboard, all packaged in an integrated unit priced one-off at $950. Floppy disk storage and a VDU are additional. The RAM is expandable on-board up to 32K, while the 32K ROM can be expanded to 48K. The Proton can support one or two floppy disks, an audio cassette recorder and a light pen input. As well as provision for a professional video monitor, the Proton has an interface for a domestic black and white or colour TV receiver, an RS232 interface, a teletext adaptor, an analogue interface and an Econet interface.

Both PASCAL and BASIC languages are offered with the system, the BASIC being similar to the Microsoft standard but considerably extended.

Acorn Computers (Australia) Pty Ltd, a division of Consolidated Marketing Corporation (Imports) Pty Ltd, will market the Acorn micros, and will be specialising primarily in the emerging schools computer market.

The Sydney-headquartered company Liveware is at present writing a direct instruction package for the Proton.

For further information contact Mr. Julian Barson, Acorn Computers (Australia) Pty Ltd, (03) 419-3033. ▼



PRICE BREAKTHROUGH

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Designed for private and light commercial use, the MICRO-80 conversion provides the PRAXIS with an industry standard Centronics printer port which will operate with most microcomputers including the TRS-80TM, the SYSTEM 80TM the SORCERER and the APPLE. Average print speed is 120 words per minute. An RS232C serial to Centronics converter is also available from MICRO-80 to enable the PRAXIS or any other Centronics compatible printer to operate from an RS232C serial port.

MICRO-80 is an A Grade Olivetti distributor and has been producing printer conversions for Olivetti daisy wheel typewriters for 12 months. All typewriters sold by us carry our Australia-wide 90 day parts and labour warranty. If your need is for a larger, heavier duty typewriter/printer, contact us for details of the ET121 or ET221 conversions.

The demand for this great value printer is sure to be high. Use the coupon below to secure your order today.

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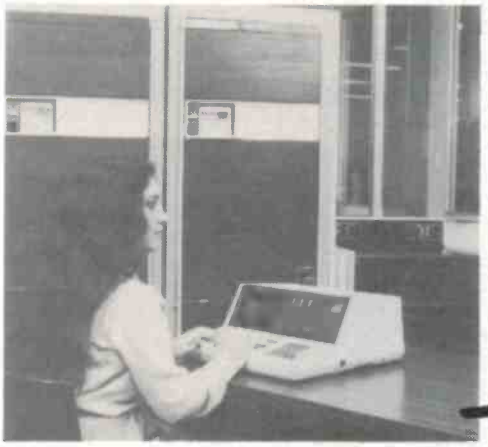

WE ARE PROUD TO ANNOUNCE THE LAUNCHING OF AUSTRALIA'S FIRST MICROCOMPUTER INFORMATION UTILITY

By Popular Demand Special Offer Extended until 28th February!

The AUSTRALIAN SOURCE is Australia's first microcomputer information utility, aimed at giving the average microcomputer user access to the computer data banks and also massive storage space previously only available to large Mainframe Installations. The era of home computers has now officially begun in Australia, now that the AUSTRALIAN SOURCE is here; as now, any small businessman or student can have on his desk for an extremely small cost, a system that has the level of storage power and access to data banks for which only a few years ago, government departments and large private users were paying millions of dollars.

The AUSTRALIAN SOURCE can be accessed through a number of 'approved' personal computers, and terminals, by use of an accoustic coupler or modem.

Users will receive a number of benefits which will include:

INFORMATION SERVICES

Members will have access to a number of information sources which will include the latest news, sports results, financial reports, and farm information.

NATIONWIDE ELECTRONIC MAIL

Members will be able, also, to communicate nationwide with other AUSTRALIAN SOURCE members through our electronic mail system.

THE AUSTRALIAN SOURCE RECOMMENDS 3M DISKETTES

SOFTWARE BANK

Users will have access to a myriad of computer programs that will include entertainment, educational aids, programming and diagnostic tools, and financial applications.

MAINFRAME POWER

Users will have the capability to make use of the Mainframe's huge storage capacity by using any of our large programs, or storing your large programs on our system.

SHOP AT HOME

You can take advantage of our 'shopping by computer' system to get the best prices on a number of popular consumer items.

EXTREMELY EASY TO USE

You do not have to be a computer programmer to make use of the AUSTRALIAN SOURCE. All of the instructions are in everyday English, so that even the younger members of your family will be able to operate the system.

LOW COST

While services like these used to cost tens of thousands of dollars to the government departments and large corporations who used them, they are now available to you for less than the cost of a packet of cigarettes a day for the 'average' user.

You can join the AUSTRALIAN SOURCE by paying a one–time joining fee (normally $100) and a small hourly user charge (normally $10 an hour 8 a.m. – 6 p.m. and $4.50 an hour 6 p.m. – 8 a.m.).

SPECIAL CHARTER MEMBER OFFER

As a special promotion, the joining fee before the 1st February, 1982, is only $60 and this also entitles you to 20% off all list user charges in the future – a great deal for the money.

TO JOIN THE AUSTRALIAN SOURCE FAMILY, AND TAKE ADVANTAGE OF THE EXCITING SERVICES WE WILL BE OFFERING, PLEASE COMPLETE THE COUPON BELOW:

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Yes, I think the idea of the AUSTRALIAN SOURCE is great! I enclose $60, so please send me my user manual and password.

☐ *I have a computer, Brand.....*

Model.....

☐ *Please send me information on low cost equipment packages I can use to take advantage of the AUSTRALIAN SOURCE'S services.*

NAME: .....

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☐ *I am interested, but I need more information.*

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After just one year, George passed his first PMG exam. This enabled him to join an electronics school that normally wouldn't take anyone who had left school so early.

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Today, George Raftou works with a leading electronics company servicing calculators. He hopes the next promotion will see him in the company's computer division. All that achieved in less than three years.

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Check the ICS electronics courses listed below then nominate a specific course in the coupon. We'll send you information without cost or obligation.

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Brisbane: 131 Elizabeth Street, Brisbane. QLD. 4000 Tel: (07) 221 0178.
Adelaide: 28 Grenfell Street, Adelaide. S.A. 5000 Tel: (08) 219 4154.
Perth: P.O. Box D157, Perth. W.A. 6001 Tel: (09) 321 8530.
New Zealand: 45 Courtenay Place, Wellington 1. N.Z. 0206

ICS

ICS 074 M&W

Printout

Mincom buys electrostatic plotter

Mincom, a Queensland-based specialist mining computing company, has installed a Benson Quadramet high-resolution electrostatic plotter in its Sydney branch office, in order to expand and upgrade its services to meet clients' increasing needs.

The Quadramet was released to the Australian market in 1981 by the TCG Group, and is claimed to offer the highest resolution of any electrostatic plotter at 100 dots per centimetre (254 dots/inch), providing line quality comparable with conventional ink plotters. It offers exceptionally high resolution and density output, achieved by four offset rows of writing stylii compared with the conventional two on other plotters.

Printing specifications include Gothic font with 123 ASCII character set, and a character generator provides characters of two sizes. The Quadramet will print 470 lines per minute or 235 lines per minute, depending on character size. Plot speeds, depending on the model, range from 0.35 to 4 inches per second.

Mr. David Merson, Managing Director of Mincom, said, "The advantages of computer-based data management, deposit modelling and mine design are becoming rapidly recognised at technical and management levels. Major companies are increasingly turning to computer techniques for geological data management and mine modelling, to enable the rapid generation of the data for financial evaluation.

"We are essentially a service company and as such must maintain facilities to provide substantial output as rapidly as possible to meet clients' needs. With the electrostatic we are now achieving in minutes the work it would take a draftsperson a week to complete or a pen plotter at least an hour."

Mincom's computer operation is based on two Prime 750 Series processors, and a Benson model 5342 round-bed plotter installed at the Brisbane operation, and a Prime 750 processor and the new Benson electrostatic in Sydney.

For more information on the Quadramet contact Mike Barraclough (02)439-6477, or Deirdre Davis (02)438-3466.

Robots for sale

The Tasman Turtle is a sophisticated robot designed for use by anyone with a microcomputer or other microprocessor-based device such as an evaluation kit.

It is said to be capable of being used for serious work in laboratories or schools for computer studies, artificial intelligence, maze solving, robotics, logic, environment mapping, etc, and could also be used in commercial and business applications such as window display and promotional work.

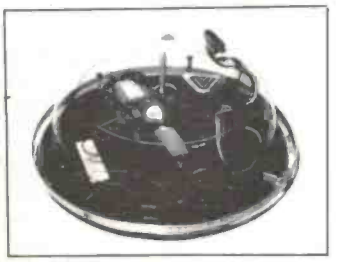
However, most people would probably meet the Tasman Turtle first in the entertainment area, where its design features are said to allow customisation and versatile implementation to a multitude of uses.

Tasman Turtles have the following features:

- heavy-duty stepper motor allowing for ramp or load manipulation for accurate positioning
- four channels dedicated to: horn on/off; horn tone; lights on/off; pen solenoid on/off
- four sensors for peripheral tactile interaction
- auxiliary input for custom use
- 25-pin RS232-type plug for connection to controlling device.

They require 8-bit parallel bidirectional data to access these functions, and a 2 amp 12 Vdc power supply.

Tasman Turtles cost $799 including power supply, not including tax. You can get further information from Flexible Systems, 219 Liverpool St, Hobart Tas. 7000.



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HS11 — 38mm	1.40	1.20	1.00	0.90	0.80	0.70
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BF470	$ .90	10 FOR	$4.00
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IN4003	.06¢	.05¢	.05¢	.05¢
IN4004	.07¢	.06¢	.05¢	.04¢
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7812	80c	80
7815	80c	70c
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MU 45 — DC 1 MA	$ 7.00
MU 45 — DC ± 100 UA	$ 7.50
MU 45 — DC 50 UA	$ 7.00
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	Yellow	30c		25c
	Orange	30c		25c
RECT	Red	.25c		.20c
	Green	.30c		.25c

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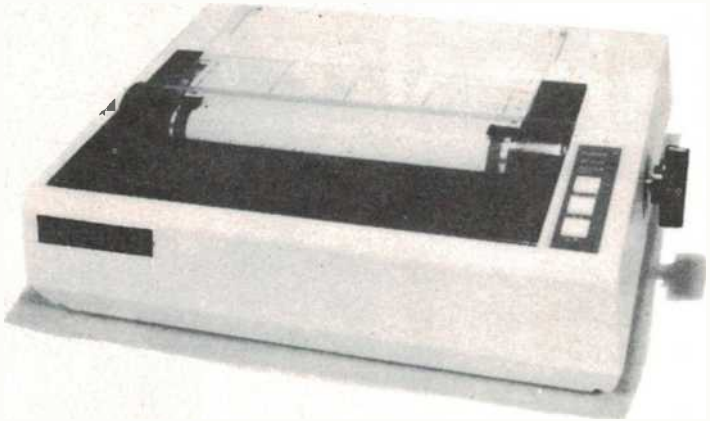
WF

Direct copy addition for the Sorcerer/MX80 printer combo

Don Thomasson

Here is a method of getting the Sorcerer to print what it's showing on the screen onto an attached Epson MX80 printer.



Epson's trusty little matrix printer contains enough processing power to be able to cope with various type styles, tabulations and line pitches. It also copes with dot resolution graphics, and some examples can be seen on the right.

THE EPSON MX80 printer employs a pair of microprocessors to control its actions, an 8049 and an 8041. The program for the 8049 is quite large, extending to 6K, and the behaviour of the printer can be varied extensively by using different programs.

The original program provided a number of type styles, vertical and horizontal tabulation, variable line pitch, and a number of other facilities. A later version dropped some of these facilities, but added 'Bit Mode', of which more anon. The most recent version seen at the time of writing covers most of the features offered by either of its predecessors, plus italic type and reverse video types. Since none of these programs appear to have identifying references, it is necessary to be specific when enquiring about them.

It should be added that some of the programs are available in three-ROM form, and to use these it is necessary to cut a link on the main circuit board to disable the program held in the 8049 microprocessor. Others are supplied as a 4K ROM and a specially programmed 8049. A little confusing, till you get the main idea.

Bit mode

The most interesting facility offered by these programs is 'Bit Mode', which allows every dot position in the whole printout area to be defined as black and white. The only snag is that this can involve quite a lot of dots, up to about 7400 per square inch. An A4 page could accommodate 650 000 dots, and storing that would involve more than 80K bytes of storage!

For some types of work, such as graph plotting, the amount of data can be cut down by specifying the position of black dots and counting off the white dots from the left hand margin, but even that can involve some complex programming.

For those who find themselves frustrated by their inability to make adequate use of Bit Mode, Screenprint may provide an answer.

Screenprint

Screenprint is a machine code program for the Z80, and though described here for the Sorcerer it can be adapted quite easily for other computers with memory-mapped displays.

The Sorcerer stores its screen data in 1920 bytes of RAM, each byte relating to a given character position on the 30-line by 64-character screen. Each byte holds an ASCII code, which is translated into a pattern of 64 dots by reference to the standard character RAM or the graphics RAM. The latter can be set by software to any desired pattern, though the lower half of the graphics range is reset to standard forms when Clear Screen is called.

Screenprint begins by setting IX to F080, the start of screen RAM, this being the screen pointer. An output sequence 1B, 41, 08 is then sent to the printer, to set up a line spacing of 221.5 mm. Some, but not all, MX80 programs require this to be followed by the sequence 1B, 32 to confirm the setting.

Bit Mode with 512 characters per line is then set by the sequence 1B, 4C, 00, 02. This has to be done afresh for every line.

HL is now set to F800, the start of the character definition area, and the first character is read into A. The result is multiplied by eight and added to HL to form a pointer, each character definition occupying eight bytes.

The next operation involves storing the eight bytes defining the character, after which the first bit of each of the eight bytes is assembled in A to form the first data output to the printer. This process is necessary because the bytes define eight horizontal dots, whereas the printer requires eight vertical dots.

When A has been set, a NOP byte is provided; changing this to 2F reverses the print action to white on black, like the screen image, but black on white is clearer.

The byte is then output, and the program loops to J4 to assemble the next output byte. When eight bytes have been transferred, a jump is made to J2 to obtain the next character.

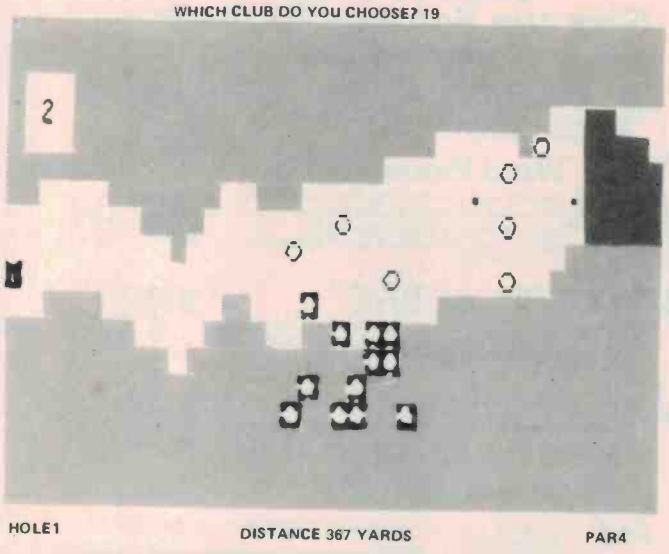
When the line is complete, IX AND 3F = 0, this being used to induce a jump back to J1 to start a fresh line, unless IX has reached F800, one location beyond the end of screen RAM.

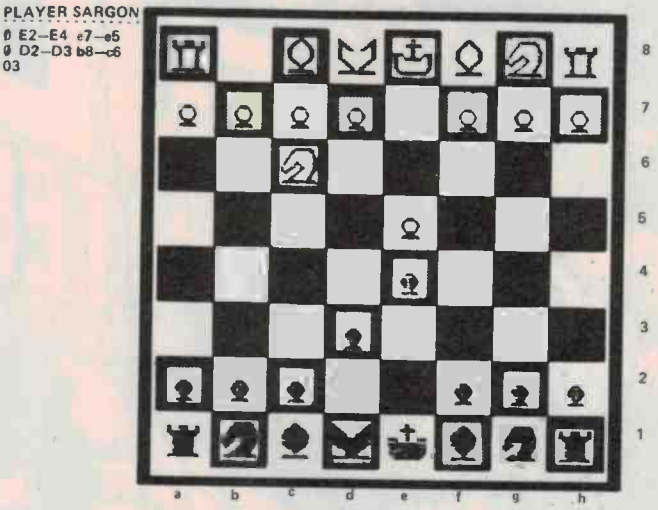
Finally, a sequence 1B, 41, 9 is output to restore the line spacing to the normal 1/6 inch pitch. Here again, some programs may require the sequence 1B, 32 to confirm the new setting.

Performance

The time taken to print a screen is about one minute, and the print quality produced is good. There is a slight discrepancy between the vertical width of a line and the nearest vertical spacing, but this is not too obvious.

An important consideration is that a manual call to Screenprint will show up on the screen and thus on the printed copy, so it is usually wise to arrange for an automatic call at an appropriate point in the program which creates the display. If this is not possible, then the intruding text can be covered by using cursor left to regain the start of the line, spacing forward to erase the text, and then pressing Return. The Monitor does not object, and ignores the redundant part of the input. ●





Two sample printouts of graphics produced on the Sorcerer taken directly from the printer. Because some reduction of size has had to be performed in order to get them onto the page the individual dots have tended to close up, but you can still see the difference in tones available. These are produced by putting less dots into a given area.

Program Listing

```
                PARLOT EQU 0E021    ;PARLOT
0008 C5          SCRPR PUSH BC      ;must be used
0009 D5                PUSH DE      ;because all
000A E5                PUSH HL      ;eight bits
000B F5                PUSH AF      ;must be
000C DD E5             PUSH IX      ;outputs
000E DD 21 80 F0       LD IX,0F080
0012 3E 1B             LD A,27      ;ESC
0014 CD 21 E0          CALL PARLOT
0017 3E 41             LD A,65      ;A
0019 CD 21 E0          CALL PARLOT
001C 3E 08             LD A,8
001E CD 21 E0          CALL PARLOT
0021 3E 1B             LD A,27      ;ESC
0023 CD 21 E0          CALL PARLOT
0026 3E 32             LD A,50      ;2
0028 CD 21 E0          CALL PARLOT
002B 3E 1B       J1 LD A,27         ;ESC
002D CD 21 E0          CALL PARLOT
0030 3E 4C             LD A,76      ;L
0032 CD 21 E0          CALL PARLOT
0035 AF                XOR A
0036 CD 21 E0          CALL PARLOT
0039 3E 02             LD A,2
003B CD 21 E0          CALL PARLOT
003E 21 00 F8    J2 LD HL,0F800
0041 DD 7E 00          LD A,(IX)
0044 DD 23             INC IX
0046 5F                LD E,A
0047 16 00             LD D,0
0049 CB 13             RL E
004B CB 12             RL D
004D CB 13             RL E
004F CB 12             RL D
0051 CB 13             RL E
0053 CB 12             RL D
0055 19                ADD HL,DE
0056 06 08             LD B,8
0058 11 00 00          LD DE,0
005B 7E          J3 LD A,(HL)
005C 12                LD (DE),A
005D 23                INC HL
005E 13                INC DE
005F 10 FA             DJNZ J3-$
0061 06 08             LD B,8
0063 21 00 00    J4 LD HL,0
0066 C5                PUSH BC
0067 06 08             LD B,8
0069 CB 16       J5 RL (HL)
006B 17                RL A
006C 23                INC HL
006D 10 FA             DJNZ J5-$
006F 00                NOP           ;To allow for
0070 CD 21 E0          CALL PARLOT   ;inversion
0073 C1                POP BC
0074 10 ED             DJNZ J4-$
0076 DD E5             PUSH IX
0078 E1                POP HL
0079 7D                LD A,L
007A E6 3F             AND 63
007C 20 C0             JR NZ,J2-$
007E 3E 0D             LD A,13       ;CR
0080 CD 21 E0          CALL PARLOT
0083 3E 0A             LD A,10       ;LF
0085 CD 21 E0          CALL PARLOT
0088 7C                LD A,H
0089 FE F8             CP 248
008B 20 9E             JR NZ,J1-$
008D 3E 1B             LD A,27
008F CD 21 E0          CALL PARLOT
0092 3E 41             LD A,65
0094 CD 21 E0          CALL PARLOT
0097 3E 09             LD A,9
0099 CD 21 E0          CALL PARLOT
009C 3E 1B             LD A,27
009E CD 21 E0          CALL PARLOT
00A1 3E 32             LD A,50
00A3 CD 21 E0          CALL PARLOT
00A6 DD E1             POP IX
00A8 F1                POP AF
00A9 E1                POP HL
00AA D1                POP DE
00AB C1                POR BC
00AC C9                RET
```

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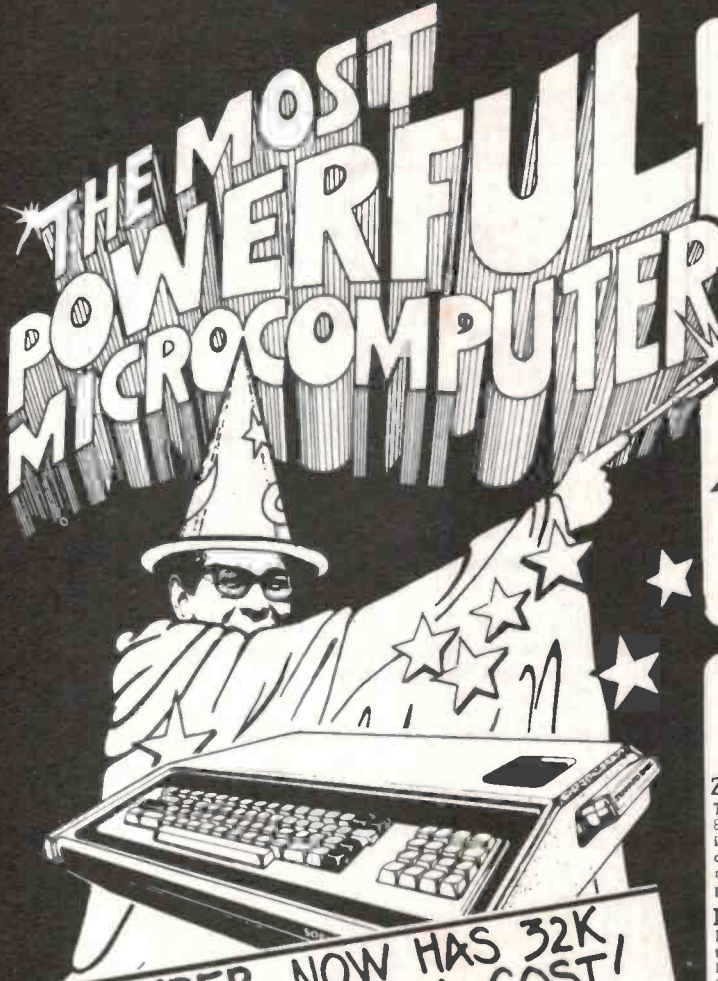

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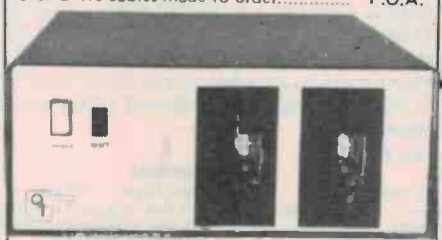

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- 2 DD55 cut outs.
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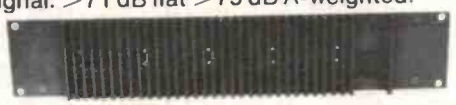

N.B. Picture Is only of original heatsink supplied with this project. Our one is tapped from the rear so that no screw heads are visible. New picture next month.

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Sinclair's little beauty — the ZX81

Phil Cohen

The ZX81 is a remarkable machine for many reasons — not the least of which is its price; it must surely be the cheapest of the BASIC machines. We asked Phil Cohen to review it.

I REMEMBER FROM my adolescence (I'm not as old as I feel) the first of the Sinclair devices to hit the British market. These included a matchbox-sized radio, a calculator (which hit *before* the Japanese ones), a digital watch kit at a fraction of the cost of competitive ones, and so on.

Although these may raise a yawn nowadays, at the time they were at the forefront of the market. Imagine the reaction of the public to the *first* digital watch, the *first* calculator — real 'Boys' Own Paper' stuff.

Sinclair entered the computer market with a little development kit based on the SC/MP processor, then moved very quickly up-market with the ZX80 (the forerunner of the ZX81).

I remember my reaction on first seeing the *ZX80* advertised — I looked at the date of the magazine to see whether it was an April edition. I really believed that it was a joke! I didn't think anyone could put so much into so small a package at so low a price.

The ZX80 had a couple of dozen chips and primitive BASIC capabilities. The ZX81 has as powerful a BASIC as many other machines on the market, and the British version has five ICs (ignoring the three-terminal regulator). The Australian version has seven, but the extra two are 'piggyback' add-ons to allow for the differing TV standards.

Amazing!

To look at, the ZX81 seems to be a mock-up of itself — it weighs about as much as a paperback, it has no moving parts, it has no trailing wires, its case is plastic. ▶

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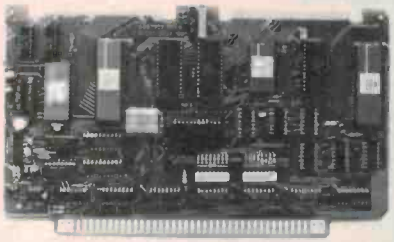

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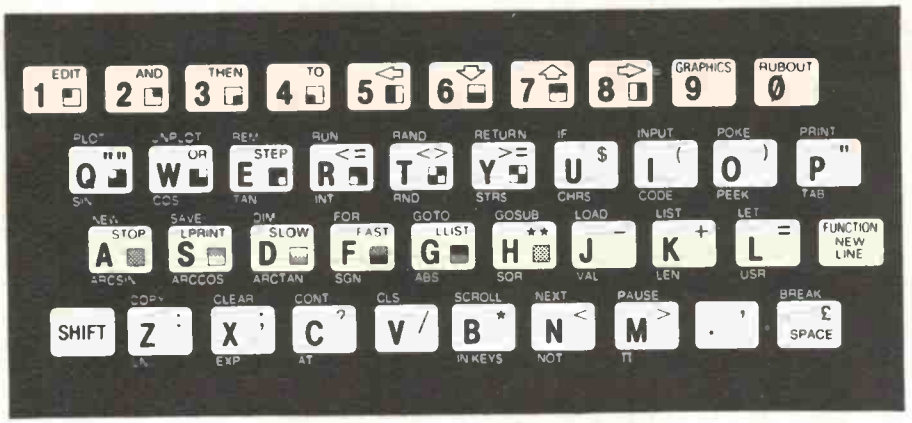


The ZX81 keyboard, just a little smaller than lifesize. It's made for small fingers. The editor's son, Jamye, boasts he can type faster than his father on this one!

The keyboard looks as if it has simply been printed onto the front of the case. In fact, it's 'elastomeric', made up of a conductive rubber sheet over a set of printed circuit contacts. When you press the sheet down, it makes contact with the circuit board. It's just difficult to believe that it is what it's claimed to be.

Hardware

Input and output for the ZX81 could not be simpler — literally. Output is direct to a TV set (not a monitor), and there are a couple of sockets for connection of a cassette recorder for program and data storage.

The power for the ZX81 comes from a 9 V dc plugpack — a combined mains plug, transformer and power supply. This plugs into the side of the computer. And that's it! Unless you want to add peripherals.

There is an exposed section of edge connector pads at the top of the machine designed for the addition of the two peripherals so far released. One is a RAM pack which brings the total memory from its existing, rather limited, 1K up to a more sensible 16K. It costs $150. The other peripheral available is a printer, which has only just been released here. It costs $175 and features full alphanumerics plus graphics and prints 32 characters to the line, nine lines every 25 mm.

The processor used in the ZX81 is a version of the ubiquitous Z-80, made by NEC and designated '780-1'.

The keyboard is laid out in the normal typewriter 'QWERTY' manner — although *much* smaller than a typewriter keyboard. One user I heard from (he's ten) said it was just the right size.

I, unfortunately, have normal-sized adult hands, so it's a bit small for me. In fact, that's one of the few criticisms I have of the ZX81 — you can't type on it, you have to use it like a calculator.

In fact, there's no 'feedback' to tell you that you've pressed a key — so you have to keep moving your eyes from the screen to the keyboard and back again. After a while (particularly during program entry) this gets very tedious indeed, but I suppose that most of the buyers (myself included, if I'd bought one instead of being loaned one for review) would rather have the cash than a better keyboard. It's very tempting for reviewers to catalogue the facilities that are missing from a device while at the same time forgetting that if they had been included, the buyer would inevitably have to pay. The incredibly low price of the ZX81 (about $250 complete, built and tested) is one of its main attractions.

The other difference between the ZX81 keyboard and those more normally found on computers is the fact that the key functions don't stop at the letters of the alphabet.

Statement Entry

This 'doubling up' of functions is due to the extremely clever way in which Sinclair have arranged their program entry.

Say you want to enter the line "10 PRINT A". In most computers, you would press the '1' key, then the '0' key . . . through to the 'A' key at the end of the line. On the ZX81 you start with the line number, then simply press the 'P' key. Up on the screen comes "10 PRINT". There's no need to type the rest of the word in. Then you press the 'A' key (no need for a space — the computer supplies that).

The ZX81 BASIC is arranged so that the first word on each line is a keyword (like PRINT, FOR etc). So when you press the 'P' key, the machine *knows* that you mean PRINT, because the next entry *must* be a keyword. On the keyboard, the word PRINT appears over the 'P' key.

In fact, nearly all of the keys have a keyword associated with them. One consequence of using this system is that the old 'LET' statement (introduced in the very first version of BASIC, nearly 20 years ago) is resurrected. Most systems these days allow you to miss out the word LET in an assignment statement.

Another consequence of the system is that the software doesn't have to check the spelling to see if it's a keyword (as in other systems, where the entry is held in memory as a series of alphanumeric characters, interpreted only at run-time). Each of the keywords is entered and stored as a single character (although it appears spelt out on the screen). This is not only faster, it also saves memory.

There is also a SHIFT key, and a combination of other keys (FUNCTION and GRAPHICS) to select other options from the same letter key. In fact, some of the letter keys have *five* different functions crammed onto their ultra-small face!

The ZX81 is not for those who have trouble with small print!

Display

The display on the screen is rather unusual for two reasons: the first is that all characters are shown normally as black on white. I found this rather pleasant, and less of a strain on the eye than the normal white-on-black.

The second rather unusual feature is that there is no automatic scrolling of the display. In most systems, when the PRINT statements in the program have put enough lines out to fill the available space, the screen 'scrolls' up one, leaving a blank line at the bottom for the next line of output. The ZX81 does not have this feature — and in fact, if the PRINT statements try to put too much onto the screen, an error will result and the program will halt!

There are two ways to get round this. One is a SCROLL statement, which moves the screen up one line. The second is the CLS statement, which clears the screen.

It is rather surprising that Sinclair have chosen not to implement the automatic scroll — perhaps they have some good reason. I can't think of one.

The character set consists of uppercase letters, numbers, and the very minimum of other symbols. In fact, Sinclair have kept the character set so small that I think some users may run into problems. For example, the symbol for multiplication is an asterisk '*', and the symbol for exponentiation (i.e: raising to a higher power) is two asterisks '**'. Now, it is quite possible to put two of the multiplication symbols into a line side by side. However, this is not interpreted by the computer as exponentiation. That has to be the special '**' symbol. Unfortunately, there is no easy way that the user can tell the difference between the two on the screen. So it is quite possible to do as

I did — to type two multiplication symbols to mean exponentiation, and then wonder why it didn't work.

Syntax Checking

Each line of the program is checked for syntax as it is entered. Not only does this mean that problems will be shown up as they occur, but also that the machine doesn't have to check the syntax again as it runs the program.

The graphics symbols are fairly complete — allowing each character position to be split into four segments, each of which can be black or white.

There are also symbols which allow shading of each character position, split horizontally into two segments (see photo of the keyboard). Each of the symbols in the alphanumeric set can be shown 'reversed', also.

As each line of program is entered, it appears on the screen in its correct position. So the normal method of looking at the program — a LIST command which scrolls the listing onto the screen — is not used.

Instead, the bottom couple of lines of the screen are an 'entry area', where the cursor appears. The top part of the screen then shows whatever part of the program the last line was entered into.

In fact, this method of entry is very much easier to use than the normal 'scroll' method. It means that you can actually see the program change as you enter lines — this is very useful for beginners, who sometimes have trouble visualising what is happening inside the machine.

There is also an EDIT facility — one of the already-entered lines can be called into the bottom part of the screen and modified, before being replaced in the main part of the program.

The operating system has a couple of features which are unique to the ZX81 — one of these is the ability to run in two modes — SLOW and FAST.

In the SLOW mode, the machine gives a 'flicker-free' display — the screen display is constant while calculations are in progress.

In the FAST mode (about four times as fast), the screen blanks while the machine is calculating, only coming on when it is paused for input (or during execution of the PAUSE command). This is because Sinclair are using the *CPU* to output the display!

The cassette saving routines have the ability to label the programs with an alphanumeric string, and to search for that string when the program is read off tape, only starting to load when they find the right program.

Another unusual feature is that when a program is saved, all the current variable values are saved, too. This is nice for fitting very 'tight' programs into the machine — the data initialisations do not need to take up *any* memory. The only space they need would already be used by the variables themselves.

Manual

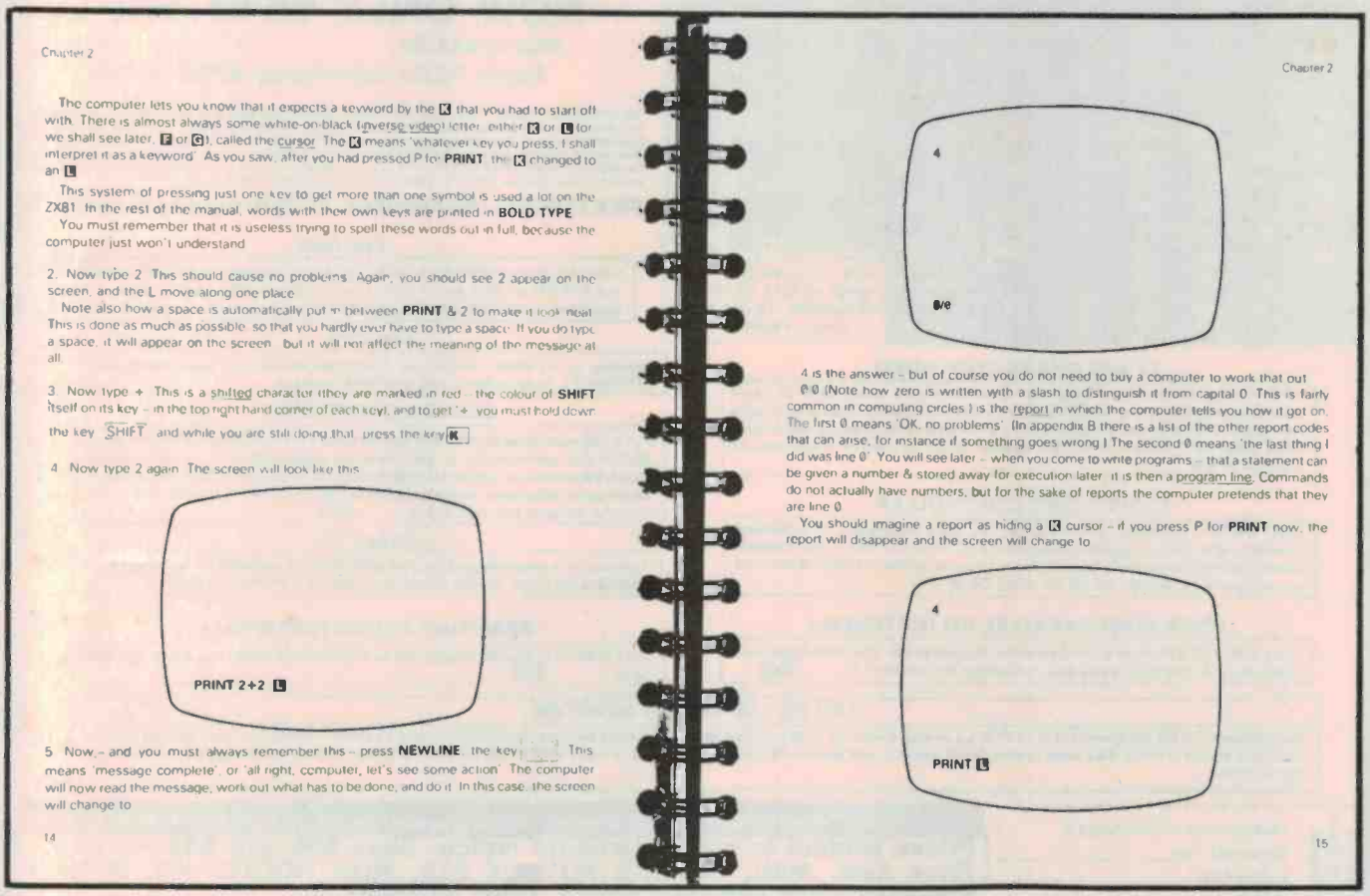
The documentation that comes with the ZX81 is really excellent — the author, Steven Vickers, has taken a very down-to-earth approach, and the whole thing (over 200 pages of it) hangs together very nicely indeed. It is well peppered with explanatory examples, and is written in an easy style that will not confuse or frighten anyone. It's also spiral bound, so that it will lie flat while you copy programs from it!

The manual for a machine like the ZX81 is almost as important as the hardware itself — it is, after all, primarily a teaching machine.

The only thing that's missing from the manual is any sort of comprehensive hardware details. I suppose, though, that given the probable audience this would not be worthwhile.

The manual not only describes the ZX81 BASIC in loving detail, it also goes on to describe the internal software in some depth, including a full listing of ▶

An example of how the manual is set out. It's one of the clearest, best-written manuals we have ever seen and perfectly suited to the user, beginner or not.



Chapter 2

The computer lets you know that it expects a keyword by the K that you had to start off with. There is almost always some white-on-black (inverse video) letter, either K or L for we shall see later, F or G), called the cursor. The K means 'whatever key you press, I shall interpret it as a keyword'. As you saw, after you had pressed P for **PRINT**, the K changed to an L.

This system of pressing just one key to get more than one symbol is used a lot on the ZX81. In the rest of the manual, words with their own keys are printed in **BOLD TYPE**.

You must remember that it is useless trying to spell these words out in full, because the computer just won't understand.

2. Now type 2. This should cause no problems. Again, you should see 2 appear on the screen, and the L move along one place.

Note also how a space is automatically put in between **PRINT** & 2 to make it look neat. This is done as much as possible, so that you hardly ever have to type a space. If you do type a space, it will appear on the screen, but it will not affect the meaning of the message at all.

3. Now type +. This is a shifted character (they are marked in red – the colour of **SHIFT** itself on its key – in the top right hand corner of each key), and to get '+' you must hold down the key SHIFT and while you are still doing that, press the key K.

4. Now type 2 again. The screen will look like this:

PRINT 2+2 L

5. Now – and you must always remember this – press **NEWLINE**, the key . This means 'message complete', or 'all right, computer, let's see some action'. The computer will now read the message, work out what has to be done, and do it. In this case, the screen will change to

14

Chapter 2

4

0/9

4 is the answer – but of course you do not need to buy a computer to work that out. 0/0 (Note how zero is written with a slash to distinguish it from capital O. This is fairly common in computing circles.) is the report in which the computer tells you how it got on. The first 0 means 'OK, no problems'. (In appendix B there is a list of the other report codes that can arise, for instance if something goes wrong.) The second 0 means 'the last thing I did was line 0'. You will see later – when you come to write programs – that a statement can be given a number & stored away for execution later. It is then a program line. Commands do not actually have numbers, but for the sake of reports the computer pretends that they are line 0.

You should imagine a report as hiding a K cursor – if you press P for **PRINT** now, the report will disappear and the screen will change to

4

PRINT L

15

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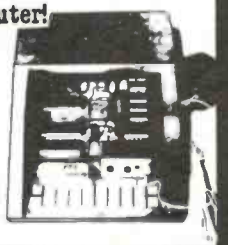

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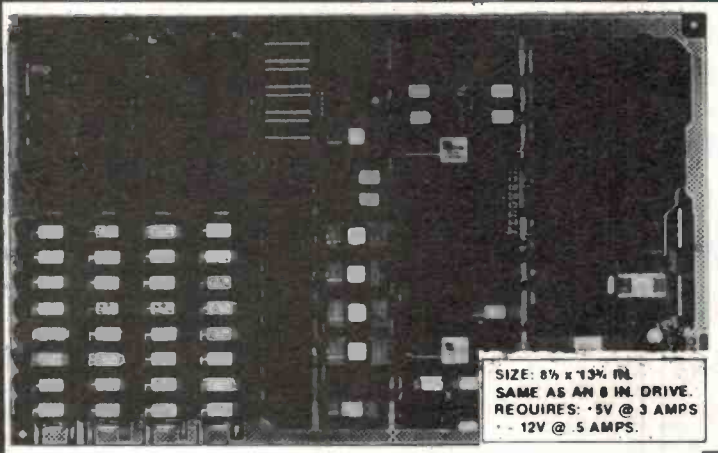

SIZE: 8½ x 13¾ IN. SAME AS AN 8 IN. DRIVE. REQUIRES: +5V @ 3 AMPS + 12V @ .5 AMPS.

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64K RAM

Uses industry standard 4116 RAM'S. All 64K is available to the user. our VIDEO and EPROM sections do not make holes in system RAM. Also, very special care was taken in the RAM array PC layout to eliminate potential noise and glitches.

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Running at 2.5 MHZ. Handles all 4116 RAM refresh and supports Mode 2 INTERUPTS. Fully buffered and runs 8080 software.

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SERIAL I/O (OPTIONAL)

Full 2 channels using the Z80 SIO and the SMC 8116 Baud Rate Generator. FULL RS232! For synchronous or asynchronous communication. In synchronous mode, the clocks can be transmitted or received by a modem. Both channels can be set up for either data-communication or data-terminals. Supports mode 2 int. Price for all parts and connectors: $95

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Uses WD1771 controller chip with a TTL Data Separator for enhanced reliability. IBM 3740 compatible. Supports up to four 8 inch disc drives. Directly compatible with standard Shugart drives such as the SA800 or SA801. Drives can be configured for remote AC off-on. Runs CP/M® 2.2.

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Consists of a separate parallel port (Z80 PIO) for use with an ASCII encoded keyboard for input. Output would be on the 80 x 24 Video Display.

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Uses Z-80 PIO. Full 16 bits, fully buffered, bi-directional. User selectable hand shake polarity. Set of all parts and connectors for parallel I/O $45

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Uses Z-80 CTC. Can be configured as a Counter or Real Time Clock. Set of all parts: $25

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The real power of the Big Board lies in its PFM 3.0 on board monitor. PFM commands include: Dump Memory, Boot CP/M®, Copy, Examine, Fill Memory, Test Memory, Go To, Read and Write I/O Ports, Disc Read (Drive, Track, Sector), and Search. PFM occupies one of the four 2716 EPROM locations provided. It does not occupy any of the 64K of system RAM!

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PLEASE WRITE OR RING FOR THE BEST POSSIBLE PRICES ON DISC DRIVES, PRINTERS AND OTHER COMPUTER COMPONENTS.

the system variables and their interpretation, and a section on how to use machine code programs with BASIC.

Using it

Now we come to the most important part — how the machine performs.

I didn't try any 'benchmark' programs on the ZX81 — there's not much point, because all they would show is that the machine is significantly slower than almost any other on the market.

I say again — it's a teaching machine. So the speed doesn't *really* matter.

I wouldn't recommend the ZX81 to someone who wants to do a lot of number-crunching, though — you'd be better off with a programmable calculator.

The display is sharp enough to be read without too much strain — even on my little portable. The characters are a little 'blocky', but not outrageously so.

Apart from the problem I mentioned earlier about the keyboard having no feedback, the only other major trouble in using the ZX81 is that 1K is really rather small — even with one character per keyword.

Executing DIM A(150) is enough to get you right into trouble. Things start to move about on the screen as you enter lines of program. I suppose that's understandable, though — they *did* manage to squeeze the whole thing into a very small case.

On the whole, ZX81 is a rather frustrating machine to use — this is partly a combination of the slowness and the keyboard feedback problem. The fact that some of the characters need up to five key presses to enter them doesn't help, either.

Then again — if it's the only computer that you can afford, and it's the first one that you've used, then it's not likely to trouble you.

ZX81 BASIC

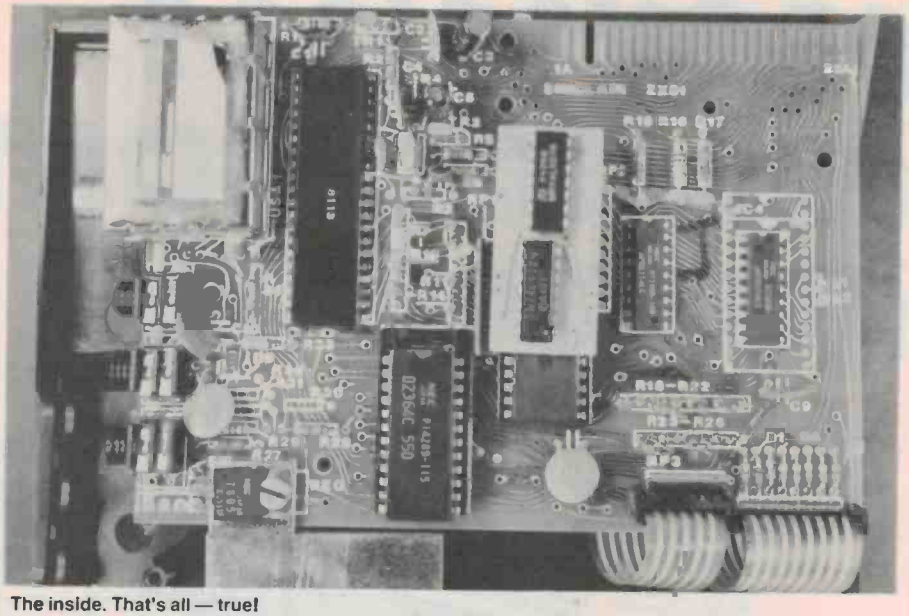
Finally, I've included a list of the commands and features of the ZX81 BASIC, so that you can see that the ZX81's language is every bit as comprehensive as that of other machines on the market.

Variables may have an alphanumeric name of any length, starting with a letter and continuing with letters and numbers — and *spaces!* This is due to the unique keyword entry method.

Values are stored to 9 digits, with a range between about 10^{-38} and 10^{38}. (That's from real-tiny-minute to gi-normous).

Array names are a single letter, and arrays may have any number of dimensions of any size.

String arrays are allowed — but all of the strings in the array are the same length.



The inside. That's all — true!

String variables are any length, but the string name is only a single letter.

Functions supported include: absolute value, arccos, AND, arcsin, arctan, CHR$, CODE (the same as ASC in other BASICS — but it's not ASCII), cos, x^e, INKEY$ (gets a key press from the keyboard), integer part of a number, length of a string, ln, NOT, OR, PEEK, pi, random number, sign of a number, sin, square root, STR$, tan, user machine code routine call, and VAL.

Statement types are:

CLEAR deletes all variables
CLS clears the screen
CONT after 'break', continues execution
COPY sends a copy of the screen contents to the printer
DIM dimensions arrays
FAST sets machine into fast mode (see text)
FOR . . . TO . . . STEP forms a loop (the variable used must have only one letter in its name)
GOSUB sends program to a BASIC subroutine
GOTO sends program to a line number (line number may be expressed as an expression)
IF . . . THEN allows changes in program flow — but multiple statements per line are not supported
INPUT allows the user to input an *expression* (!)
LET is required for assignment statements
LIST allows the user to call up any part of the program on the screen's display area
LLIST sends it to the printer
LOAD searches for the program name on the tape, then loads it
LPRINT sends output to the printer
NEW initialises the whole system
NEXT ends a FOR loop
PAUSE stops the program for a set period from 1/50 of a second to about 10 minutes
PLOT makes one quarter of a character position in the position specified go on
POKE allows the program to alter memory directly
PRINT puts information onto the screen. Features supported are: comma (giving a fixed tab), semi-colon (at the end of the statement, preventing line feed and carriage return) and TAB
RAND allows randomisation of the RND variable sequence
REM for remarks
RETURN ends a subroutine
RUN runs a program. RUN (line number) starts the program from that line number
SAVE puts the program onto tape, with a name of any length
SCROLL moves all the lines in the display area up one
SLOW puts the machine into slow mode (see text)
STOP halts execution
UNPLOT turns off one quarter of a character position in the position specified

Summary

The ZX81 is a very high value-for-money machine. It's designed as a teaching machine, and at a price around $250 is very well targeted.

It is not a machine for those who have number-crunching applications in mind. For that it is rather slow and a bit awkward.

It does, however, have almost all the advanced features found on other BASIC systems. Having mastered the ZX81, you will be able to drive almost any other machine after a couple of days.

It would make a tremendous birthday present for anyone from age 10 upwards. For a week's wages, you would be giving a package that contained many years of future for the recipient.

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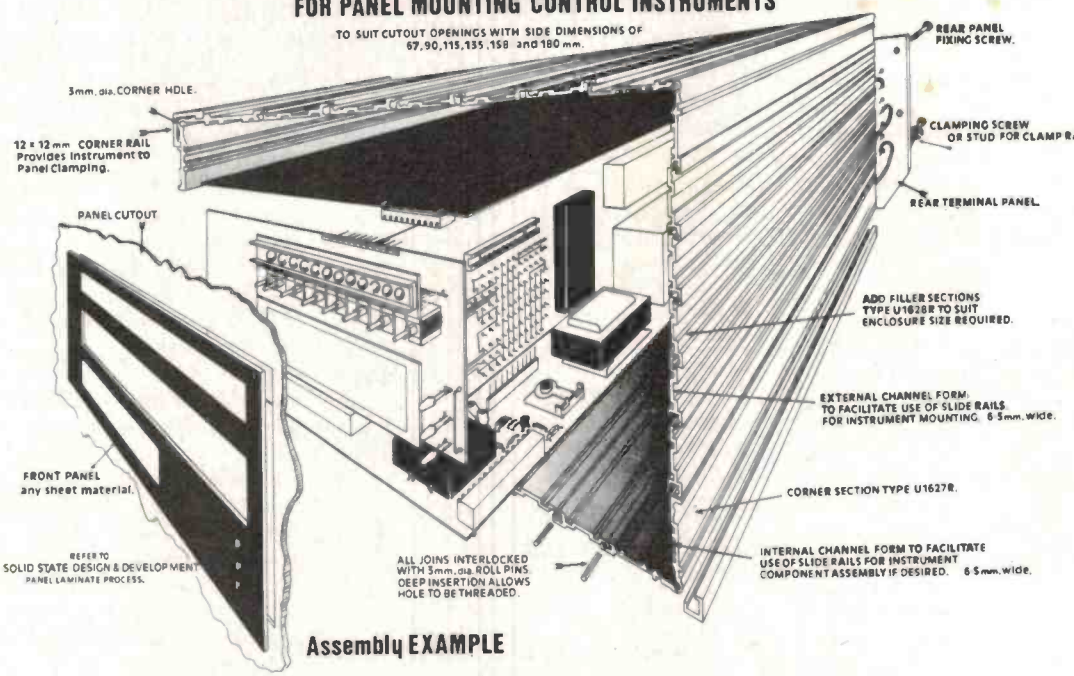

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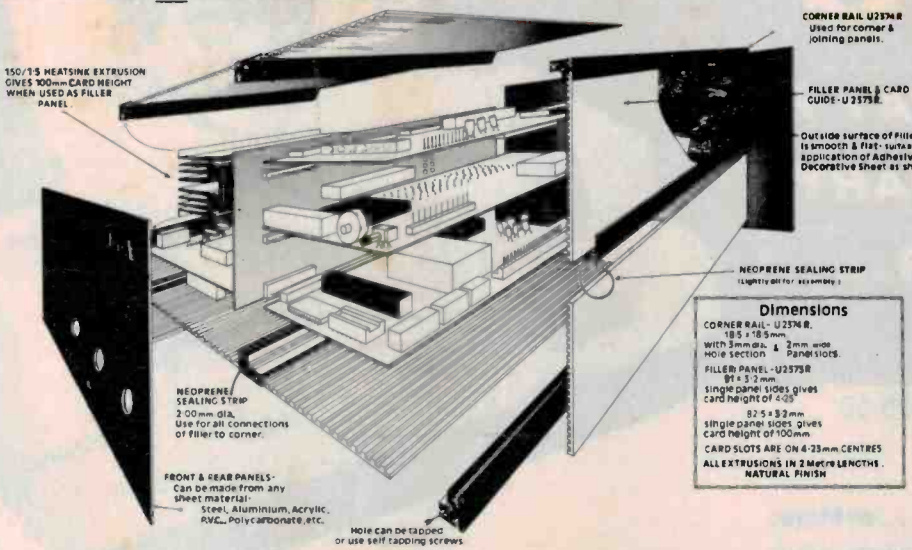

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The design of this system facilitates a simple plug-together circuit construction eliminating much assembly detail, & the need for many screws.

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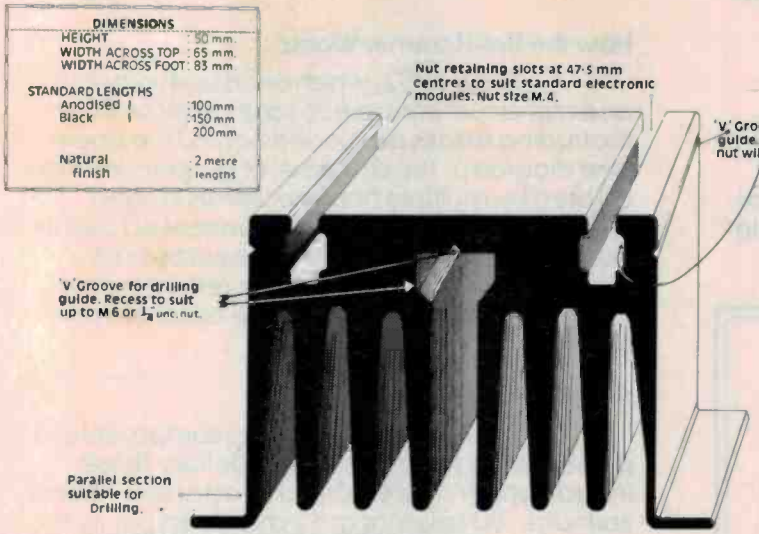

Versatility is the keynote of this extrusion. The incorporated features permit high-speed assembly with minimum use of jigs & fixtures for fitting electronic "pack" & stud mount devices, as well as terminals

Performance

100mm Black Anodised length-
Vertical in free air.
1·4° C/W @ 30W

Don't forget - this extrusion is compatible with Series II Extrusions -
SEE ABOVE ILLUSTRATION

HEATSINK EXTRUSION TYPE 150/1-5

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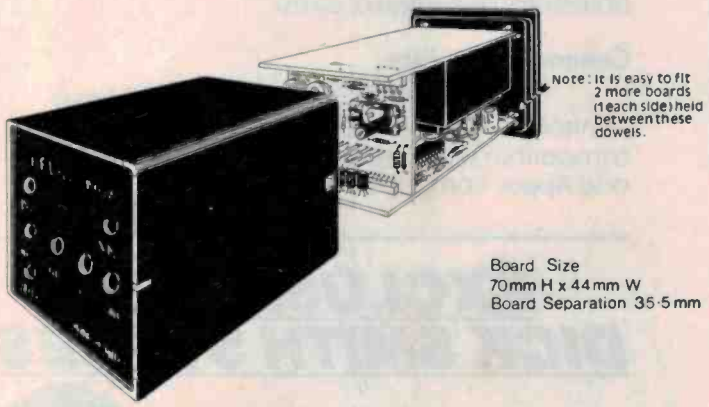

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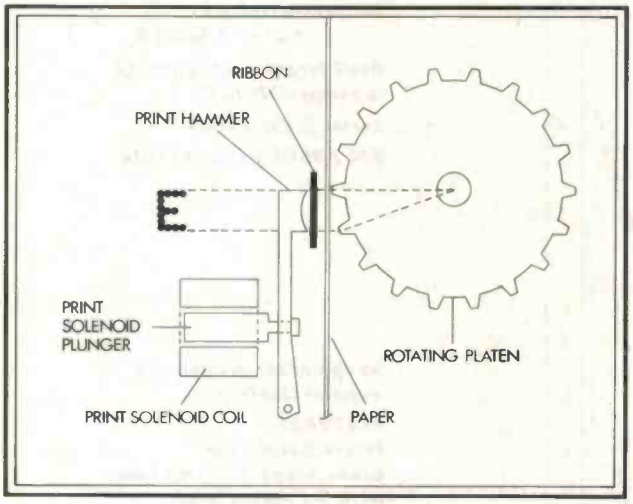

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How the Uni-Hammer Works

The X-3252, which prints both graphics and alphanumerics, uses a rotating platen with protruding splines positioned behind the paper (see diagram). The character or graphics image is created by multiple hammer strikes in rapid succession as the print head advances across the paper. The precision gear train assures exact positioning of the print hammer relative to the splines on the platen, to provide excellent print quality.

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The X-3252 has features comparable to printers selling for thousands of dollars. These include upper/lower ASCII character sets, ribbon cartridge, 80 columns at 12 characters per inch, adjustable tractor feed, original and 2 copies, 30 characters per second, and full graphics with a resolution of better than 60 dots per inch in both horizontal and vertical axes.

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GRAPHIC DETAILS

MANY CURRENTLY available personal microcomputers are equipped with memory-mapped screens and graphics character sets. These facilities allow the user to produce pictorial and graphic displays (the resolution generally being somewhat crude) and play all those interesting games. But what if you want to translate a program written for another machine which uses another graphics set and has a different screen memory area? Up till now this has been a difficult task, and its success has tended to depend on the quality of the documentation supplied with the published software.

Now, if you had a series of charts showing all the standard codes and screen positions, you could look up on the appropriate one, cross-reference to your machine and select the correct graphic and its code. Here we give a selection of graphics sets belonging to some of the popular machines, along with a variety of useful notes. But before we dive in, it is necessary to explain where they all came from.

The ASCII set

The standard character code set for computers is known as ASCII, the acronym for American Standard Code for Information Interchange. It is based around a seven-bit natural binary sequence, thus providing a total of 127 different alphanumeric and control codes. Although $2^8 = 128$ we usually regard 'all zeros' and 'all ones' as NULL codes, hence the figure of 127 unique codes. In many systems an eight-bit code is used, with the extra bit functioning as a parity check.

The first table gives the complete ASCII character set, but it is important to bear in mind that this and all the subsequent tables are printed as they would be written on paper (black on white), whereas the VDU displays everything in white on black, so you must mentally reverse everything in order to 'see' what it looks like on the screen.

The ASCII codes from 1 to 32 have special control functions. The ones of most use to the general programmer are as follows: 7 — Bell, 10 — Line feed, 12 — Form feed (can be used as a Clear Screen), 13 — Carriage return, 32 — Space. On some machines, notably those of US origin, code 35 will be a # (hash) symbol.

Character codes

All the alphagraphic code sets are similar in a number of ways to the ASCII set in that their alphanumeric codes follow the same sort of pattern, code E being a number four greater than code A, for example. In general the first 31 codes are used for graphics, as are the extra 127 codes not used by the ASCII set. It should be noted at this point that these numbers are not replacements for the ASCII code but numbers to be used in conjunction with the BASIC PEEK and POKE commands, which access a referenced location in memory.

If you wish to use the ASCII set then the BASIC function CHR($) should be used; for example, PRINT CHR$ (12) clears the screen by using the appropriate ASCII control code, whereas POKEing code 12 would output the respective graphic character. This apparent quirk is a trap for the unwary, but a little practice soon prevents the silly mistakes. ▶

CODE	SYM-BOL	CODE	SYM-BOL	CODE	SYM-BOL	CODE	SYM-BOL
0	NUL	32	SP	64	@	96	
1	SOH	33	!	65	A	97	a
2	STX	34	"	66	B	98	b
3	EXT	35	£	67	C	99	c
4	EOT	36	$	68	D	100	d
5	ENQ	37	%	69	E	101	e
6	ACK	38	&	70	F	102	f
7	BEL	39	'	71	G	103	g
8	BS	40	(	72	H	104	h
9	HT	41	)	73	I	105	i
10	LF	42	*	74	J	106	j
11	VT	43	+	75	K	107	k
12	FF	44	,	76	L	108	l
13	CR	45	—	77	M	109	m
14	SO	46	.	78	N	110	n
15	SI	47	/	79	O	111	o
16	DLE	48	0	80	P	112	p
17	DC1	49	1	81	Q	113	q
18	DC2	50	2	82	R	114	r
19	DC3	51	3	83	S	115	s
20	DC4	52	4	84	T	116	t
21	NAK	53	5	85	U	117	u
22	SYN	54	6	86	V	118	v
23	ETB	55	7	87	W	119	w
24	CAN	56	8	88	X	120	x
25	EM	57	9	89	Y	121	y
26	SUB	58	:	90	Z	122	z
27	ESC	59	;	91	[	123	{
28	FS	60	<	92	\	124	!
29	GS	61	=	93	]	125	}
30	RS	62	>	94	↑	126	~
31	US	63	?	95	←	127	DEL

The ASCII code set. Codes 0 to 31 are non-printing and are used to control external devices.

Standard codes

One of the commonly asked questions is: "how can we give the cursor movements?" The answer is simple: you use the standard set of character codes we have developed. These are as shown in Table 1.

To indicate that these are not part of the computer program we always enclose them in square brackets; most systems will generate a Syntax Error if you try to run a program without converting them into something more sensible. This idea has been expanded to include graphics as well, simply because many people don't possess printers that can draw them.

To indicate the appropriate graphics character for a machine such as the Commodore, the following procedure is used. Each key is fitted with a graphic legend that corresponds to the graphic that will be produced when that key is pressed in the 'graphics' mode. The 'heart' symbol, for example, is on the 'S' key. To indicate that you want the heart you write it as [↑S].

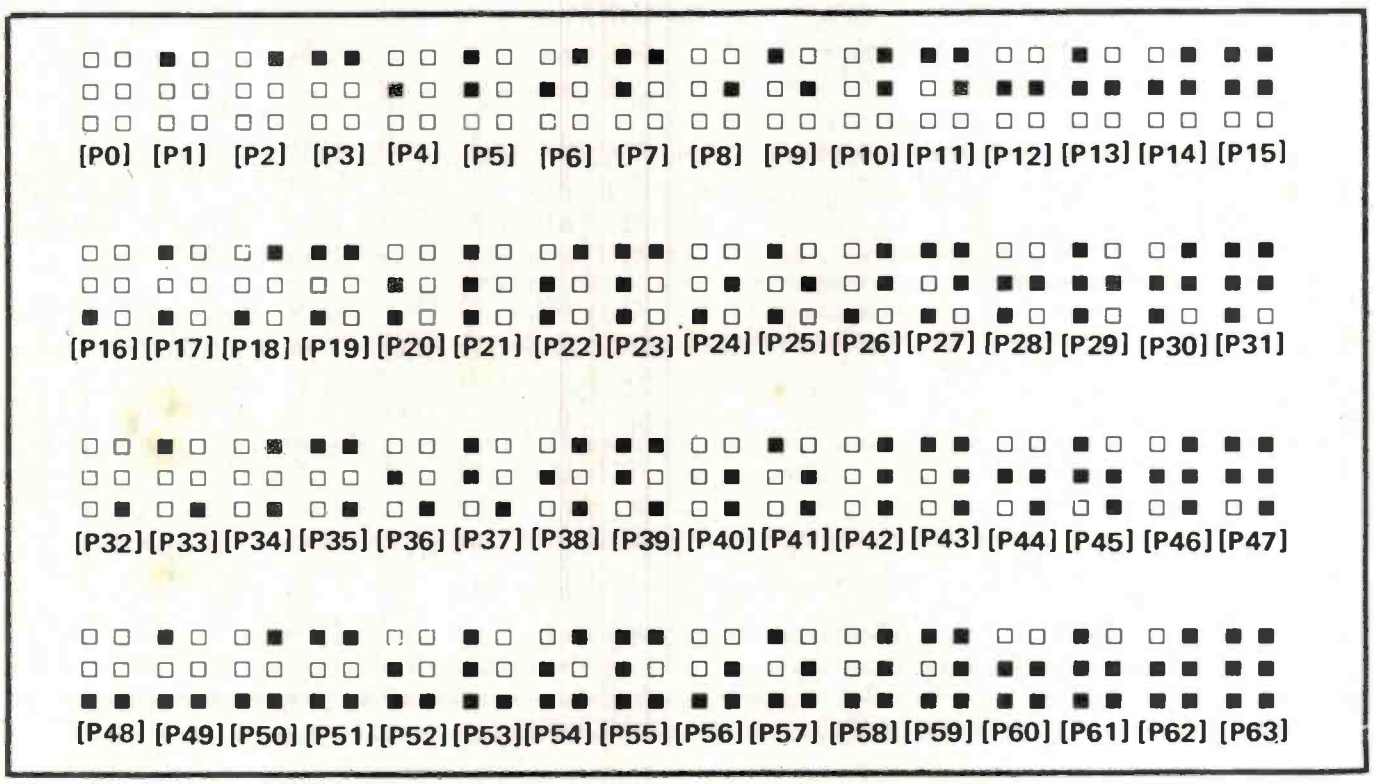
With both the graphics and the cursor codes you can indicate multiple entries by inserting a number; [12 CD] would mean 'twelve Cursor Downs'. If you wish to clarify the graphics by means of a REM statement do make it clear which lines you are referring to; an even better method is to use a short table at the beginning of the program, or as part of the description.

[CD]	Cursor Down
[CU]	Cursor Up
[CL]	Cursor Left
[CR]	Cursor Right
[CLS]	Clear Screen
[HOM]	Home Cursor
[REV]	Reverse Graphics On
[OFF]	Reverse Graphics Off
[SPC]	Space Character

Table 1. The way in which we represent the various cursor controls and screen function commands.

Footnote

These tables are all compiled with the help of the computer manufacturers' data, but some companies seem to be very slow in submitting the information. If you own a machine that has not been featured and you think that it should be then please contact us with the details.



Pixel Codes

The above codes are generated within each character space as 'chunky' graphics. We have given them each a 'standard' code for future use.

GRAPHIC DETAILS

CODE	SYM-BOL	CODE	SYM-BOL	CODE	SYM-BOL	CODE	SYM-BOL	CODE	SYM-BOL	CODE	SYM-BOL	CODE	SYM-BOL	CODE	SYM-BOL
0	@	32	SP	64		96	SP	128	@	160	SP	192		224	SP
1	A	33	!	65	♠	97		129	A	161	!	193	♠	225	
2	B	34	"	66		98		130	B	162	"	194		226	
3	C	35	#	67		99		131	C	163	#	195		227	
4	D	36	$	68		100		132	D	164	$	196		228	
5	E	37	%	69		101		133	E	165	%	197		229	
6	F	38	&	70		102		134	F	166	&	198		230	
7	G	39	'	71		103		135	G	167	'	199		231	
8	H	40	(	72		104		136	H	168	(	200		232	
9	I	41	)	73		105		137	I	169	)	201		233	
10	J	42	*	74		106		138	J	170	*	202		234	
11	K	43	+	75		107		139	K	171	+	203		235	
12	L	44	,	76		108		140	L	172	,	204		236	
13	M	45	-	77		109		141	M	173	-	205		237	
14	N	46	.	78		110		142	N	174	.	206		238	
15	O	47	/	79		111		143	O	175	/	207		239	
16	P	48	0	80		112		144	P	176	0	208		240	
17	Q	49	1	81		113		145	Q	177	1	209		241	
18	R	50	2	82		114		146	R	178	2	210		242	
19	S	51	3	83	♥	115		147	S	179	3	211		243	
20	T	52	4	84		116		148	T	180	4	212		244	
21	U	53	5	85		117		149	U	181	5	213		245	
22	V	54	6	86	X	118		150	V	182	6	214		246	
23	W	55	7	87		119		151	W	183	7	215		247	
24	X	56	8	88	♣	120		152	X	184	8	216		248	
25	Y	57	9	89		121		153	Y	185	9	217		249	
26	Z	58	:	90	◆	122		154	Z	186	:	218		250	
27	[	59	;	91		123		155	[	187	;	219		251	
28	\	60	<	92		124		156	\	188	<	220		252	
29	]	61	=	93		125		157	]	189	=	221		253	
30	↑	62	>	94	π	126		158	↑	190	>	222		254	
31	←	63	?	95		127		159	←	191	?	223		255	

Screen Memory: 32768-33767
8000H-83E7H
Format: 25 lines of 40 characters
Notes: Graphics characters may be converted to lower case alphabetics with POKE 59468,14 and back with POKE 59468,12. CHR$(147) clears the screen. Note that when outputting screen-based information the PET uses an absolute TAB rather than spaces, which can disrupt apparently neat formats.

Commodore PET

GRAPHIC DETAILS

CODE	SYM-BOL	CODE	SYM-BOL	CODE	SYM-BOL	CODE	SYM-BOL	CODE	SYM-BOL	CODE	SYM-BOL	CODE	SYM-BOL	CODE	SYM-BOL
0		32	SP	64	@	96		128		160		192		224	
1		33	!	65	A	97		129		161		193		225	
2		34	"	66	B	98		130		162		194		226	
3		35	#	67	C	99		131		163		195		227	
4		36	$	68	D	100		132		164		196		228	
5		37	%	69	E	101		133		165		197		229	
6		38	&	70	F	102		134		166		198		230	
7		39	'	71	G	103		135		167		199		231	
8	BS	40	(	72	H	104		136		168		200		232	
9		41	)	73	I	105		137		169		201		233	
10	LF	42	*	74	J	106		138		170		202		234	
11	FF	43	+	75	K	107		139		171		203		235	
12	FF	44	,	76	L	108		140		172		204		236	
13	CR	45	—	77	M	109		141		173		205		237	
14	CURON	46	.	78	N	110		142		174		206		238	
15	CUROF	47	/	79	O	111		143		175		207		239	
16		48	0	80	P	112		144		176		208		240	
17		49	1	81	Q	113		145		177		209		241	
18		50	2	82	R	114		146		178		210		242	
19		51	3	83	S	115		147		179		211		243	
20		52	4	84	T	116		148		180		212		244	
21		53	5	85	U	117		149		181		213		245	
22		54	6	86	V	118		150		182		214		246	
23	32/64	55	7	87	W	119		151		183		215		247	
24	[CL]	56	8	88	X	120		152		184		216		248	
25	[CR]	57	9	89	Y	121		153		185		217		249	
26	[CD]	58	:	90	Z	122		154		186		218		250	
27	[CU]	59	;	91	↑	123		155		187		219		251	
28	[HOM]	60	<	92	↓	124		156		188		220		252	
29		61	=	93	←	125		157		189		221		253	
30	ERL	62	>	94	→	126		158		190		222		254	
31	ERF	63	?	95	—	127		159		191		223		255	

NON DISPLAYABLE CHARACTERS

PIXEL CHARACTERS

PIXEL CHARACTERS

CHARACTER COMPRESSION CODES

CHARACTER COMPRESSION CODES

Tandy TRS-80 Model 1

Screen Memory: 15360-16383
3C00H-3FFFH

Format: 16 lines of 64 characters, selectable to 32 characters.

Notes: Character codes from 0 to 31 are control codes. Notable ones are: 14 — Cursor on, 15 — Cursor off, 23-32/64 — character select, 29 — Reset cursor to start of line, 30 — Erase to end of line, 31 — Erase to end of frame. Pixel graphics are accessed by codes 129 to 191 inclusive and the remaining 64 are used as TAB generators from 0 spaces to 63 spaces for space commission in programs.

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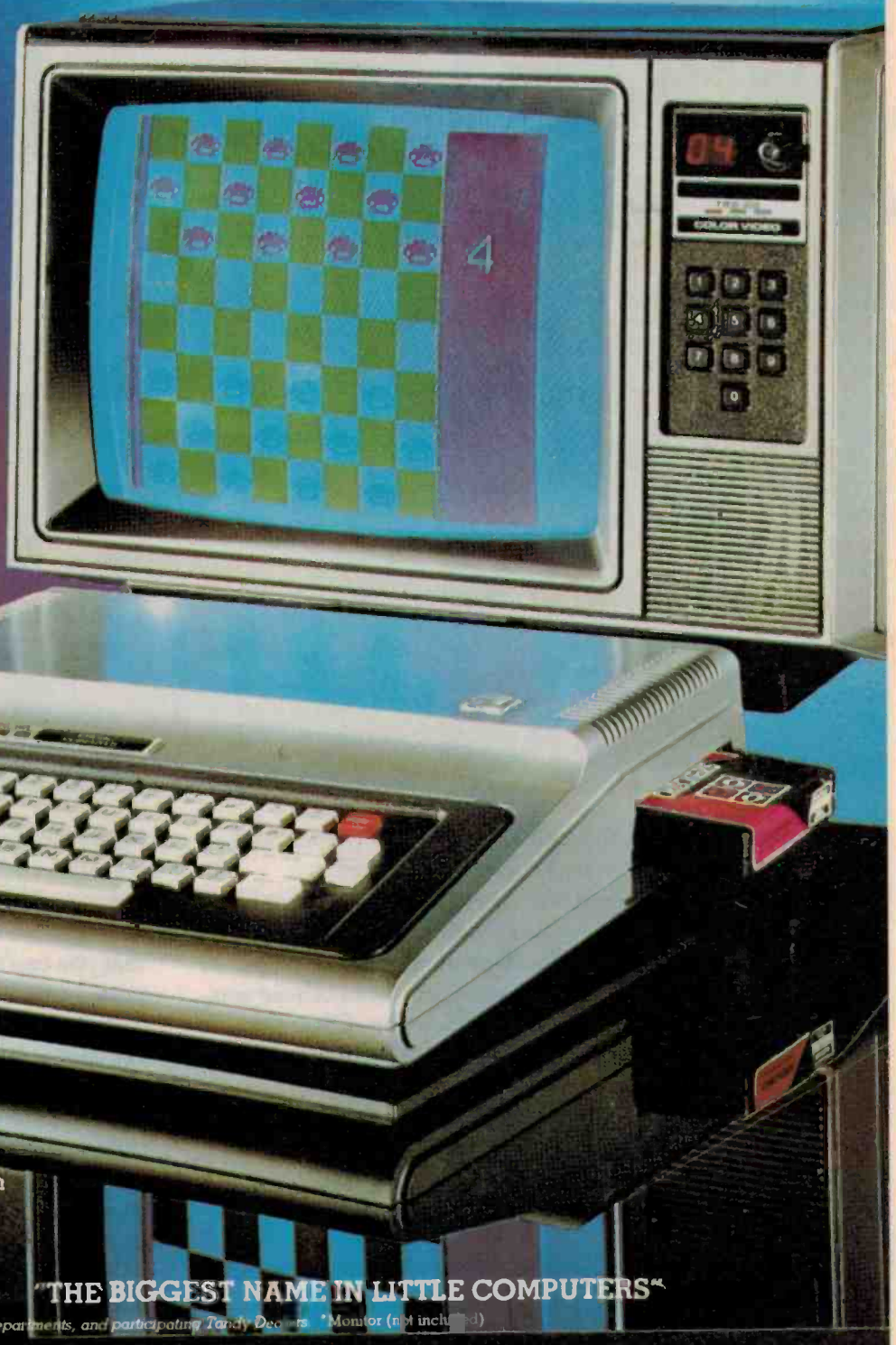

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How to store more data on cassette

If you don't want, or cannot afford, to go to a disk-based system, then you'll certainly need to make more efficient use of your cassette storage system. Here are some very useful routines for those running something akin to 12K Microsoft BASIC.

Ian Sinclair

MOST ARTICLES and books seem to treat the subject of cassette data files very casually, assuming that any serious users must be into disk operations anyhow. This isn't necessarily the case, and this article aims to look at the neglected subject of making the best possible use of cassettes for data filing, particularly where large amounts of data are concerned.

The system on which these routines have been developed is a TRS-80, but it is more than likely that your cassette system is structured in the same way, particularly if your BASIC is the 12K Microsoft type.

The system constraints

The fundamental data storage command is PRINT#-1, followed by the appropriate variable name, which may be numeric or string in type. Each time the PRINT#-1 command is encountered in a program the cassette motor is started, a leader of 255 bytes of synchronisation pulses recorded, then the data, checksum and filename followed by a trailer of one byte. Even if the data consists of just one number the same procedure is followed and if the PRINT#-1 command is placed in a loop the result will be a number of separate recordings equal to the number of loops performed.

Life would be considerably easier if we could write:

```
PRINT#-1,FOR Z=1 TO 20;L$(Z):NEXT
```

but we can't, even if 20 of the strings would fit comfortably in the 248 bytes (or so) that are allowed in each burst of recording.

Ways round

For these reasons alone it is worth spending some time looking for alternatives to this method, both for packing and unpacking data from tape.

The simplest packing routine depends on the use of multiple variables after the PRINT#-1 command. If we write:

```
450 PRINT#-1,L$(1),L$(2),L$(3),
    L$(4),L$(5)
```

then all five strings will be recorded in the one burst provided their length does not exceed the 248 byte limit.

This is quite adequate provided you know the length of the strings and can be sure that they will not exceed the limit. Variables can, of course, be mixed but when you recover them from the tape with the INPUT#-1 command you must ensure that the type order is maintained or errors will occur.

The problems start to arise when a large quantity of data has to be recorded and subsequently recovered, because the simple method given above does not always represent the most efficient way of going about the task. Life is easy if the data comes in a standard form; take strings of 12 characters in length, for example. If these were arranged as an array, L$(n), and each element contained a string of 12 characters we could pack 20 of them into one burst of recording:

```
100 T$="":FOR J=1 TO n STEP
    20:FOR Z=0 TO 19
110 T$=T$+L$(J+Z):NEXT
    Z:PRINT#-1,T$:T$="":NEXT J
```

The total number of variable items is represented by n in the above example. Using this technique you can pack five minutes of tape with a very impressive number of bytes of information, five seconds per 240 byte burst giving a total of 2880 bytes per minute or 14K in five minutes.

To actually unscramble all this information the subroutine given in Listing 1 is needed. This replays the tape using the INPUT#-1 command and uses the MID$ string operator to separate out the 12 character groups from the complete string. There are several ways of terminating the playback which avoid the normal error message that results from reading nothing.

The first is to actually PRINT#-1, n in line 480 so that the routine knows how many sets of characters it is supposed to read. An alternative is to detect a null string and use that as the terminator, as has been done in Listing 1. The third method is to use the built-in error trapping routines of the TRS-80 to force the program out of the INPUT loop when an 'out of data' error occurs.

How long . . . ?

The really thorny problem, however, is when strings of undetermined length have to be recorded and replayed. Data such as names and addresses won't always conform to a convenient 12 characters per string format, yet we already know how wasteful it is to use one variable at a time. There are three possible solutions to this problem, all of which I use on a regular basis.

The first is to pad out all the data to a standard length. As long as the data does not vary too widely this is a reason-

ably acceptable technique, and Listing 2 gives a routine which will pad to a length of 20 given that the data is between 8 and 20 characters in length. Normally, we would not pad strings which vary quite so much; between 12 and 20 would be more acceptable.

One of the failures of this technique is that it generally results in ragged printing, so some de-padding will have to be performed before the data can be sent to a printer. This can be performed by a routine such as that shown in Listing 3; it's slow, but so are printers! When you are faced with strings that can vary between 1 and 50 characters in length, padding is no longer a viable solution and another method of packing must be sought.

Spaces that aren't

One of the alternatives which can be usefully employed is code 128. On the TRS-80 this produces a space, but it is not identical to the ASCII 32 space that the keyboard produces. This character is often available and a look through the graphics set of your system should reveal one. As shown in Listing 4, this character can be identified as a separate entity and is used as a delimiter between strings.

In order to check that the string you're about to add onto the block will not cause the total number of bytes to exceed the set maximum of 240, we must incorporate the look-ahead routine in line 570. As long as the length does not exceed 240 we continue packing; if it would exceed on adding the next string we stop, record the block of data, zero the byte count and start again.

The packing speed is fairly fast but the corresponding unpacker, Listing 5, is not, owing to the fact that each character in turn has to be inspected to see if it is CHR$(128). If the data is being printed as it is being unpacked then this delay is of less importance.

The ultimate packer?

My 'best' solution to the problem is to use a slightly lower packing density, which increases the recovery speed. The packing routine in Listing 6 finds the total length of each string with the LEN() function and then packs the data string with the string and its length. For machines which have the VARPTR function, like the TRS-80, the use of PEEK (VARPTR(L$(n)) provides the same information as the LEN() function. The data string will now look something like:

15S.R.SMITH 1042719P.J.ROBERTSON 512069C.O.JONES etc . . .

Note that the single figure values of length have been padded out to two places by using RIGHT$ ("00"+STR$(L),3). As before, the total string length is monitored before concatenation to ensure that the target of 240 bytes is not exceeded.

Recovering the data from this kind of packing is performed by a routine like that of Listing 7. The first two characters of the string give the length of the first sub-string in the block and from this the starting point of the next string length can be found. Both the packing and unpacking routines are quite fast, even on a standard machine; adding the speed-up package and Southern Software's ACCEL program will make them very fast indeed.

It is worth noting, however, one point which seldom seems to be made in print, which is that the speed of any string handling routine varies according to the number of strings used. Each time a string is declared, even if it is being nulled, a new string space is prepared and the computer has to reorganise its variable storage area. When the reserved string space is very small the delays caused by this memory management routine, or garbage collection as it is often called, can be very large. On a recent test a recording of 300 strings took nearly two hours simply because of the time taken by the management routine.

The only way out of this predicament is to make sure that the memory areas used are not too full. This can be done by recording a set number of strings and then re-running the program or simply by CLEARing the variable areas. Pauses caused by the management routines can be easily detected; they don't respond to the Break key!

In conclusion

If you are not yet disk-based then you can at least take heart, there's still some life left in the old data cassette yet. Indeed, bulk storage is much better handled by tape than disk, especially long lists that are simply processed sequentially. The floppy disk also has rivals in devices such as the Stringy Floppy.

Obviously the speed and efficiency of all these routines is limited by the operating speed of the computer and the storage speed of the cassette system. If time is critical one can always revert to machine code routines for the packing and unpacking of the data. ●

```
490  P=0
500  INPUT#-1,T$:IF T$="" THEN 560
510  FOR J=1 TO 20
520  L$(P)=MID$(T$,12*N-11,12)
530  P=P+1
540  NEXT J
550  GOTO 500
560  REM**REMAINING PROGRAM
```

Listing 1. The simplest 'unpacker' using strings of standard length.

```
100  T$=""
110  FOR K=1 TO N STEP 12
120  FOR J=0 TO 11
130  L$=RIGHT$(STRING$(12,32)+L$(K+J),20)
140  T$=T$+L$
150  NEXT J
160  PRINT#-1,T$
170  T$=""
180  NEXT K
```

Listing 2. A routine to create strings of a fixed length and pack them onto the tape.

```
100  FOR N=1 TO LEN(L$(N))
110  IF ASC(MID$(L$(N),N,1))=32 THEN NEXT
     ELSE LPRINT TAB(10) RIGHT$(L$(N),
     LEN(L$(N))-N)
```

Listing 3. The output from the 'unpacker' will need to be formatted before printing or display.

```
500  CLS:PRINT "PREPARE A CASSETTE OF
     SUITABLE LENGTH FOR A DATA FILE"
510  PRINT "NOTE THE START POINT ON THE
     COUNTER, PRESS PLAY AND RECORD"
520  PRINT "PRESS ENTER WHEN READY"
530  INPUT X:CLS:PRINT TAB(21)"PLEASE WAIT"
540  PRINT#-1,I
550  A$="[SPC]"
560  FOR N=1 TO I:A$=A$+L$(N)+CHR$(128)
570  IF LEN(A$)+LEN(L$(N+1))<245 THEN 590
580  PRINT#-1,A$:A$="[SPC]"
590  NEXT N:PRINT#-1,A$
600  CLS:PRINT "RECORDING FINISHED. PRESS
     ENTER TO RETURN TO MENU"
```

Listing 4. Using a special code to separate the items in each block.

```
620  CLS:PRINT@336,"PREPARE THE INDEX TAPE
     TO REPLAY"
630  PRINT TAB(13)"PRESS PLAY KEY. WHEN
     READY PRESS ENTER"
640  INPUT X:CLS:PRINT TAB(19)"ENTERING
     DATA, PLEASE WAIT":X=1
650  INPUT#-1,I:REM**I IS THE MAX NUMBER
660  INPUT#-1,A$:FOR N=1 TO 245:
     B$=MID$(A$,N,1)
670  IF B$<>CHR$(128) THEN L$(X)=L$(X)+B$:
     GOTO 690
680  X=X+1
690  NEXT N:IF X<I THEN GOTO 660
700  CLS:PRINT TAB(26)"DATA ENTERED"
```

Listing 5. The corresponding 'unpacker' for the routine above.

```
7000  CLS:T$="":PRINT@340,"RECORDING, PLEASE
      WAIT":PRINT TAB(20) STRING$(22,95):
      PRINT#-1,B$,S,R,TT
7010  FOR X=1 TO R:Q$(X)="[2 SPC]"+Q$(X):
      Q$(X)=RIGHT$(Q$(X),3):L=LEN(L$(X))+3:
      C$=RIGHT$("00"+STR$(L),3):
      T$=T$+C$+L$(X)+Q$(X):IF LEN(T$)+
      LEN(L$(X+1))<240 THEN NEXT
7020  PRINT#-1,T$:IF X<R THEN T$="":NEXT
7030  CLS:PRINT@329,"RECORDING COMPLETE,
      PRESS ANY KEY TO CONTINUE"
```

Listing 6. This routine gives the best overall performance for general use.

```
3000  CLS:PRINT@347,"REPLAY TAPE":PRINT
      TAB(27) STRING$(11,35):PRINT:PRINT
      TAB(15)"PREPARE CASSETTE AND PRESS
      PLAY":PRINT TAB(15);:INPUT"PLEASE
      ENTER CLASS DESIGNATION";BB$:N=1:
      Z=1:Y=0
3010  INPUT#-1,B$,S,R,TT:IF BB$<>B$ THEN
      FS="WRONG TAPE":GOSUB 1500:GOTO 40
3020  INPUT#-1,T$
3030  L=VAL(MID$(T$,Z,3)):L$(N)=MID$(T$,3+Z,
      L-3):Q$(N)=MID$(T$,Z+L,3):Z=Z+L+3:
      N=N+1:IF N<=R AND Z<LEN(T$) THEN GOTO
      3030 ELSE IF N<R THEN T$="":Z=1:
      GOTO 3020
```

Listing 7. A typical program segment for recovering data packed by the routine above.

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4021	1.10
4022	1.05
4023	.70
4024	1.00
4025	.50
4026	2.20
4027	.60
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4029	1.20
4030	.60
4031	2.20
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4035	1.30
4039	.70
4040	1.70
4041	1.05
4042	.70
4043	.70
4044	.70
4046	1.20
4047	1.20
4048	.60
4049	.60
4050	.60
4051	1.00
4052	.80
4053	.80
4060	2.00
4066	.80
4068	.60
4069	.70
4070	.50
4071	.60
4072	.50
4073	.60
4075	.60
4076	1.20
4077	.50
4078	.60
4081	.60
4082	.60
4089	1.00
4093	.80
4503	.60
4510	1.50
4511	1.50
4512	1.10
4514	2.50
4516	1.40
4518	1.50
4519	.55
4520	1.60
4522	1.25
4527	1.20
4528	1.25
4529	1.60
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74C48	1.55
74C73	.75
74C74	.70
74C76	.75
74C83	1.40
74C85	1.20
74C86	.80
74C90	.80
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LM305-H	.80
LM307-CN	.40
LM307-H	.90
LM308	.70
LM308-H	1.20
LM310-N	2.20
LM310-H	2.60
311	.60
LM311	.60
LM311-H	1.20
LM318	2.80
LM322	3.90
LM324	1.20
LM325	3.10
LM329-DZ	1.40
LM334-Z	1.30
LM335	12.40
LM336-Z	3.20
LM339	.90
LM348	1.10
LM349	1.80
LF351-N	.70
LF356-AN	1.10
LF357	1.10
LM358	.70
LM373	4.10
LM374	5.40
LM376	.70
LM377	2.90
LM379	5.70
LM308 8PIN	1.30
LM380	
14PIN	1.50
LM318A-N	2.40
LM318N	1.80
LM382N	2.00
LM383	2.70
LM384	2.40
LM386	1.00
LM387	1.30
LM391	1.80
LM393	.80
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741	.25
LM741-H	1.20
UA747	1.00
UA747HC	2.20
UA748	.50
UA748MC	1.25
UA753	1.80
UA760HC	4.10
UA777	2.40
UA777HC	2.65
9334	1.70
UA743	1.80
UA760MC	4.10
UA796HC	1.70
LM802	1.10
LM1310N	2.40
1408	4.90
LM1458	.60
UA1488	1.50
UA1489	1.50
MC1495	7.30
MC1496L	11.40
LM1558	1.50
LM1596	1.40
LM1380	3.10
LM2902	1.40
LM2917	
8PIN	2.80
LM2917	3.10
CA3028	1.80
LM3039	.90
CA3046	1.70
3065	.45
LM3080	1.20
LM3089	3.90
CA3130T	1.40
CA3130E	1.80
CA3140	1.40
3401	.70
3611	1.10
LM3900	.90
LM3909	1.00
LM3914N	3.90
4136	1.40
LM4250	1.75
UA4558TC	1.40
MM5837	2.50
LM7555	1.80
Mc10116L	.95
LF13741	.60
LF1374-1H	.70
DS75452	.50
76477	4.90
75451	.60
75491	1.40
75492	1.40

TTL (s)

74S00	.80
74S02	.80
74S04	.80
74S10	.75
74S11	.75
74S32	.75
75S51	.75
74S74	1.20
74S86	1.40
74S112	1.20
74S135	2.20
74S138	3.20
74S157	2.95
74S158	2.95
74S182	3.30

7400 SERIES

7400	.40
7401	.40
7402	.40
7403	.40
7404	.40
7405	.50
7406	.50
7407	.50
7408	.40
7409	.40
7410	.40
7411	.40
7412	.40
7413	.50
7414	.70
7416	.50
7417	.60
7420	.40
7421	.40
7423	.50
7425	.45
7426	.40
7427	.40
7430	.40
7432	.40
7437	.40
7438	.50
7440	.50
7441	1.00
7442	.50
7443	1.40
7444	1.20
7445	1.10
7446	1.00
7447	1.00
7448	1.00
7450	.50
7451	.50
7453	.40
8T26	2.20
9300	.60
9307	1.80
9308	1.20
7454	.60
7472	.60
7473	.60
7474	.60
7475	.60
7476	.60
7480	.65
7482	1.80
7483	.80
7485	.80
7486	.60
7489	2.60
7490	.70
7491	.55
7492	.60
7493	.60
7494	.90
7495	.45
7496	.80
7497	2.50
74107	.80
74109	.60
74116	2.20
74121	.45
74122	.65
74123	.60
74125	.55
74126	.60
74132	.80
74141	1.10
74145	.85
74147	2.00
74148	1.40
74150	1.20
74151	.60
74152	4.90
74153	.70
74154	1.20
74155	.90
8T28	1.60
9310	.65
9311	1.00
9312	1.35
74156	1.50
74157	.60
74161	1.00
74162	1.00
74163	.85
74164	.60
74165	.60
74174	.50
74175	.90
74176	1.10
74177	1.10
74180	.90
74181	2.30
74182	.90
74184	1.20
74185	1.20
74190	1.00
74191	1.50
74192	1.70
74193	.80
74194	1.10
74195	.65
74196	.85
74197	1.10
74198	1.10
74199	1.30
74221	.90
74290	.90
73293	.90
74365	.80
74366	.80
74367	1.00
74368	1.00
8T96	1.80
9314	1.30
9368	1.75
9370	2.00

74LS SERIES

74LS00	.40
74LS01	.40
74LS02	.40
74LS03	.40
74LS05	.40
74LS08	.40
74LS09	.40
74LS10	.40
74LS11	.40
74LS13	.50
74LS14	.90
74LS15	.40
74LS20	.40
74LS21	.40
74LS22	.40
74LS26	.40
74LS28	.40
74LS30	.40
74LS32	.40
74LS33	.40
74LS37	.50
74LS38	.50
74LS40	.50
74LS42	.75
74LS47	.85
74LS48	1.00
74LS49	1.00
74LS51	.40
74LS54	.50
74LS55	.55
74LS58	.65
74LS73	.55
74LS74	.60
74LS75	.45
74LS76	.50
74LS78	.50
74LS83	1.00
74LS85	1.00
74LS86	.50
74LS90	.70
74LS92	.90
74LS93	.80
74LS95	.65
74LS96	1.55
74LS107	.60
74LS109	.60
74LS112	.60
74LS113	.65
74LS114	.50
74LS122	.50
74LS123	.75
74LS125	.50
74LS126	.70
74LS132	.80
74LS133	.50
74LS136	.50
74LS138	1.20
74LS139	.85
74LS151	.75
74LS153	.60
74LS154	1.50
74LS155	1.00
74LS156	1.00
74LS157	.90
74LS158	.70
74LS160	.85
74LS161	.85
74LS162	1.00
74LS163	.85
74LS164	1.30
74LS165	.50
74LS168	1.90
74LS169	1.90
74LS170	2.80
74LS173	.90
74LS174	.90
74LS175	.90
74LS181	2.50
74LS189	3.80
74LS190	1.30
74LS191	1.10
74LS192	.85
74LS193	.85
74LS194	.70
74LS195	.80
74LS196	1.25
74LS197	1.00
74LS221	1.10
74LS245	2.35
74LS247	.90
74LS249	1.30
74LS251	.80
74LS253	.90
74LS257	.65
74LS258	.50
74LS259	2.45
74LS260	.90
74LS266	.90
74LS273	1.60
74LS279	.65
74LS283	1.15
74LS290	1.10
74LS293	1.15
74LS295	1.60
74LS298	1.00
74LS352	1.30
74LS353	1.30
74LS365	.50
74LS366	.70
74LS367	.90
74LS368	.90
74LS373	1.50
74LS374	1.70
74LS386	.50
74LS670	2.70
81LS95	2.10
95H90	11.50
11C90	19.50
81LS96	2.10
81LS97	2.10

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2N657	.60
2N930	.60
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2N1711	.50
2N1893	1.00
2N2219A	.60
PN2222	.20
PN2222	.30
2N2463	.35
2N2484	.65
2N2646	.70
2N2647	1.10
2N2894	.80
2N2904	.45
2N2905	.40
2N2906	.45
2N2913	1.20
PN2907	.30
2N3053	.60
2N3054	.90
2N3055	.90
2N3301	.40
2N3440	1.10
2N3502	.70
2N3503	.70
2N3563	.30
2N3564	.30
2N3569	.30
PN3565	.30
PN3566	.30
PN3567	.30
2N3568	.30
2N3638	.30
2N3639	.30
2N3640	.30
2N3641	.30
2N3645	.30
PN3642	.30
PN3643	.30
PN3644	.30
2N3646	.30
2N3692	.50
2N3693	.35
2N3702	.30
PN3694	.30
2N3704	.30
2N3709	.30
2N3713	2.20
2N3819	.80
2N3866	2.00
2N3904	.30
2N3906	.30
2N4030	1.10
2N4032	.55
2N4033	.90
2N4036	1.00
2N4037	.90
PN4121	.30
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2N4235	1.90
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PN4249	.30
2N4250	.30
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2N4355	.30
2N4356	.30
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2N4403	.50
2N4416	1.00
2N4906	2.80
PN4868	.30
2N5088	.30
2N5089	.30
2N5179	1.90
2N5303	3.30
2N5320	.80
2N5401	.30
2N5458	.70
2N5459	.70
2N5461	.70
2N5484	.70
2N5485	.70
2N5486	.70
2N5769	.30
2N5770	.25
2N5830	.25
2N5831	.30
2N5856	.30
2N5873	1.10
2N5874	1.40
2N5961	.30
2N5963	1.10
2N6027	.60
3N201	.90
AC127	.70
AC128	.70
AC187	.70
AC188	.70
AD149	2.50
AD161	1.70
AD162	1.70
BC318	.30
BC319	.18
BC327	.15
BC328	.30
BC337	.30
BC338	.30
BC547	.15
BC548	.15
BC549	.15
BC549C	.40
BC557	.16
BC558	.16
BC559	.16
BC637	.25
BC638	.36
BC639	.80
BC640	.80
BCY70	.85
BCY71	.85
BD115	1.50
BD135	.70
BD136	.70
BD137	.70
BD138	.70
BD139	.70
BD140	.70
BD235	.65
BD234	.50
BD237	.50
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BD301	.75
BD302	.75
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8228	9.50
8238	8.00
8243	8.00
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8253	19.50
8255A	8.60
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8275	99.00
8278	99.00
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Learning logic with the 'Fox and Hen'

This program was written as a learning aid to teach students the logical AND and OR operations, and will run on both the ZX80 and ZX81 with expanded RAM.

M.P. Biddell

THE PROGRAM allows a discovery learning process in which students open and close the gates of six cages, to determine whether a fox can gain access to a hen and eat it. The knowledge gained from this visual and manual experimentation is applicable to all switching circuitry and all logic problems involving AND and OR gates. It makes the learning process more interactive using the computer. In fact, it's an ideal application of a micro to assist the learning process.

Using it

The program should be started using GOTO 90. This produces the VDU display shown in Figure 1, which represents a plan view of six cages. 'F' represents the fox and 'H' represents the hen. The letters A to G represent the gates to the cages. In response to the question 'is gate A open 1 = yes 0 = no?' the student simply presses 1 or 0 followed by NEWLINE. Pressing 0 will block gate A with a black square, thus closing it. The student is then confronted by a similar question for gate B and so on. When all the gates have been programmed to be open or closed the computer makes the quite complex decision as to whether the fox can eat the hen or not. This is obvious visually, since if a combination of gates is open to allow the fox to wander through to the hen, he could eat it. If access to the hen is allowed, the fox (F) will be POKEd into the hen's cage and the hen (H) will disappear. Pressing 'R' resets the gates.

Learning by discovery

The student is asked to examine line 440 of the program:

```
IF A AND B AND E = 1 OR C AND F AND G = 1
OR A AND D AND G = 1 OR C AND F AND D
AND B AND E = 1 THEN GOTO 470
```

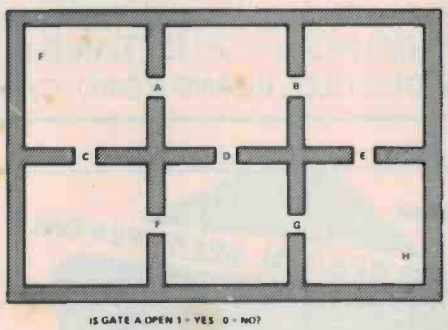

Figure 1. The screen format.

Program Listing

```
10   FOR J=1 TO 24
20   PRINT CHR$(128);
30   NEXT J
40   RETURN
50   FOR I=0 TO 16
60   PRINT CHR$(128),
70   NEXT I
80   RETURN
90   CLS
91   PRINT "FOX AND HEN"
92   LET B=1
93   LET C=1
94   LET D=1
95   LET E=1
96   LET F=1
97   LET G=1
100  GOSUB 10
110  GOSUB 50
120  GOSUB 10
130  GOSUB 50
135  PRINT CHR$(128);
140  GOSUB 10
150  LET W=PEEK(16395)+PEEK(16397)*256
160  POKE W+82,43
170  POKE W+87,38
180  POKE W+252,43
190  POKE W+95,39
200  POKE W+260,44
210  POKE W+182,40
220  POKE W+190,41
230  POKE W+198,42
240  POKE W+264,45
241  PRINT
245  LET Z=37
245  LET Z=Z+1
247  IF Z=45 THEN GOTO 440
250  PRINT"IS GATE ";CHR$(Z);" OPEN? 1=YES 0=NO"
260  INPUT X
280  IF Z=38 THEN LET A=X
290  IF Z=39 THEN LET B=X
300  IF Z=40 THEN LET C=X
310  IF Z=41 THEN LET D=X
320  IF Z=42 THEN LET E=X
330  IF Z=43 THEN LET F=X
340  IF Z=44 THEN LET G=X
350  IF A=0 THEN POKE W+86,128
370  IF B=0 THEN POKE W+94,128
380  IF C=0 THEN POKE W+149,128
390  IF D=0 THEN POKE W+157,128
400  IF E=0 THEN POKE W+165,128
410  IF F=0 THEN POKE W+251,128
420  IF G=0 THEN POKE W+259,128
430  GOTO 246
440  IF A AND B AND E=1 OR C AND F AND G=1 OR
     A AND D AND G=1 OR C AND F AND B AND E=1
     THEN GOTO 470
450  PRINT"HEN IS SAFE"
460  GOTO 480
470  PRINT"FOX ATE THE HEN"
475  POKE W+82,0
476  POKE W+264,43
480  PRINT"PRESS R FOR RESET"
490  INPUT A$
500  IF A$="R" THEN GOTO 90
510  GOTO 490
```

This single line is the computer's controlling logic for this complex decision (there are many many combinations of gates). The student is asked to test as many combinations of gates as he can think of to indeed verify that this controlling logic is correct for all the combinations. Without being aware of it the user is learning, by this simulation, the basic principles of switching and logic circuitry. This is quite a fun way of learning.

The program structure

The program overcomes the ZX80 memory mapping problem by accessing the address of the D-file through PEEKing system variables 16396 and 16397 and using these to define variable W. See line 150 of the program. The gates to the cages and the fox (F) and hen (H) are then POKEd into the D-file using variable W, plus a displacement; lines 160-240 carry this out. The gates are closed by POKEing CHR$(128) into the D-file (lines 360-420).

Line 440 represents the decision-making logic for the fox to eat the hen (or otherwise). If the fox is able to eat the hen lines 475 and 476 POKE the appropriate positions to move the fox and make the hen disappear.

The future

Programmers have concentrated, in the past, on writing games. In the educational sphere, applications have been very limited. There is a great scope for programs that simulate physical systems very closely and allow students to 'play tunes' with certain variables to see how the system would react. I believe this is the direction in which we should be progressing, since micros are very adept at quickly computing, processing large numbers of combinations and displaying the results.

A variety of analogue and digital systems could be simulated and the student could indulge in many experiments of the type 'what happens if I?', with the micro showing the results visually. ●

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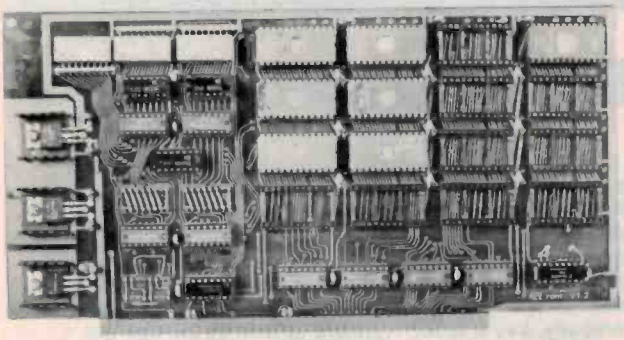

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Board only	$ 69	$ 60
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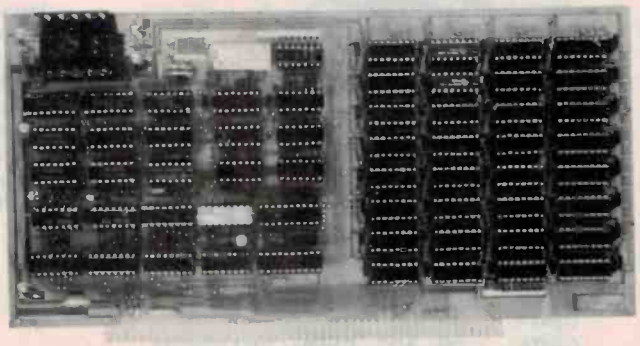

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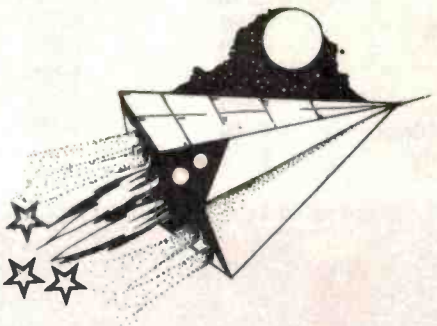
'660 INVADERS



No set of computer games software is ever complete without including some form of the ubiquitous 'invaders' game. Here's the '660 version and a few tricks on how to score well.

The invading UFOs enter the screen area at top right and proceed across the screen at varying speeds. There are 'large' UFOs and 'small' UFOs. Your rocket launcher is at bottom centre of screen and keys 4, 5 and 6 launch your rockets. Key 5 launches them vertically, key 4 launches them angled to the left, key 6 launches them angled to the right. A 'hit' on a large UFO will score you 5 points (. . . it's *easy!*), a 'hit' on the small UFO scores you 15 points (harder). It takes some skill to score hits with key 6, but it's a little easier with keys 4 and 5. But watch it! — Timing your launch with key 5 is a little more critical than you think. In the right hand corner of the screen is a number showing how many rockets you have left. Your score is displayed in the left hand corner of the screen. Kill, kill!

Press 'RESET 8' to start a new game.

```
0600   A6 CD   I=06CD
0602   69 38   V9=38
0604   6A 08   VA=08
0606   D9 A3   SHOW 3MI@V9VA
0608   A6 D0   I=06D0
060A   6B 00   VB=00
060C   6C 03   VC=03
060E   DB C3   SHOW 3MI@VBVC
0610   A6 D6   I=06D6
0612   64 1D   V4=1D
0614   65 1F   V5=1F
0616   D4 51   SHOW 1MI@V4V5
0618   67 00   V7=00
061A   68 0F   V8=0F
061C   26 A2   DO 06A2
061E   26 AC   DO 06AC
0620   48 00   SKF V8≠00
0622   16 22   GO TO 0622
0624   64 1E   V4=1E
0626   65 1C   V5=1C
0628   A6 D3   I=06D3
062A   D4 53   SHOW 3MI@V4V5
062C   6E 00   VE=00
062E   66 80   V6=80
0630   6D 04   VD=04
0632   ED A1   SKF VD≠KEY
0634   66 FF   V6=FF
0636   6D 05   VD=05
0638   ED A1   SKF VD≠KEY
063A   66 00   V6=00
063C   6D 06   VD=06
063E   ED A1   SKF VD≠KEY
0640   66 01   V6=01
0642   36 80   SKF V6=80
0644   26 D8   DO 06D8
0646   A6 D0   I=06D0
0670   16 86   GO TO 0686
0672   75 FF   V5+FF
0674   84 64   V4=V4+V6
0676   D4 53   SHOW 3MI@V4V5
0678   3F 01   SKF VF=01
067A   16 46   GO TO 0646
067C   6D 08   VD=08
067E   8D 52   VD=VD&V5
0680   4D 08   SKF VD≠08
0682   16 8C   GO TO 068C
0684   16 92   GO TO 0692
0686   26 AC   DO 06AC
0688   78 FF   V8+FF
068A   16 1E   GO TO 068E
068C   26 A2   DO 06A2
068E   77 05   V7+05
0690   16 96   GO TO 0696
0692   26 A2   DO 06A2
0694   77 0F   V7+0F
0696   26 A2   DO 06A2
0698   6D 03   VD=03
069A   FD 18   TONE=VD
069C   A6 D3   I=06D3
069E   D4 53   SHOW 3MI@V4V5
06A0   16 86   GO TO 0686
06A2   A6 F8   I=06F8
06A4   F7 33   MI=V7(3DD)
06A6   63 00   V3=00
06A8   26 B6   DO 06B6
06AA   00 EE   RET
06AC   A6 F8   I=06F8
06AE   F8 33   MI=V8(3DD)
06B0   63 32   V3=32
06B2   26 B6   DO 06B6
06B4   00 EE   RET
06B6   6D 1B   VD=1B
```

```
0648  DB C3  SHOW 3MI@VBVC
064A  CD 01  VD=RND
064C  8B D4  VB=VB+VD
064E  DB C3  SHOW 3MI@VBVC
0650  3F 00  SKF VF=00
0652  16 92  GO TO 0692
0654  A6 CD  I=06CD
0656  D9 A3  SHOW 3MI@V9VA
0658  CD 01  VD=RND
065A  3D 00  SKF VD=00
065C  6D FF  VD=FF
065E  79 FE  V9+FE
0660  D9 A3  SHOW 3MI@V9VA
0662  3F 00  SKF VF=00
0664  16 8C  GO TO 068C
0666  4E 00  SKF VE≠00
0668  16 2E  GO TO 062E
066A  A6 D3  I=06D3
066C  D4 53  SHOW 3MI@V4V5
066E  45 00  SKF V5≠00
```

```
06B8  F2 65  V0:V2=MI
06BA  F0 29  I=DSP,V0
06BC  D3 D5  SHOW 5MI@V3VD
06BE  73 05  V3+05
06C0  F1 29  I=DSP,V1
06C2  D3 D5  SHOW 5MI@V3VD
06C4  73 05  V3+05
06C6  F2 29  I=DSP,V2
06C8  D3 D5  SHOW 5MI@V3VD
06CA  00 EE  RET
06CC  01 7C
06CE  FE 7C
06D0  60 F0
06D2  60 40
06D4  E0 A0
06D6  F8 D4
06D8  6E 01  VE=01
06DA  6D 10  VD=10
06DC  FD 18  TONE=VD
06DE  00 EE  RET
```

PATTERNMAKER

This one's fascinating. You can have the computer draw a complex, varying 'kaleidoscope' pattern on the screen starting from a 'seed' pattern drawn by you. When you run the program, four spots appear in the centre of the screen, making a square block. Keys 2, 4, 6 and 8 are used to move the spots in each of the four screen quadrants to create the seed pattern. Key 2 moves the spots vertically away from the centre, key 4 moves the spots horizontally away from the centre, key 6 moves them horizontally towards the centre and key 8 moves them vertically towards the centre. When you've created your pattern, press key 0 and the computer will commence drawing the pattern out across the screen, continuously repeating it. Note that when the pattern crosses an existing line, the screen is blanked. Try this seed pattern: press key 2 four times, then key 4 four times, then press key 0.

The subroutine from 0632 to 0674 causes the pattern to be duplicated in the four quadrants of the screen.

```
0600  60 00  V0=00
0602  63 80  V3=80
0604  61 1F  V1=1F
0606  62 0F  V2=0F
0608  26 32  DO 0632
060A  A6 00  I=0600
060C  F3 1E  I=I+V3
060E  F0 0A  V0=KEY
0610  F0 55  MI=V0:V0
0612  40 00  SKF V0≠00
0614  16 1C  GO TO 061C
0616  73 01  V3+01
0618  33 00  SKF V3=00
061A  16 08  GO TO 0608
061C  63 80  V3=80
061E  A6 00  I=0600
0620  F3 1E  I=I+V3
0622  F0 65  V0:V0=MI
0624  40 00  SKF V0≠00
0626  16 1C  GO TO 061C
0628  73 01  V3+01
062A  43 00  SKF V3≠00
062C  16 1C  GO TO 061C
062E  26 32  DO 0632
0630  16 1E  GO TO 061E
0632  40 02  SKF V0≠02
0634  72 FF  V2+FF
0636  40 04  SKF V0≠04
0638  71 FF  V1+FF
063A  40 06  SKF V0≠06
063C  71 01  V1+01
063E  40 08  SKF V0≠08
0640  72 01  V2+01
0642  A6 77  I=0677
0644  6A E0  VA=E0
0646  8A 12  VA=VA&V1
0648  6B 1F  VB=1F
064A  81 B2  V1=V1&VB
064C  3A 00  SKF VA=00
064E  72 01  V2+01
0650  6A F0  VA=F0
0652  8A 22  VA=VA&V2
0654  6B 0F  VB=0F
0656  82 B2  V2=V2&VB
0658  3A 00  SKF VA=00
065A  71 01  V1+01
065C  6B 1F  VB=1F
065E  81 B2  V1=V1&VB
0660  D1 21  SHOW 1MI@V1V2
0662  8A 10  VA=V1
0664  6B 1F  VB=1F
0666  8B 25  VB=VB-V2
0668  DA B1  SHOW 1MI@VAVB
066A  6A 3F  VA=3F
066C  8A 15  VA=VA-V1
066E  DA B1  SHOW 1MI@VAVB
0670  8B 20  VB=V2
0672  DA B1  SHOW 1MI@VAVB
0674  00 EE  RET
0676  01 80
0678  00 00
```

Sight & Sound

This year it's turntables at the Japan show

Nakamichi's 'Rolls Royce' turntable — the TX-1000. Multiply by ten for the price in dollars!

It doesn't seem like a year ago that Dennis Lingane reported for us on the wonders of the last All Japan Hi-Fi Show, but time rolls on and the Japanese R&D merchants have had a whole year in which to discover and develop new directions for the titillation of the audio buff. Last year amplifiers were the focus of attention; this year the spotlight switches to turntables and miniaturisation.

In Japan the whole audio industry seems to get onto the same technological kick at the same time (who said competition was the basis of capitalism?), and if it seems odd that they've all concentrated on improvements and new designs for the conventional turntable when PCM digital records (Pulse Code Modulation, for those who keep forgetting the jargon) are predicted to be all the rage by the end of the year, then it only goes to show that marketing has nothing to do with logic.

The various manufacturers have taken different directions in their turntable designs, but many have followed the Technics SL10 concept and gone for miniaturisation; in the Technics example, the tonearm is enclosed in the hood of the player. Hitachi has a model which follows the exact dimensions of the Technics player, and Sanyo has a Technics lookalike but without the tonearm in the lid.

Pioneer has made quite an effort in this new wave of turntable miniaturisation, with an ingenious unit measuring only twelve inches wide by nine inches deep (around 300 x 230 mm). How do you get a twelve-inch record onto a nine-inch turntable? Simple — you push a button and a front panel drops down, the record platter slides out, and a tonearm swings out from inside the box. However, we apparently won't be seeing this unit on sale in Australia, though for anyone wanting a really mini system it could be a good buy on an overseas trip.

While most manufacturers were heading for miniaturisation, Nakamichi have gone the other way. They have produced a new computerised turntable weighing around 35 kg, with its own intelligence that even sizes up faults in the pressing of your records and automatically adjusts its mechanics to compensate. Priced at around $5000 in Japan, it is expected to be nearer $10 000 when released here! It comes with two tonearms and a third sensing arm which 'talks' to the on-board computer. A section of the turntable rises out of the plinth and the sensing arm swings out, settles onto the inner circle of the record and measures the imperfection of the pressing (caused in the casting and producing wow and flutter). This arm then tells the computer how far the rotation is out, and the turntable drive system is adjusted to compensate. All highly sophisticated!

Linn Sondek are cashing in on the latest fashion trend in order to compete in the Japanese market. Based on the current swing in Japan towards things English, Scottish ▶

entrepreneur Ivor Tiefenbrun has come up with a Linn Club. Basically, anyone who buys a Linn Sondek product automatically becomes a member of the club and is entitled to wear the club tie (made in Jermyn Street, London, where all the best club ties come from, so we're told), and a blazer badge depicting a rampant red lion heavily embossed with gold thread. They can even get a wall plaque to hang in their home. The quality of the product seems to have got lost in the marketing somewhere along the line.

Still with turntables, Sharp have made a portable version of their upright two-sided player, presumably so you can take it to the beach and get your record collection warped in the heat and the player clogged with sand.

The suction turntable also had a few followers at this year's show. This concept is basically a vacuum system which sucks the record onto the platter and gets rid of minor warps; the suction holds it flat while it's played. This technique is said to reduce resonance because the record and the platter become as one. Some credibility is given to the idea by the fact that Thorens has a suction turntable on the way.

With all this flurry over turntables, PCM, which is tipped to supersede them all anyway, was by no means ignored. Every manufacturer worth his salt had an integrated PCM digital player on show, and all the companies are very confident of the launch of the PCM disc by the end of 1982. They are even confident about the 'software' — i.e: the records. For example, a Sony spokesperson says it has the assurance of its wholly-owned subsidiary Sony/CBS that the PCM discs will be in good supply by the time of the launch.

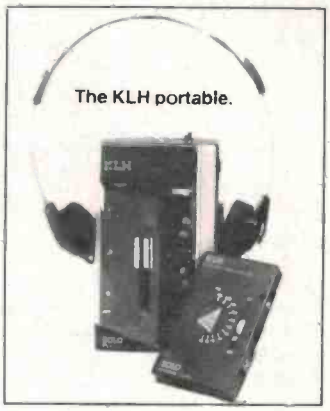
Getting away from turntables, it seems that the general trend in audio electronics is towards the 'midi' concept — i.e: something between the mini-systems that have been trying for two or three years to properly establish themselves and the conventional (maxi?) systems. Hedging their bets? Such midi-sized systems are being offered by all manufacturers in the coming year, most featuring remote control not as an exclusive option but as a standard feature.

Another important trend in the ever-inventive electronics industry is towards the microcassette. According to Technics' charts showing the growth of the compact cassette and the microcassette in the marketplace, the growth of the Philips compact cassette in the 1960s was exactly duplicated by the growth of the microcassette in the '70s. Technics maintain that compact cassette sales will level out in the '80s and the microcassette will catch it up.

Every hi-fi company showed microcassette stereo decks as part of their mini-systems range, and National Panasonic and Aiwa both had prototypes of microcassette car players. Portable stereo microcassette radios also abounded in the Akihabara (the electonic and electrical shopping suburb of Tokyo, where 200 multi-storey shops bulge with the latest in electrical and electronic equipment at the best prices in Japan). So there seems to be no doubt that in the domestic market at least the Japanese microcassette has quite a future in the next generation of hi-fi systems.

So — "Curiouser and curiouser", as Alice would say. PCM is on the way, but the conventional turntable has far from finished developing. Will the microcassette become the new market sensation, or will 'midis' sweep the board? No doubt the next All Japan Hi-Fi Show will offer a few answers — and plenty more surprises.

Dennis Lingane



The KLH portable.

KLH to launch full product range in Australia

KLH, who have become known in Australia for their computer-controlled loudspeakers, have recently merged with a major Japanese electronics manufacturer to launch a full range of KLH electronic products in Australia.

The products will include amplifiers, receivers, cassette decks, tuners, a turntable and a budget range of loudspeakers. KLH promises quality with good value for money, and has an impressive record dating back to 1957 to back it up. For example, in 1959 the KLH Model 6 became one of the six all-time best-selling loudspeakers and was not discontinued until 1974, and in 1965 KLH was the first manufacturer to be licensed for Dolby and produced the first tape deck incorporating Dolby for domestic use.

As a prelude to the release of the full range of products, KLH has already made available the KLH Personal Stereo Cassette/FM Receiver. The headphones are ultra-light, using somarium cobalt magnets, and two headphone jacks are provided for tandem listening. A locking talk-through switch also allows for two-way communication. Rrp for this walkaround cassette deck/receiver is $229.

For further information on all products contact Concept Audio Pty Ltd, 22 Wattle Rd, Brookvale NSW 2100, (P.O. Box 422, Dee Why NSW 2099). (02)938-3700; telex: AA24369.

Double cassette deck from Sharp

Hot on the heels of Sharp's bilateral turntable (which automatically plays both sides of a disc) comes the stereo double cassette receiver, which moves away from the traditional idea of three-in-one units now on the market for most household applications.

Sharp's new unit, the System 700, features a double cassette deck with blending and editing facilities, linked to an AM/FM receiver producing 50 watts per channel, and stereo speakers.

"We are now offering three major household audio concepts," said Sharp's audio product manager Doug Thompson. "One is the VZ-3000, with bilateral turntable. There is the household components system, with amplifier, turntable, tapedeck and so on. And now we have the System 700 with its double cassette deck for further flexibility. Each is designed to fulfil a specific need, and the System 700 allows customers to bypass the turntable option if they want to by turning to tape instead."

The System 700 also includes APSS (automatic programme searcher system), metal tape capability and a Dolby noise reduction unit. The double cassette deck and tuner are linked to an inbuilt amplifier that delivers 50 W per channel through twin three-way speakers.

Suggested retail price for the system, with cabinet, is $799. Further information may be obtained from Mrs. J.W. Lee Martin, (02) 922-6922.

Sennheiser 'phones are light on the ears

Meet the latest thing in Sennheiser headphones — the new super-light, super-inexpensive HD 40. Strong on price to performance ratio, the HD 40 are said to have been designed to give the most discerning audio buff a good earful of the finest reproduction.

The HD 40 also have a special new feature that is very handy for storage; their driver system (that's the bit that goes over the ears) can be turned around the headband so that they can be laid flat. It also comes complete with 3 metres of cable.

Technical specifications for the HD 40 are:

- Frequency response: 22 — 18 000 Hz
- Nominal impedance: 600.

For more information contact R.H. Cunningham Pty Ltd, P.O. Box 4533, Melbourne Vic. 3001, (03)329-9633, or P.O. Box 214, Neutral Bay Junction NSW 2089, (02)909-2388.

Video industry group formed

The Australian consumer video industry, comprising all major suppliers and brands of domestic video recording and playback equipment, has formed an industry group. The group's spokesman, Mr. Gerry Gerlach, said that it had been formed to promote video as a home entertainment medium and to provide a forum for discussion of relevant information relating to industry trends and developments.

Mr. Gerlach explained that one of the group's main objectives will be to keep the media informed of developments within the video industry. The AVS group will provide an interface between the industry and the media.

Other organisations related to the home entertainment and video industries have already been formed, and the AVS will co-operate with these other groups in the long-term development of the Australian video industry.

For further information contact Mr. G. Gerlach, Spokesperson, Australian Video Suppliers' Group, c/o G. Gerlach & Associates, P.O. Box 764, Chatswood NSW 2067. (02)419-7613.

Broadcast-quality video system from National

National's newly released ¾" broadcast-quality video cassette system is expected to be of interest to regional TV stations, advertising agencies, production houses and research companies because of its high performance and versatility.

The system consists of the direct drive model NV-9240 recorder, the NV-9600 editing recorder and the NV-A960 editing controller.

The NV-9600 editing recorder incorporates the facilities of earlier models, including the playback of tape recorded in NTSC, and also features a flying erase head and performs frame-by-frame edits.

The NV-9240 cassette recorder can be used as a master studio recorder, a dubbing deck, a source player, an editing system, or for high-quality recording or playback.

The NV-A960 automatic editing controller governs the performance of both insert and assembly edits and controls the selection of the desired editing mode.

The National Panasonic Series 9000 Video Cassette System is available through its Australian distributors, GEC Australia Ltd's Electronics Division. For further information contact Ian Nicholas on (02)212-5488.

Best of both video worlds from Sharp

A VHS video recorder that combines the functions of a standard deck with those of a portable recorder was recently released by the Sharp Corporation.

Video recorders were previously aimed either at users who wanted to connect video to a television set for recording and replay, or at people who wanted a portable unit linked with a video camera for commercial or home movie use. The all-purpose video unit from Sharp is said to combine both functions in a new concept designed to give users the best of both worlds with one piece of versatile equipment.

Called the Video Champ 2300, the recorder operates in the same way as a standard video recorder when connected to a television set indoors. Outside, or at other locations away from mains supply, it can operate from its own battery pack or from a car battery.

Features of the Video Champ 2300 include:

- four-hour recording and playback with E-240 tapes
- fast forward picture search system
- freeze frame function
- eight-channel UHF/VHF tuner
- one-day, one-event programmable timer
- fine editing function

The recorder can be connected to any one of Sharp's three video cameras. Latest in the camera range is the lightweight XC-30, released by Sharp at the same time as the Video Champ 2300. Weighing only 1.4 kg, the compact camera also offers a collection of features:

- fixed focus 2x zoom lens with auto iris to eliminate focusing and exposure errors
- informative viewfinder, with low-light and battery warnings, plus recording indicator
- built-in condenser microphone
- built-in VCR start/stop trigger
- accessory shoe to carry lighting equipment.

The Video Champ 2300 is expected to retail at around $1300, and the XC-30 camera at about $700.

For further information contact Mrs. J.W. Lee Martin, (02)922-6922.

Vector gear is grey, not green

If you were casting your eye over the Vector Research integrated amp and cassette deck displayed on page 2 of the December and January issues, you may have noticed a curious thing — the picture shows them as green.

Now, while Vector Research gear may be 'unconventional' in other regards — the designers went for 'no compromises' — the gear is not so far out on a limb as to be presented in green. After all, it would hardly fit in with 'Danish Modern' decor, would it? Or most other domestic decors, for that matter. No, really, it's a quiet, refined gunmetal grey. Very suave.

The gear turned out green as a result of some error in the production process when the page was made up. Murphy being an Irishman, naturally the error caused them to be green. Grrr.

Apparently there were also a few mistakes in the information we published about Vector Research products in the November issue. As stated, Vector Research hi-fi products will be distributed by a newly formed company, Keio International, as will Crown Radio cassette portables. However, other products distributed by Keio will be Altec Lansing American loudspeakers, not DR Industries' Silcron and RMS ranges of speakers. Keio is also carrying only cassette portables from Crown Radio, not three-in-one systems as shown in the photograph in the November issue. The address for contacting Keio International is also different: 198 Normanby Rd, South Melbourne Vic. 3205. (03)64-3546/7/8/9.

Let's hope we've got it right between us this time.

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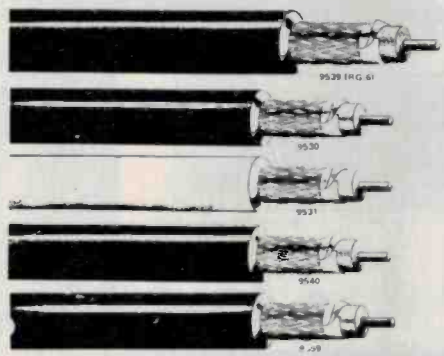

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For over twentyfive years the name Marantz has stood for the ultimate in audio engineering brilliance and fidelity.

In keeping with this standard of technical excellence, the new Marantz Gold range of Cassette Decks with stunning designer element of brushed-gold finish now includes a recorder incorporating the latest in noise reduction processing.

The Marantz SD3030 Cassette Deck features the new Dolby C system to provide recordings with far less tape hiss than those made using standard Dolby B.

Unlike some other noise reduction systems, Dolby C recordings can be played back on a deck equipped with standard Dolby only without audible distortion or pumping effects.

Recording enthusiasts will be delighted by the other models in the new range.

Marantz Gold decks offer a variety of advanced features such as LED peak level meters on the SD1030, fine bias adjustment on the SD2030, and a motorized linear skating loading system on the SD5010.

All feature Dolby B noise reduction, compatibility with metal tapes, soft touch controls and DC Servo motors to ensure constant tape speed and silent operation.

So, set your standards high. And your recording standards higher.

See your local stockist and listen to the future. Listen to Marantz.

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Decks shown in stack (from top): SD1030, SD3510, SD2030, SD3030 and SD5010. All decks shown with TDK Metal tapes.

Distributed by MARANTZ (Australia) Pty. Ltd. 19 Chard Road, Brookvale NSW 2100
Telephone (02) 939 1900 Telex AA24121 Melbourne (03) 544 2011,
Brisbane (07) 44 6477, Adelaide (08) 223 2699, Perth (09) 276 3706. Townsville (077) 72 2011

Marantz Gold
The New Audio Standard.

New range of Marantz cassette decks

Marantz (Australia) recently announced a new range of gold-fascia cassette decks with retail prices from $179 to $699. The series incorporates various advanced features, including microprocessor control on two models, linear skating cassette loading on two models, and compatibility with metal particle tapes on all models.

Model SD3030 also features the latest Dolby C noise reduction system, which is said to improve the signal-to-noise ratio by a further 10 dB over the Dolby B system, without affecting dynamic range or overall response.

As well as adjustable tape bias to cater for all types of tape on all models, Marantz has engineered all the tape heads for long life, whilst on top-line models the heads are constructed of high-performance sendust alloy.

The tape transport mechanism is said to have been updated on the new range, eliminating the old 'piano-key' controls in favour of soft touch controls. DC servo motors are employed in all models to ensure constant tape speed.

Provision for real-time clock operation (for recording or playback at a predetermined time in user absence) is built into the SD9020 and the SD8020, and all other models have timer stand-by facilities for use with an external timer.

For more information contact Marantz (Australia) Pty Ltd, 19 Chard Rd, Brookvale NSW 2100. (02) 939-1900; telex: AA24121.

More copyright confusion

Consumers who have spent large sums of money purchasing expensive video recording equipment have recently been alarmed to read reports of a US Federal Court of Appeal decision suggesting that taping of television programmes on home video recorders, even for private and domestic use, is a copyright infringement.

The United States decision, which is almost certain to be appealed against by the Sony Corporation, is in direct conflict with the stance taken by the United Kingdom Government, which in July 1981 published a 'Green Paper' rejecting similar claims which had been made by copyright owners in Great Britain seeking the imposition of a levy or tax on video equipment or video and audio blank tapes. The Australian Audio Video Tape Association (AAVTA) has called on the Attorney General's Department in Australia to end the confusion by taking positive action to legalise single copying of television programmes for private and domestic use.

The Association spokesman, Mr. P.A.G. Rose, points out that it is quite clear that Copyright Acts in all countries such as Australia, which are contracting parties to international copyright conventions, permit governments a certain amount of freedom to legislate in relation to private and domestic use and for education and research, without infringement of the basic rights of copyright owners.

Comprehensive American surveys point clearly to the fact that most video recorder owners use recorders for 'time shifting' — that is watching their favourite programmes at a more convenient time — rather than for storage and repeated use. Traditionally, after watching, tapes are then erased and reused for the same purpose.

The imposition of any levy or tax on either blank cassette tape or video recording hardware would be to ignore the rapidly increasing rate of use of non-infringing portable video cameras instead of the old Super-8 home movies. In such cases Mr. Rose says there is no justification whatsoever for any levy to be charged for blank video tape as material recorded will be of an original nature.

The Association says that the stance taken by the United Kingdom Government is clearly the more practical approach, and the one which should be followed by the Australian Government. A commonsense solution along these lines can be achieved by including single copy private and domestic recording and specified educational recording in the 'fair dealing' provisions of the Copyright Act.

For further information contact Mr. Peter Rose, Vice-Chairman and Spokesman, Australian Audio-Video Tape Association, c/o 3M Australia Pty Ltd. (02)498-0033.

TV wristwatch not far away?

Standard Telephone and Cable (STC), based in London, recently demonstrated that the wristwatch TV is not an impossible concept by showing a display unit only 36 mm square and a few millimetres thick.

This device is expected to lead to what STC describes as, "Probably the ultimate in display compactness and miniaturisation", and was shown at the recent New York international symposium of the Society for Information Display. STC's work in this field is backed by British Telecom and the UK Ministry of Defence because of its potential use in many types of pocket-sized equipment as well as telecommunications and aircraft instrumentation.

The unit has a liquid crystal display instead of the more conventional cathode ray tube, but unlike the LCDs used in most digital watches, the normal seven segments for each numeral in a watch are replaced by 1600 picture elements.

Built in at the back of the display is a large-area silicon chip which can provide all the electronic drive circuits needed for a display of such complexity, and dyes are used to give the device a range of colours. It is the first LCD of its kind to have a large-area integrated circuit incorporated into its structure.

Now that the 1600 picture elements version has shown that the concept works, scientists at the Standard Telephone laboratories are working on a display with 57 600 picture elements on a screen 69 mm square, to give good clarity.

According to STC, such displays need only very low electrical power, but are able to display, for example, a full page of teletext together with diagrams and graphics.

The unconventional Yamaha B6

The Yamaha B6 amplifier is unconventional both in its appearance and in its power supply, which closely resembles that of the Carver M400, reviewed in an earlier ETI. Louis Challis discusses the similarities and differences between the B6 and both the Carver model and conventional power amps.

Louis Challis

THE RELEASE of the Yamaha B6 power amplifier in America and subsequently in Europe has created a good deal of interest from those technically aware of the attributes of an amplifier that does not use a conventional power supply. There are many parallels to be drawn between the Carver M400 (reviewed ETI, Nov. 1981) and the Yamaha B6 amplifier. Neither uses a conventional power supply, and although the literature provided by Yamaha is extremely sketchy, there is a strong likelihood from the power rating of the unit and the other general information provided that this is either a licensed version of the Carver principle or that it closely follows a similar path. Figure 1 shows the principle of operation (from the Yamaha literature). It has a remarkable similarity with the principles and art which Carver presents in his literature, but the description of the operation thereafter exhibits significant differences.

How?

Yamaha describe the X power supply system as one in which unnecessary power dissipation is avoided by segmenting the ac sinewave power into precisely measured portions before it is fed to the power rectifier system. An optically coupled feedback loop controls the main power supply triacs, which turn on at precisely the right time during each power cycle, between 90° and 180° in each half-cycle. This switching is controlled by the instantaneous power consumption of the amplifier and thereby (in an analagous manner to the Carver system) achieves an exceptional output power performance without the need for expensive power transformers or large and bulky filter circuitry.

Thereafter, claims made for the B6 are, if anything, more glossy and rosy than those made by Carver for the M400, but whilst Carver compares his amplifier to a conventional amplifier with a large power transformer and conventional output stage, Yamaha stress the difference between their unit and the efficiency of the latest Japanese

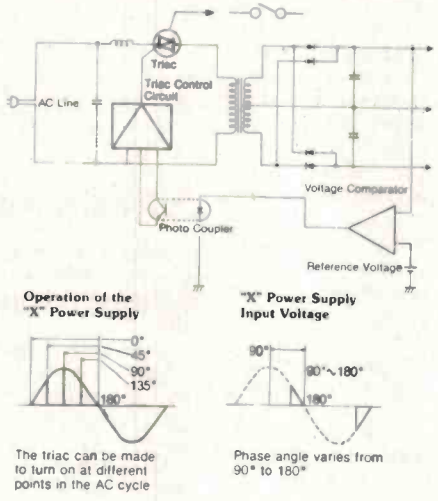


Figure 1. **'X' power supply circuit diagram and operation.**

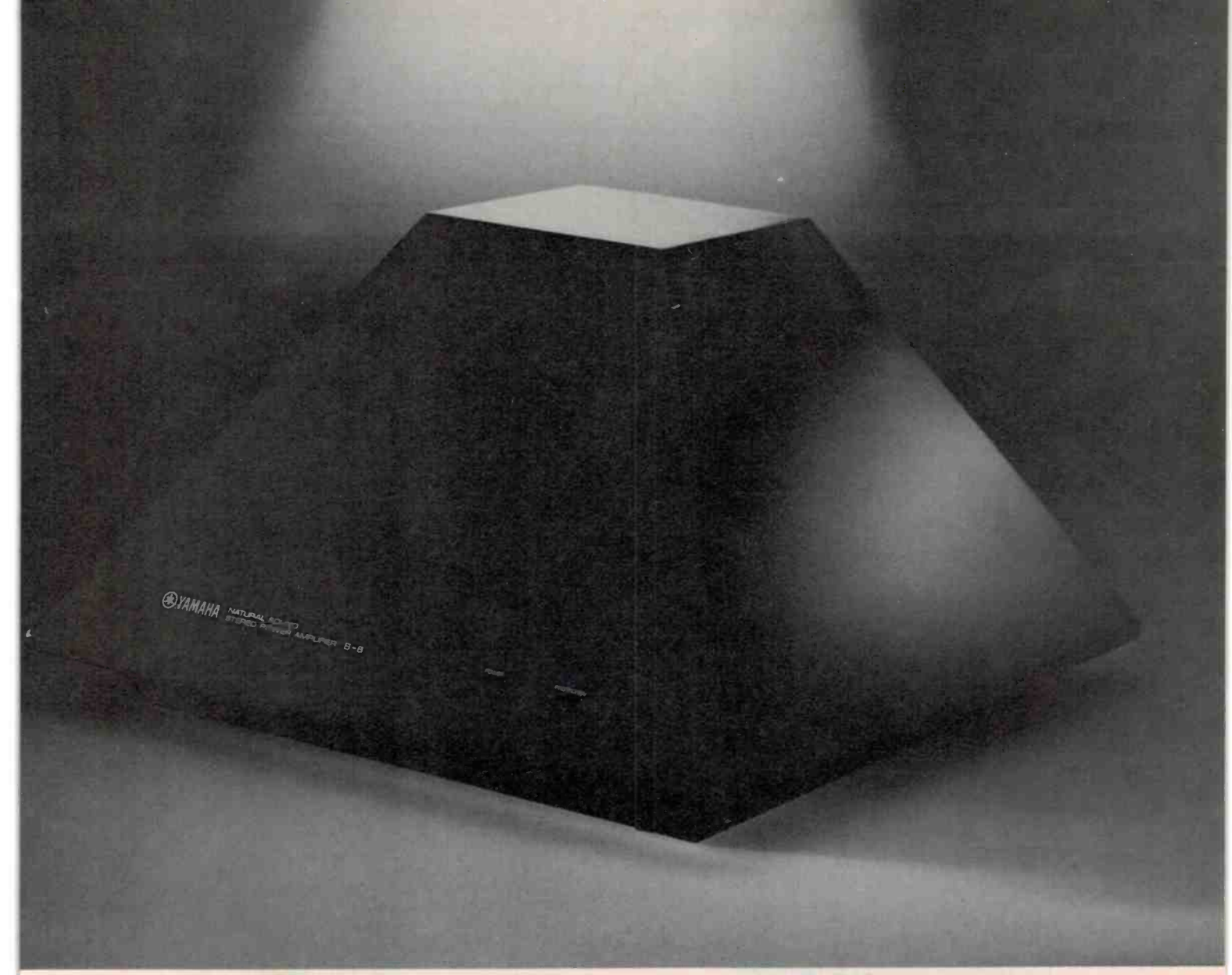
switching power supply systems as typically marketed, for example, by Sony (but they do not actually mention Sony). They also claim, in a similar manner to Carver, that the power supply output is virtually free from voltage 'spikes', so that no electromagnetic energy is radiated by the unit to interfere with the performance of high gain amplifier stages.

Yamaha offer four amplifiers featuring the X power circuitry: the B6, the A760, the A960 and the A1060. The power ratings of these amplifiers are not stated, so we presume that the B6 is the smallest of the series and that the other units overcome the voracious power demands that other high-powered amplifiers require to operate effectively.

Unlike Carver, Yamaha provide some very nice circuit schematics of the feedback control system and, more importantly, a very small schematic of the main amplifier circuitry. This tells us little about the operation of the amplifier except to show that it has two positive and negative voltage rails and a separate earth between which the transistors switch. By contrast the Carver amplifier has three positive and three negative rails. It seems from this that *there are a number of significant differences* in the electronic circuitry details between the Carver Amplifier and the Yamaha B6, and this review assesses some of the main features, similarities and differences.

The B6

The unit which I received was not new, but it had one of the most unusual appearances of any amplifier we have seen in the last decade. For reasons best known to the designers they have avoided the inexpensive 'cube format' that Carver chose for their amplifier and instead have selected a truncated pyramid. This is a diecast cabinet featuring two bezel lights on the smooth front panel, with a large finned and ventilated heatsink at the back. Recessed back under the rear edge are two gold-plated coaxial phono-type input sockets,



two pairs of spring-loaded loudspeaker connection terminals, an earth terminal, a speaker on-off pushbutton switch and the mains lead. This is terminated with a three-pin plug for connecting directly to the normal power outlet.

Underneath the leading edge of the face is a pushbutton mains switch for turning on the power. Two bezels are provided, one for the power on and the second as an overload light. This protection light operates to indicate that the unit has been overloaded, particularly in those situations where excessive voltage or power is drawn or when short circuits are connected to the output of the system. Access to the unit's electronics is gained through the base but, rather surprisingly, after undoing all the screws on the base, the unit still did not seem to want to come apart. The base of the unit, like the top, is fabricated as a diecasting and incorporates more than 24 screws connecting various sub-sections, which each had to be unscrewed before access could be gained to the control section of the printed circuit cards and electronics.

There are a few parallels between the construction of this unit and the Carver M400 amplifier unit, in that it is electronic component intensive. The printed circuits in this unit appear to be constructed to a higher standard than in the Carver amplifier, whilst the number of high-powered and medium-powered switching transistors and triacs appears to be even more numerous than in the Carver unit. With typical Japanese thoroughness the unit has been carefully laid out to assist the service organisations, and all the components and test points are clearly labelled and readily accessible.

Once again the only real complication is to get the unit fully apart because of the large numbers of screws required to disassemble it. I never succeeded, nor did the editor, who also tried valiantly.

It seems possible that Yamaha may have spent as much on their diecastings as they might have spent on a transformer, and only Yamaha's sales and costing personnel can answer that criticism.

On test

The specified ratings for this amplifier have been presented in a different way from the Carver M400, thereby making a direct comparison more complex. Whilst the power output and total harmonic distortion is stated as being 200 watts, most of the other performance factors relate to the 100 watt level, at which point we would expect the unit to perform better, and so it does. The frequency response is impeccably flat, being within 0.5 dB from 10 Hz to 100 kHz. Yamaha utilise faster switching transistors than Carver and faster triacs in their power supply, and thus achieve a substantially greater bandwidth than the Carver M400 amplifier ▶

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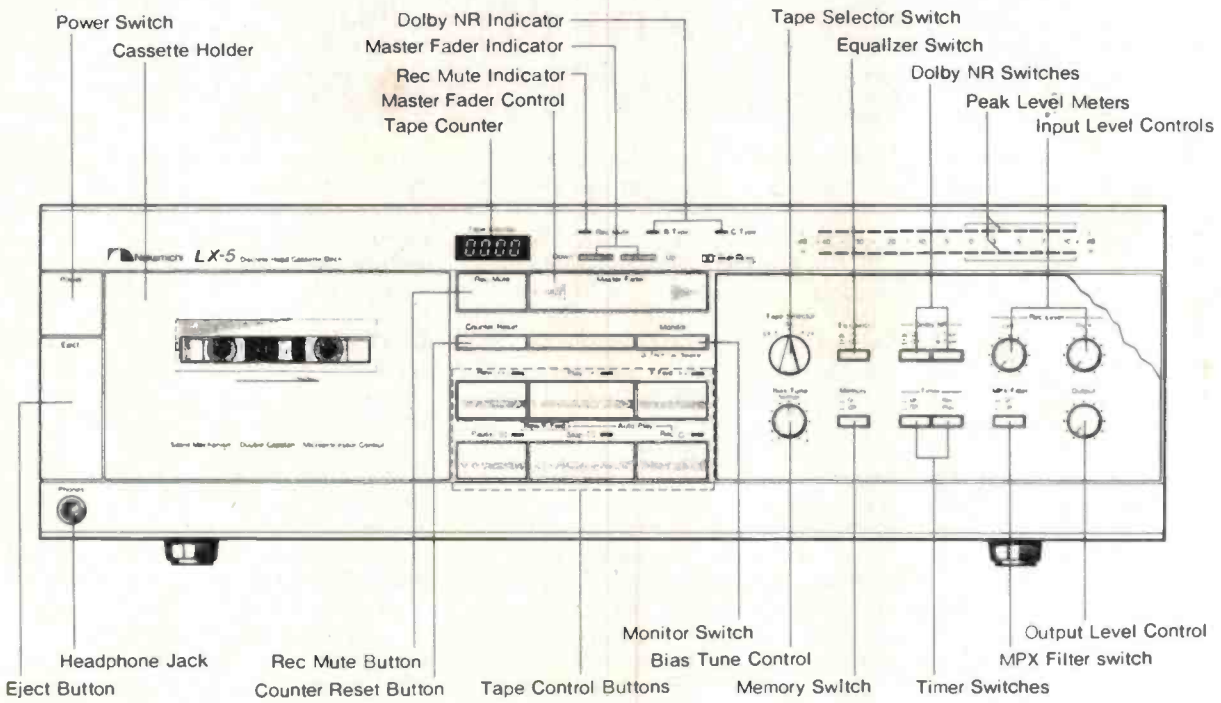
LX-5/LX-3

News Release

Nakamichi Corporation

The LX-5 and LX-3 follow the same elegant design trend initiated by the Nakamichi 700ZXL and 700ZXE. A wide central belt of silver holds the cassette door, main transport controls, and a hinged panel which swings down to reveal additional controls. Above and below it are black bands, the upper one containing an array of LEDs: the meters, tape counter, and other indicators. Both models also incorporate advanced Nakamichi features found in our top-line decks: the Asymmetrical, Diffused Resonance, Dual Capstan Transport, the Discrete Three Head system (LX-5), and Dolby C-type noise reduction.

By offering increased transport control flexibility in combination with elegant styling and excellent all-around performance, the LX-5 and LX-3 are impressive additions to the Nakamichi line.



LX-5 Front Panel (showing controls behind the hinged panel)

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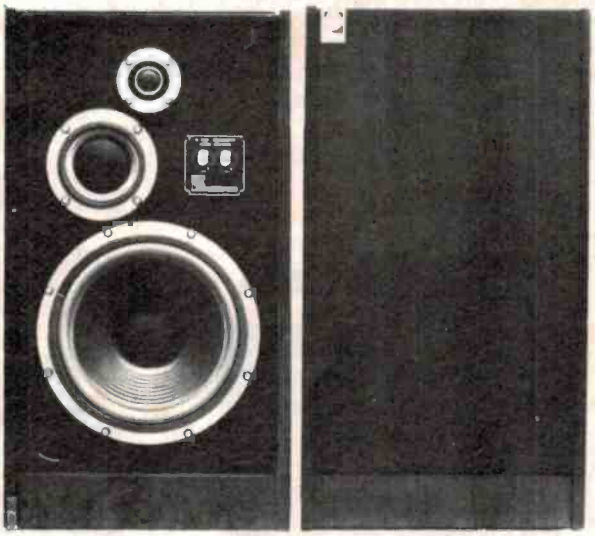
MODEL: ANDROMEDA I



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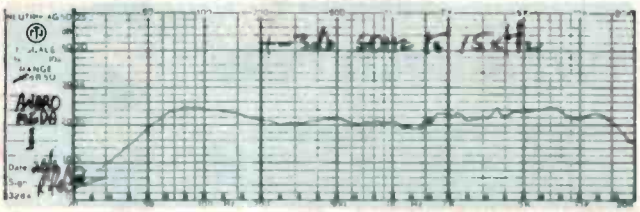
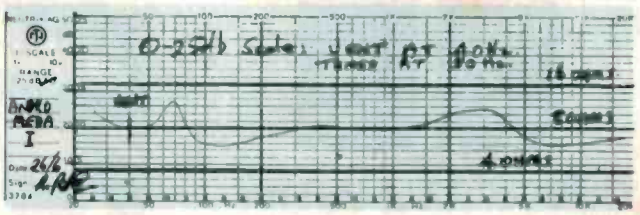


FREQUENCY GRAPH: CALIBRATED. 0 - 50 db Scale



IMPEDANCE GRAPH (Z) CALIBRATED. 0 - 25 db Scale

GENERAL DESCRIPTION

The series one was developed from the more famous series two, using a smaller enclosure, and a single mid-range, but same crossover and components as the two. We detected only a slight loss in dynamic range, but a slightly richer, more enhanced deep bass end. Rock, middle of the road, and jazz, seemed to be their forte, although every digital classic we put through them gave an overwhelming performance. Still cannot find anything to better them in the price bracket, even up to twice the price.

CABINET MATCHING:

790 mm deluxe in veneer only.

SOUND PRESSURE LEVEL: 1 watt. 1 meter 94db.

SHIPPING: 1 only per carton (matched pairs)

WEIGHT

	IN CARTON	OUT OF CARTON
	32.8 kg.	32.00 Kg.

DIMENSIONS:

Height	860 mm	790 mm
Width	480 mm	430 mm
Depth	460 mm	390 mm

SPECIFICATIONS:

TYPE: Reflex twin tuned port
SYSTEM: 30 cm (12") 3 way, 3 element
MAXIMUM RATING: 120 watt R.M.S.
MINIMUM PREF. DRIVE: 15 watts (8 ohm)
DRIVER SIZE: 30cm (12")
CAPACITY: 76 litre
BAFFLE: 26mm heavy braced
COLOURS AVAIL: Sen Ash — Oak Veneer
ATTENTUATION: Mid and high constant
CROSSOVER TYPE: Inductive — capacative — resistive
CROSSOVER *frequ*: 360 Hz, 5 k Hz
MIDRANGE ROLLDOWN: 6db.
MIDRANGE ROLLOFF: 6db.
DRIVER ROLLOFF: 6db.
TWEETER ROLLDOWN: 18db.
TWEETER ROLLOFF: N/A
SUPERTWEETER ROLLDOWN: N/A
FREQUENCY RANGE: 20 Hz to 20 k Hz
EFFECTIVE RANGE: 40 Hz to 20 k Hz.

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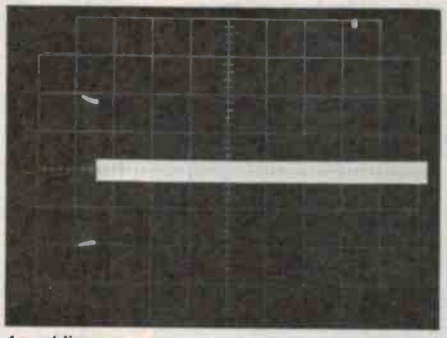
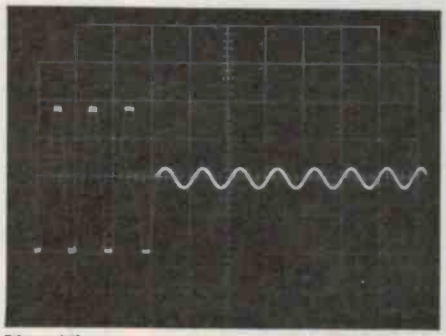
From page 127

Transient overload recovery test (IHF-A-202). 10 dB overload re rated power into 8 ohms — both channels driven. Overload duration: 20 ms; repetition rate: 512 ms.



1 ms/div.



50 ms/div.

does. The total harmonic distortion at 200 watts is typically 0.016% at 90 Hz, 0.009% at 1 kHz and 0.0046% at 6.3 kHz. This is higher than the manufacturer's claims of 0.003% but is nonetheless a good performance. At the one-watt level the manufacturer's claims are more closely approached, although are again slightly exceeded at the 1 kHz and 6.3 kHz test frequencies.

The residual hum and noise related to the 1 W level is excellent, being −88 dB (unweighted) and −89 dB (A-weighted). This similarity to the S/N ratings of the Carver amplifier for the unweighted and A-weighted levels comes as a result of the commutation noise components measured, and these figures are less meaningful in the overall analysis, as the attached photographs make visually apparent.

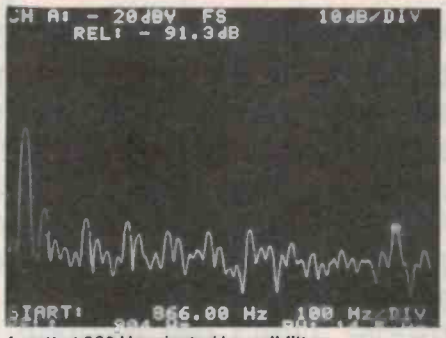
Channel separation is excellent, being typically better than 72 dB at any frequency up to 20 kHz.

We repeated the measurements which we performed on the Carver amplifier utilising our fast Fourier analyser, which can look at full frequency bandwidths in rapid time, to determine the harmonic components of the drive signal and related low-level components using a 900 Hz 200 W toneburst signal, and to determine the relativity between commutation noise and the harmonics at 180 Hz and higher frequencies. As can be clearly seen from the photographs, the harmonics and commutated 50 Hz components interrelated with those harmonics are particularly high. The 350 Hz component, which is highlighted, is only −66.8 dB relative to the fundamental (which has been preattenuated in the measurement chain prior to taking the photograph). This amplifier is thus similar to the Carver, with the commutation noise components rising with increasing signal power output.

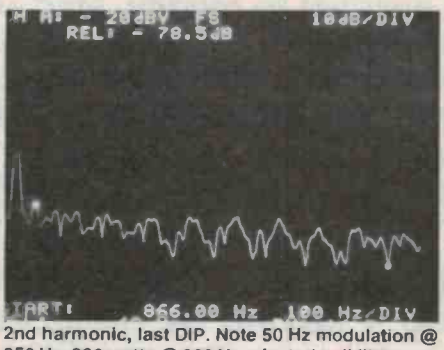
Subjectively

The subjective testing of the amplifier we were using (which had been used by others before us) was temporarily slowed down by the untimely demise of the unit just as I started performing my ritual evaluation at home. The failure involved the total loss of power, but the fuse whose failure I presumed to be the root cause of the trouble was nowhere to be seen. I had already tried to open up the unit without success, so I finally handed it over to the importers, who arranged for another unit to be reviewed.

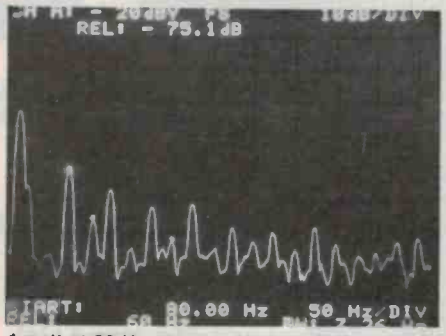
This new unit exhibited no problems whatsoever, and I must presume that the prototype unit had either been



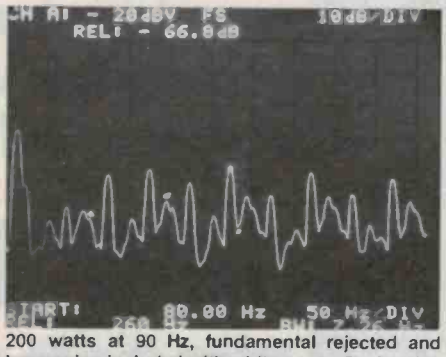
1 watt at 900 Hz rejected by null filter.



2nd harmonic, last DIP. Note 50 Hz modulation @ 950 Hz. 200 watts @ 900 Hz rejected null filter.



1 watt at 90 Hz, max. peaks −75. 1 dB of fundamental. Max. peak is −75.1 dB cf. fundamental.



200 watts at 90 Hz, fundamental rejected and harmonics included with white spots. Peak noise signal indicated by marker.

abused or had some other deficiency. After connecting up the B6 amplifier to a Yamaha C4 preamplifier, I was able to perform a subjective evaluation in which the B6 amplifier was compared directly with a Yamaha M2 amplifier. This has a similar peak rating but is a conventional class B amplifier with all the attributes (or vices) of that class of amplifier. The M2 is an excellent amplifier with a peak power rating well in excess of the manufacturer's 200 W stated output, and has proved itself to be eminently suitable for loudspeaker testing, for which it has been used extensively in the last few months.

The test set-up I chose for the loudspeakers was to connect two pairs of high-quality monitor speakers, each with the ability to handle the peak power rating. Instead of the normal A-B set-up I placed one of the first type in each A channel and one of the second type in each B channel of the two amplifiers. By this means the lack of two matched pairs was satisfactorily overcome and it became possible to directly compare the two amplifiers (rather than the speakers).

The Yamaha B6 amplifier performs remarkably well, in general terms as well as the M2 does, all the way up to the 200 W peak output. At output levels in the range 60 W to 200 W there is the ▶

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STOP

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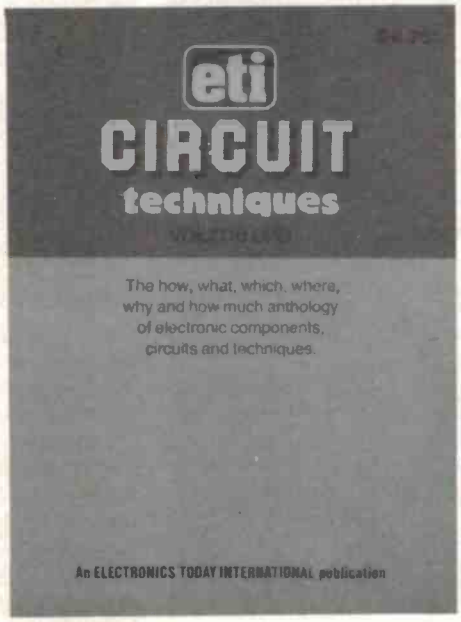

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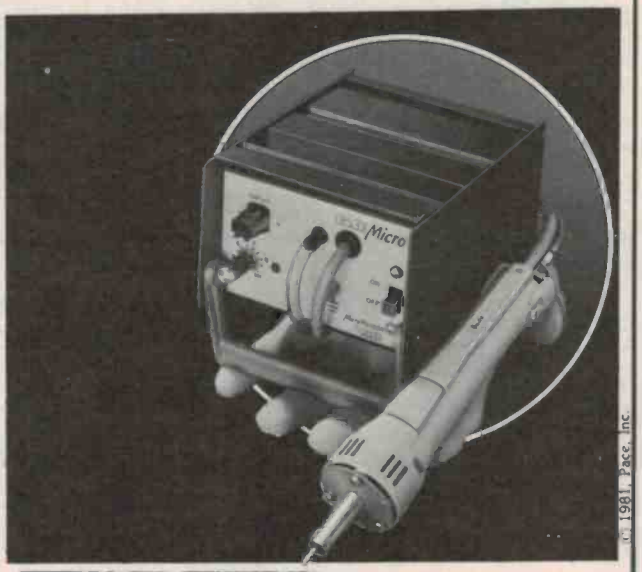

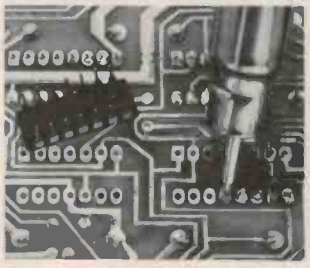

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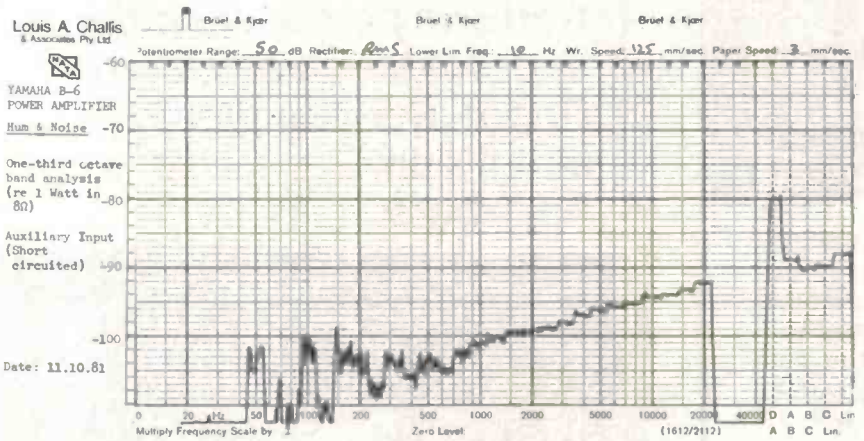
From page 131

faintest trace of an increase in dynamic noise figure, but detecting this was particularly difficult not only for me, but also for other experienced listeners whose assistance I sought. Surprisingly, this phenomenon was a little less pronounced in the B6 than it was in the Carver M400, for which I can give no explanation. At moderate levels, which are power outputs of less than 50 W, the B6 Amplifier is completely indistinguishable from the M2 amplifier. Put more simply, at these levels the B6 performs in all respects just like any other conventional high-quality amplifier. Of course it draws less power, has an unusual appearance, and is if anything, rather esoteric.

The B6 amplifier is unquestionably 'state of the art', for it provides excellent performance over most of its range and does most, but not all, of the things claimed for it by its manufacturers. The dynamic noise problem which we discovered in the Carver amplifier is less pronounced but still just detectable, although it would not be detectable by the above average listener except when performing an A-B test with the same zeal that we exercised. Basically, the B6 amplifier achieves a noteworthy performance and its attributes far outweigh its limitations. However, at a recommended retail price of $1399 it does not necessarily reflect the same value for money as other 200 W amplifiers, even allowing for a five-year warranty, which only 'softens the blow'. ●



YAMAHA B6 AMPLIFIER

Dimensions:	*290 mm wide, 176 mm high, 290 mm deep*
Weight:	*9.2 kg*
Price:	*$1399 rrp*
Manufacturer:	*Nippon Gakki, Japan*
Distributor:	*Rose Music, 17-33 Market St, South Melbourne Vic. 3205.*

MEASURED PERFORMANCE OF YAMAHA POWER AMPLIFIER B-6 S.N. G04850

HARMONIC DISTORTION:

(A) (At Rated power of 201 Watts into = 40.1 Volts)

	90Hz	1kHz	6.3kHz
2nd	-83.0	-84.0	-86.7dB
3rd	-77.6	-85.7	-dB
4th	-85.0	-90.0	-dB
5th	-	-92.0	-dB
THD.	0.016	0.009	0.0046%

(B) (At 1 Watt into 8Ω)

	90Hz	1kHz	6.3kHz
2nd	-90.7	-89.0	87.7dB
3rd	-	-	-96.0dB
4th	-	-	-dB
5th	-	-	-dB
THD	0.0029	0.0035	0.0044%

TRANSIENT INTERMODULATION DISTORTION: Very low: Less than 0.1%

(3.15kHz square wave and 15kHz sine wave mixed 4:1

NOISE & HUM LEVELS:

re 1 Watt into 8 Ω) AUX -88 dB (Lin) -89 dB(A)

(with volume control set for 1 Watt output with, 102mV input (Aux)

MAXIMUM OUTPUT POWER AT CLIPPING POINT:

(IHF -A- 202)

(20mS burst repeated at 500mS intervals) 134 V P-P

= 281 Watts

Dynamic Headroom = 1.4 dB (re 201 Watts)

FREQUENCY RESPONSE:

(-3dB re 1 Watt, 0.5V Input to Aux) Left <1.0 to >100kHz Right

SENSITIVITY:		Left	Right
(for 1 Watt in 8 Ω)	AUX	102mV	100mV

INPUT IMPEDANCE:		Left	Right
	AUX	22k Ω	22kΩ

OUTPUT IMPEDANCE: = 27 milliohms (@ 1kHz)

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Frequency Response: 50-15,000 Hz.
Polar Pattern: Cardioid (undirectional), rotationally symmetric about axis, uniform with frequency.
Impedance: Microphone rating impedance is 150 ohms (180 ohms actual) for connection to microphone inputs rated at 19 to 300 ohms.

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"How we chose the Wheels Car of the Year."

Peter Robinson

"This year there were six finalists for Wheels Car of the Year.

Audi 5+5
Datsun Bluebird
Datsun Skyline
Honda Accord
Mercedes-Benz S-class
Toyota Celica.

"But this year was very different. I had some help. And pretty impressive help it was, too.

Alan Moffat, one of the best drivers in Australia, certainly the best known. With three "Bathursts" under his belt.

Evan Green, once p.r. man with GM and Leyland, long time motoring writer for the Sun-Herald.

Dimitri Caplygin, executive engineer Girlock, perhaps the finest brake engineer in the world. David Bentley, industrial designer and car stylist, fathered the Kimberley and Tasman. Mike McCarthy, technical editor, Wheels.

"The plan was to take off for three days, cover at least 1500 kilometres in each car, swapping drivers each 100 kilometres or so.

"The route: Sydney to Castlereagh drag strip for electronic measuring of base performance – acceleration, braking, speed tests. Then south to Goulburn Queanbeyan and the climb to Cooma. Overnight.

Day 2: through the Snowy to Victoria and down to Omeo. Up through the Kiewa Valley for Night #2 at Albury.

Day 3: Albury to Tumbarumba, Tumut, Yass, Goulburn, Sydney. The run would test the works; suspension, performance, interior comfort and vision, fuel economy, safety, driveability, cornering, fatigue. On freeways, two lane bitumen, back roads, dirt, peak-hour city, night time country. The works.

DAY #1

"I picked up Moffat from the Hilton at 6.55 am. I was five minutes early and he was waiting. We drove in the Benz. Evan met us in the Skyline I'd given him at dinner the night before (at Puncinella, in the Cross, fantastic meal, had a great yarn... but that's another story).

Sydney's roads are so terrible it took an hour to get from the city to Castlereagh.

"We stayed till 1.00 doing the tests. And already the cars were starting to sort themselves out. One which looks a million dollars went like five cents... you would not believe it.

"Funny thing we fast realised. As editor of Wheels I'm hard on cars when I get behind the wheel. That's my job. But to someone like Moffat... he's never canned a car in his life. He's been taught to mother them along so they last the race. All measurements were taken with a gadget called the Correvit. It's fixed with suction caps to the side of the car and monitors everything that happens from acceleration to braking. It takes the human factor out of assessment.

"Moffat remarked as we sat over dinner in Cooma that he was driving more kilometres in three days than he had in ten years in Australia. Seems Alan only drives from his home to the airport at Tullamarine.

"Moffat soon made up for it. So did we all. Drive an hour or so. Stop. Swap notes. Change cars, drive another hour. Stop. File reports. Swap cars and take off again.

DAY #2

"The most beautiful countryside

I reckon is between Cooma and Omeo. Amazing. One minute we're all sprouting Banjo Patterson, the next the mountains flatten out to picture-book rolling hills. Again it's swapping cars. By now two or three makes are out of contention. No one says so but each of us quietly knows it. Day Two is a day of ups and downs. Literally. Mountain after mountain. Bend after bend. We arrive at Albury at 10.30 pm. The cars are in better shape than us.

DAY #3

"By now I'd chosen 'my' Wheels Car of the Year.

One by one I checked with the other drivers. I asked them to rank their best cars in each of six categories.

One: Advancement in design.
Two: Engineering excellence.
Three: Value for money. Four: Safety.
Five: Utilisation of resources.
Six: Performance of intended function.

I tallied the answers and there was a clear winner. We drove home to Sydney."

Read Peter Robinson's full report in February Wheels. There's seven pages on the winning car and two pages each on the five runners up.

Wheels Car of the Year.

Wheels, February, now on sale.

'The quality remains after the price is forgotten.'

Henry Royce, founder of Rolls-Royce, 1906.

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The new red Zerostat Pistol is the latest version of a leader in it's field. The simplest way to remove static and it's associated symptons. Needs no refills, batteries or power supply and neutralises static charges in seconds. Lasts for at least 50,000 operations. **$24.95.**

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Combines the Zerostat Anti-static pistol, Discwasher D-4 Record Cleaning System and Discwasher SC-2 stylus cleaner in a handsome walnut storage tray with smoked perspex dust cover at a significant cost saving over the individual components. **$69. Save 22%. Discorganiser,** the walnut tray and the perspex lid are available separately for just $25.

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SC-2 STYLUS CLEANER

SC-2 Stylus Cleaner fluid is formulated to disperse not only harmful grit, but also the very vinyl additives which D-4 fluid protects and which can clog stylii. SC-2 brush, with bristles of a calculated density and texture, removes dirt without damage to delicate stylus cantilevers. Reverse of brush is a magnifying mirror for easy stylus inspection. **$13.95.**

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Pageant Series II loudspeakers

The Pageant Series II loudspeakers, manufactured in England by the relatively unknown company (to Australians) Mordaunt Short, are excellent for the classical or light music buff, according to Louis Challis. However, if you're into hard rock they most probably won't give you the performance you're looking for.

Louis Challis

THE NAME Mordaunt Short is relatively unknown in Australia, for the product of this small English manufacturer has only recently reached the Australian market.

The Pageant Series II is the second largest speaker in their series, with a recommended retail price of $698. The basic design of this system is conventional, consisting of a 280 mm diameter bass-mid driver and a 25 mm dome tweeter installed in a conventional bass reflex enclosure with a volume of 40.5 litres. This is a rather handy size, designed to suit most residential situations, and provides a reasonable compromise between low frequency bass response and good mid-frequency performance, with the capability of providing output extending up to 25 kHz.

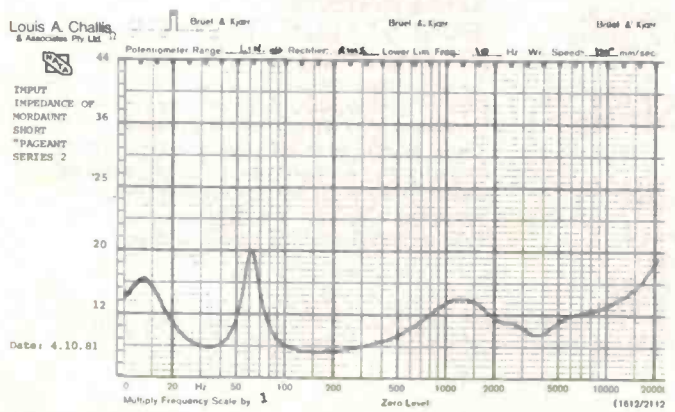
Design

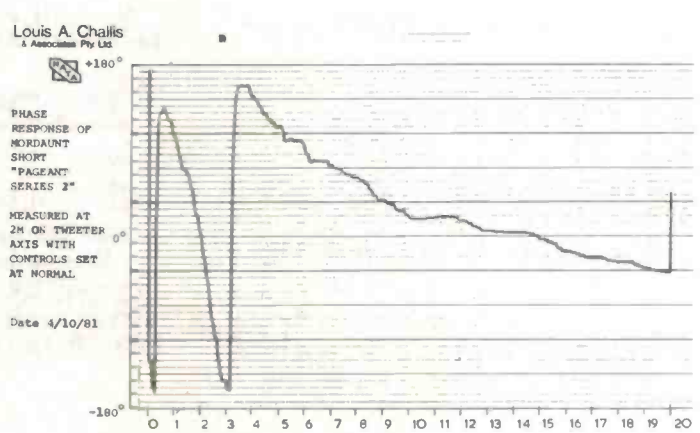
The configuration chosen sensibly locates the tweeter and bass/mid-range unit in a vertical line, with the DSB208 bass/mid-frequency transducer towards the bottom of the enclosure, the tweeter some 250 mm vertically above it, on the central axis, and the 37 mm venting port at the very top of the unit. This places the bass unit in a rather unsuitable position to optimise the reflection component from the floor, and for this reason the manufacturers recommend placing the speaker on a stand at least 400 mm above floor height in order to improve the bass response.

The DSB208 is a versatile speaker incorporating a ceramic magnet assembly and a long-throw voice coil with a linear suspension system, supplemented by a compliant role surround, to achieve a reasonable low frequency performance at moderately high output sound pressure levels. This approach has obvious limitations, as a speaker designed to cover two decades of frequency must do so with some sort of compromise, which in this case is at the bottom end rather than at the top end.

The dome tweeter is a 25 mm diameter synthetic dome made of isophon unmodified KK10/8, which provides a reasonable compromise between absolute frequency linearity and natural frequency resonances.

The enclosure is manufactured from 15 mm thick, high density particle board, veneered internally and externally to provide a balanced stressing. The rear is sprayed in an artificial





flecked paint to minimise costs. The front panel utilises an effective artificial fabric with excellent flow resistance characteristics and is retained by plastic inserts on the front face of the cabinet.

The lower edge of the base of the cabinet features a satin-look brushed aluminium escutcheon plate. The rear incorporates a pair of spring-loaded terminals in a recessed wall for entraining bared wires, together with a DIN speaker socket and two slide switches to provide a nominal 3 dB cut for both the mid-range and high frequency range. This facility is indicated by a simple frequency curve, which forms part of the labelling on the rear of the cabinet itself. Whilst the cabinet is braced by internal wooden battens, it does exhibit a higher degree of mechanical resonance when struck by the fist than I would normally expect from a well-designed enclosure. This phenomenon does of course show up well in the decay response spectra curve, and more will be said about it later.

On test

The objective testing of the enclosure provided a few surprises. The first relates to the frequency response measured at 2 m on axis, with the microphone positioned on the same level as the tweeter with the two switch controls set to normal. Under these conditions the interaction between the loading port and the bass driver provides some degree of interference, resulting in the output between 40 Hz and 150 Hz being typically 6 dB lower than that provided for the rest of the frequency response. Obviously by positioning the microphone in a different position this can be corrected for, but as this is our standard measurement position, we chose to stay with it in order to provide a consistent comparison.

Apart from the low frequency interaction phenomenon the frequency response can be described as being remarkably flat and in excellent agreement with the manufacturer's own curves (which are presented at 1 m reference).

At 30° off axis the frequency response is still good, extending to beyond 11 kHz, at which point the roll-off becomes sharp, as would normally be expected from this type of tweeter system. Activation of the mid and top-cut controls provides a small but sensible level change in the overall response, and unlike certain other American and European speakers in which such controls virtually wipe out either the mid-range or high frequency end of the spectrum, these controls again constitute a compromise between gross change in frequency response and what I believe is a more acceptable modest change.

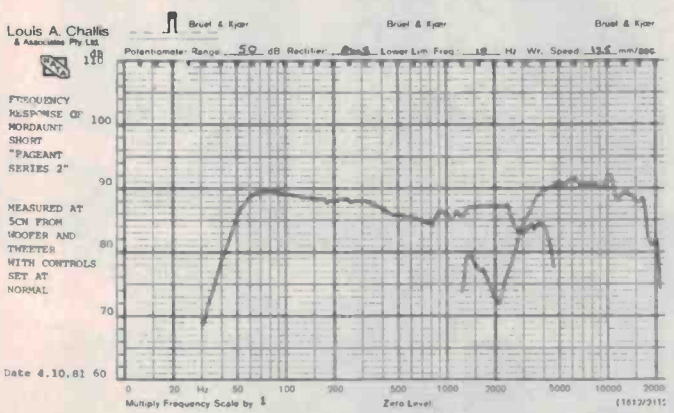
The frequency response measured at 5 cm from the woofer and tweeter respectively shows that the designers have achieved a fairly sensible and smooth response from each of the drivers which is, in general terms, better than that achieved by many more expensive speaker systems that we have recently tested.

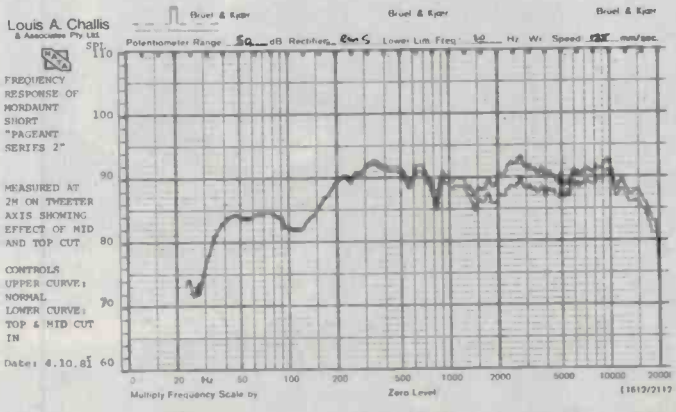
The impedance curve is also good, featuring a modest, low value impedance peak of only 20 ohms at 62 Hz and a lowest value of impedance of 7.2 ohms at 170 Hz. This impedance curve is smooth enough to allow this speaker to be paralleled with any other normal 8 ohm speaker system without any likelihood of serious matching problems. The impedance curve is smoother than in most of the units in the same price range.

The phase response is a little unusual in that it exhibits a full 360° change of phase at the 3 kHz crossover, thereafter being relatively smooth, with less than 150° change over the operating range of the tweeter.

The distortion characteristics of the speaker are not a strong point and only fair, while the output is kept to less than 87 dB at 2 m (which corresponds to 93 dB at 1 m). The testing we would normally have performed for 100 Hz of 90 dB at 2 m (96 dB at 1 m) could not be performed because of the very high level of distortion produced by the bass/mid-range unit. We were forced to reduce our drive level down to 87 dB for the 100 Hz frequency, only at which point was the distortion level 4.1%. Fortunately the distortion levels at the standard test frequencies of 1 kHz and 6.3 kHz were quite acceptable, and one could deduce from this that the bass/mid-range unit is a much better mid-range than a bass unit.

The tone burst testing revealed a significant degree of ringing both at 1 kHz and at 6.3 kHz, and this was con-▶





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All the excitement of your favourite movies will be at your fingertips. Star Video library features new releases like Cabaret, Straw Dogs, Bilitis, The Story of O.

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names.
Video cassette library.

like Alan Seale, Dr. Wright, Charmaine Solomon. To win the Star Video cassette library you have to fill in the gaps in the name of this magazine.

There's a total of $25,000 worth of prizes in the Name our Names contest. In Wheels and Two Wheels you could win a MiGi sports car valued at $7,200.

In Revs and Modern Motor you could win a Kawasaki K175 trail-bike, Eurovox car stereo, Bob Jane mag wheels and tyres, Astraview sunroof and a Perfect Tune car cylinder head conversion valued at over $2,000. In Modern Boating and Modern Fishing you could win a Haines Hunter runabout V133 outboard, 55 h.p. Tohatsu outboard motor and D.A.M. fishing tackle valued at $5,290. In Outdoors and Overlander you could win a Jayco Jayfinch camper trailer valued at $4,600.

In Australian Golf and Rugby League Week you could win Dunlop golf gear, a Sony video recorder and Star Video sports library valued at $3,400.

The name of this magazine is: E - I.

Read the conditions, fill in your entry form and mail it to Name our Names, Murray Publishers Pty. Ltd., 154 Clarence Street, Sydney. The first correct entry opened wins the Star Video cassette library.

Name _____

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Conditions of Entry: 1. Only entries received by the closing date will be accepted and proof of posting will not be considered as proof of entry. 2. The Judges' and company's decision is final and no correspondence will be entered into. 3. All entries remain the property of the Editor. 4. The winner will be notified by registered mail and the name published in the June issue of this magazine. 5. The prize is not redeemable in cash, nor transferable to a third party, except where the winner is under 16 years of age, when the prize in total shall be delivered to the care of a parent or guardian. 6. Each entry must be handwritten on an original coupon printed in this magazine except In those States where local laws prohibit this limitation in which case an original handwritten entry in the same format as the coupon on plain paper will be acceptable. 7. Employees, and their relatives of Murray Publishers Pty. Ltd., or their related companies or agencies are ineligible to enter. 8. Submission of an entry to this competition indicates acceptance of the above conditions, and no claim of a legal nature will be entertained as a result of such participation by any contestant. Closing date, April 30th, 1982. Permit No: TC81/1735.

WM&O/LP4

firmed by the decay response spectra. The initial decay was fairly smooth with the exception of primary resonances in the 3 kHz, 6 kHz and 12 kHz regions. Significant second-order ringing is observable at these frequencies and four other frequencies, three of which are above the normal audible range of detection.

The speaker exhibits fairly modest sensitivity, requiring something in the vicinity of 5.5 watts of energy to produce the standard signal level. Based on this input power and the manufacturer's stated rating, it seems advisable that amplifiers with power ratings of at least 15 watts should be used with the speakers and that a peak power limit not exceeding 100 watts should be specified without separate fusing in the speaker leads.

Subjectively

The subjective testing of this system was carried out by referencing it against two other well-known British speaker monitor systems, on a range of classical, rock, guitar, voice and orchestral music. The mid-range performance of the Pageant Series II system is excellent, and with it comes a naturalness of spoken and singing voice which belies the cost of the system itself. By contrast, on much of the violin music and particularly on timpany I found the treble just a little more coloured than I would like in a good speaker system, and this is in good agreement with the visual analysis of the decay response spectrum.

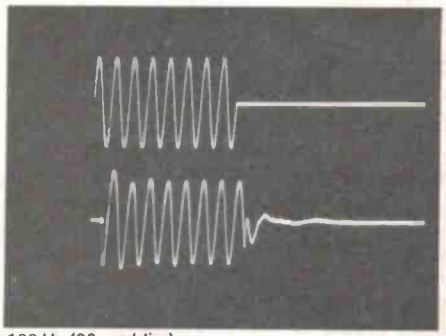
This deficiency was of course overshadowed by the bass response, which is generally good at power levels of less than 5 watts, but with powers of greater than 5 watts and frequency components of below 100 Hz gives rise to significant and very audible distortion. On heavy rock the bass speaker output breaks up completely and can produce distasteful sounds unless one is prepared to turn down the amplifier level to compensate. The speakers do not protect themselves from excessive drive, so using a very high-powered amplifier with this speaker is definitely not a good idea.

The Pageant Series II is designed to produce an excellent to above average reproduction of choral works, monitoring of light music and associated speech reproduction, good to excellent reproduction of classical music and fair to middling performance on rock music. If you are a high fidelity buff then the Mordaunt Short Pageant Series II is most probably just about your 'cup of tea'. If you are a hard rock fan or one of the younger generation who have a taste for what can only be described as 'heavy' music, then the Mordaunt Short Pageant Series II speakers are unlikely to meet your requirements. ●

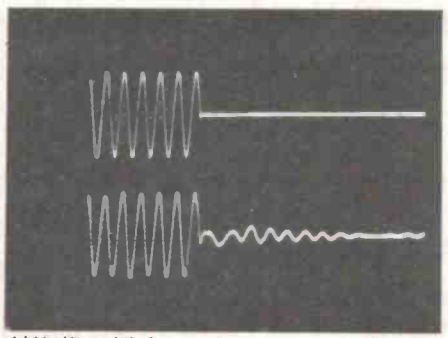
MORDAUNT-SHORT PAGEANT SERIES 2 LOUDSPEAKER SYSTEM

Dimensions:	*533 mm high, 333 mm wide, 230 mm deep.*
Weight:	*9.6 kg*
Price:	*$698*
Manufacturer:	*In the United Kingdom by Mordaunt Short Ltd, Hampshire*
Distributor:	*Concept Audio, 22 Wattle Rd, Brookvale NSW.*

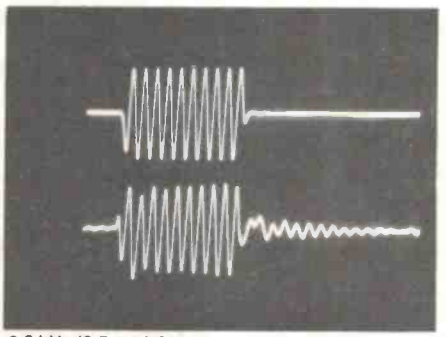
Tone burst response of Mordaunt-Short Pageant Series 2, serial no. 47612 (for 90 dB steady state SRL at 2 m on axis). Upper trace is electrical input; lower trace is loudspeaker output.



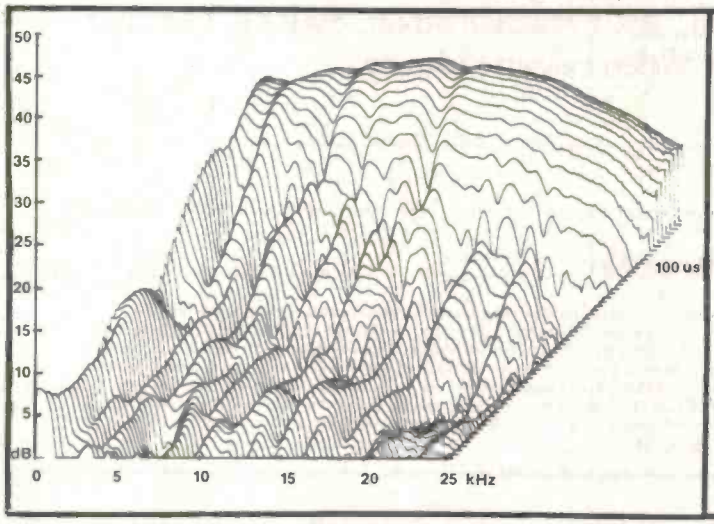
100 Hz (20 ms/div.)



1 kHz (2 ms/div.)



6.3 kHz (0.5 ms/div.)



MEASURED PERFORMANCE OF MORDAUNT - SHORT "PAGEANT SERIES 2" SERIAL NO. 47612

FREQUENCY RESPONSE: 40Hz - 18kHz

CROSSOVER FREQUENCIES: 3.5kHz

SENSITIVITY:

(for 90dB average at 2m) 9.4 VRMS = 11 Watts (nominal into 8)

HARMONIC DISTORTION: (for quoted sound pressure level @ 2m)

	(87dB)	(90dB)	(90dB)
	100Hz	1kHz	6.3kHz
2nd	-28.8	-42.2	-52.2
3rd	-34.2	-42.5	-61.2
4th	-53.3	-53.2	-
5th	-47.2	-61.8	-
T.H.D.	4.1%	1.1%	0.26%

INPUT IMPEDANCE:

100Hz	8 Ω	
1kHz	13.6 Ω	
6.3kHz	12.0 Ω	
Minimum at	170Hz	7.2 Ω

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Mail enquiries: There is no charge for replies, but a foolscap-sized, stamped, addressed envelope must be enclosed. Queries relating to projects can only be answered if related to the item as published. We cannot advise on modifications to projects, other than errata or addenda, nor if a project has been modified or if components are other than specified. We try to answer letters as soon as possible. Difficult questions may take time to answer.

Phone enquiries: We can only answer readers' technical enquiries by telephone after 4.30 pm. In enquiring by telephone about back issues or photostats, please ask for the Subscriptions Department.

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THE RECORDING SOCIETY of Australia, established 1964, invites you to join monthly demonstrations, lectures, live recordings etc. For information and syllabus write to Don Patrick, 36 Argyle St, Macleod Vic 3085. Phone (03)459-1717.

KEYBOARD CASE ONLY ex Hammond organ model X2 (new), black vinyl and chrome folding stand. Internal dimensions (case) 31" x 16" x 7". $120. (03)25-2119.

HI-FI MAGAZINES: (120), last 2 years' 'Audio', 'Stereo Review', 'High Fidelity', 'Practical Hi-Fi', 'Hi-Fi for Pleasure', etc. $45 or offer. (02)620-1203.

THE TAPE CLUB of AUSTRALIA welcomes new members. Enter a whole new world through your tape/cassette recorder. Full details: SAE to 7 Coleman Ave, Homebush, NSW 2140 or PO Box 118, Wellington, NSW 2820.

PAIR HEATHKIT 'Cotswold' speakers, spare bass driver, $100. Playmaster valve tape adaptor, needs repair, Truvox deck, boxed, $100. Proceeds R.P.A. Hospital. Dorsch (02)89-1638, Woolwich.

FOR SALE: ETI 740 FM tuner + AM tuner built in. Works beautifully, $90. Ring S. Sidoti (02)660-5120 after 5.30 pm.

DID YOU GET a cassette recorder for Christmas? Then why not join a tape club? Full details from the Tape Club of Australia, 7 Coleman Ave, Homebush NSW 2140. Phone (02) 76-5330 after 6 pm.

DO YOU OWN a cassette recorder? Why not join a tape club? Full details from Boomerang Tape Recording, P.O. Box 118, Wellington, NSW 2820. Phone 738 after 6 pm.

COMMUNICATIONS

WANTED: 'Command' or BC342 wartime receiver parts for student projects. Contact Rob Gurr VK5RG, Box 35, Daw Park SA 5041, or (08)276-4547.

VLF RECEIVER, fully portable. Covers audio frequencies, receives natural ionospheric sounds (whistlers, spherics), navigation beacons (OMEGA), etc. G. Neumann, Phys-chem. Dept., UNSW, Kensington 2033.

CB COURIER Spartan 18 chan AM/SSB with aerial, pwr supply, 15 m co-ax SWR meter and more, $220. (02)427-6225.

NOVICES UPGRADE: Novice amateur radio group is conducting AOCP course by Ron Bircham, VK2DQ. Starting 3rd Sat Jan at WIC, St Leonards NSW. Ph John: (02)86-3364.

AUSTRALIAN RADIO DX CLUB: For shortwave, mediumwave, utility and amateur listeners. Big monthly bulletin sent to all members. Details from Box 260, Carnegie Vic 3163 for a stamp.

MISCELLANEOUS

SELL: Weller temp. controlled soldering iron with transformers, 60 W, all working, $30. 160 20k trimpots, $10. 15 2500 uF 35 V caps, $10. Ring (03)318-1271.

TEXAS-55 CALCULATOR with manuals, original condition, suitable tech. student, now surplus to requirements. A steal at $35. (02)665-5794.

WANTED: August 1977 Electronics Today magazine. Reasonable condition. Also January 1979 Electronics Australia mag. Contact Chris Nixon, 7 Soames Pl, Bentley WA 6102.

FOR SALE: Sound effects, amplifiers, power supplies, test gear, 2-core cable, music colour, light chaser, auto transformer, Cannon connectors. Ronell, (02)331-3547.

WANTED: Kriesler/Phillips ultrasonic transmitters, also Kriesler television set with 59/3 chassis, both working or not. Swap 59/1 deflection board for 59/3. (02)645-3737 after 5 pm.

COMPUTERS

Z80 STARTER KIT, hex keypad, EPROM programmer, 2K RAM, 2K monitor, S100 expansion, cassette interface, hex address and data display, Z80 CTC and PIO, $250. (03)386-6156.

FOR SALE: ASR-33 printer, 110 baud, with interface to run off cassette port on TRS80/System 80. $350 including spares and manuals. (02)981-4762.

WANTED: SWTP MPA or MPA-2 6800 CPU. Bare board or assembled. Contact R. Steedman, (05)156-8291, or write to P.O. Box 98, Bairnsdale Vic. 3875.

FORTH Interest Group meets first Friday each month. Contact FIG P.O. Box 103, Camberwell Vic. 3124. (03)29-2600.

SELL EA VDU, includes 124 VA transformer, cassette interface and professional-style keyboard. Working order, suit Miniscamp, etc. $140. (050)27-4701 (ah).

OHIO SUPERBOARD II, 8K RAM plus high quality video unit with inbuilt power-supply, BWD 421 CRO dual trace, going cheap. Phone Ronn, (02)587-6168.

HALL-EFFECT KEYBOARD, unused, fully ASCII encoded, all keys for word processing, $130. In shop $200 plus. 230 Wheeler Cres, Wanniassa ACT. 31-5829.

APPLE II compatible 48K computer system with disk drive, CTV/monitor, game paddles and DOS 3.3. $2450 ono. (02)724-4548 after 7pm.

SELL: ZX-80, 1K, old ROM, ps, games and companion bks, display hold prog., 9 newsletters, cost $360, sell $225. Geoff Black, 27 Killarney Cres, Capalaba Qld 4157.

OSI SUPERBOARD II complete with 8K RAM, power supply and manuals, ready to operate, $290. Contact Dane Howe, (03)350-1646 (ah).

TELETYPE ASR33, excellent condition, tape reader and punch, 20 mA interface, maintenance manuals, $300. Phone (03)29-2600.

MICROLINE 80: Brand new, in carton, $650. Paul Wilson, (03)758-1554.

FOR SALE: 16K S-100 4 MHZ static RAM. California Computer Systems model 2016 with Bank Select Manual, etc. New and experienced guaranteed OK. Retail $330, sell $165. Phone (069)53-2848. John Watson. P.O. Box 108, Leeton NSW 2705.

TRS-80, MOD 1, LEV II with LNW exp. I/F, 2 disk drives, Axiom 801 printer, large amount software, manuals, spare drive. Details Len Scotney (02)726-2163. $2500.

Z80 STARTER KIT USERS: New 2K monitor in EPROM includes arithmetic routines, CTC controller, random number generator, reads/writes data 25 times faster. Write for details: U. Knop, 13 Want St, Parkes NSW 2870. (068)62-3359 (ah).

EPROM PROGRAMMING 2716, 2708, 2516 5 V EPROMS. From KC cassette $5, from listing $15 for 2K bytes. Chip not included, cassettes returned. U. Knop, 13 Want St, Parkes NSW 2870. (068)62-3359 (ah).

SELL: S100-Z80 CPU card, DG640 VDU, 16K RAM, power supply and motherboard, all operating. Phone George Poropat, Mulgrave Vic. (03)560-4078.

HEATH/ZENITH H8 computer with H17 disk drives, CPM/HDOS operating systems, BASIC, etc. Serial printer port for word processing. $1500 (03)233-6739 (ah).

16K SYSTEM 80 MKII computer. Video monitor, over $190 in programs including EDTASM plus, covers, excellent condition, $800. Freight free. Ph: Clive (042)96-3381.

WANTED: Info on CDC's 9433 disk drives, or near type. From CDC 516, Honeywell 110 computers. Will pay. Martin, 8 Walker Pl. Church Pt NSW 2105. (02)99-2917.

SELL: Power supply, 240 Vac-12 V 2 amp, 5 V 1 amp. dc on aluminium chassis, $34. Mark Sully, 61 Newman St, Niddrie Vic. 3042. (03)379-2879.

FOR SALE: Memorex 1280 computer terminal-printer-digital cassette, RS232 compatible. $390. Anthony (02)674-2707.

SELL: SHARP PC1211 pocket computer with cassette interface. Identical to Tandy pocket TRS-80. As new, $180. Colin, Ursula College, ANU, Canberra 2600. (062)49-2460 during working hrs.

BIGBOARD CP/M system, Z-80, 64 KB, fully optioned Ferguson board, Shugart 800 drive, software, professional 3-drive cabinet & P/S, keyboard & monitor, documentation, $2450 or offers. (02)449-5885 ah.

WANTED: Back issues 1-12 (Jan-Dec 1980) of 80-Microcomputing magazine. Tom Milenkovic, Sydney (02)217-2303.

8" SHUGART 800 disk drives (2), $390 ea. Teletype model 40 keyboard display terminal, $760. Diablo daisywheel serial printer, $1900. All excellent condition with documentation. (02) 449-5885 (ah).

APPLE II PLUS, 48K disk, VDU, software, $2100 ono. Brian Walsh, Tocal College, Paterson 2421. Phone (ah) (049)30-1148.

MICROTEK MT32.6, $150.00. Upgrade from 16K to 48K. Memory chips included ready to run, just connect to your TRS-80 16K. The parallel printer port enables you to run most printers. A. Tito, 207 Lauren Street, Urangan Qld. 4658. (071)28-9527.

TANDY QUICK PRINTER II. 120 LPM upper/lower case on 2 3/8" aluminised paper, as new, and four rolls of paper included. Interface to suit System-80 included. $200 the lot. A. Tito, 207 Lauren Street, Urangan Qld. 4658. (071) 28-9527.

FOR SALE: CHIPOS microcomputer, as in EA June, July '79. Uses 6802, slight modifications, $100. Ring S. Sidoti (02)660-5120 after 5.30 pm.

SELL: 32K Sorcerer computer, Base-2 printer, National Monitor/TV, Development Pac, extensive software and documentation. As new. Retail $2500+, sell $1950. B. Blair, 3 Lee St, Noble Park Vic.

APPLE TWO PLUS, 48K RAM, disk drive, colour monitor and software, $2600 ono. (03)873-3820, after 7 pm, ask for Terry. 29 Blanche Drive, Vermont Melb.

16K SUPER 80: $400 ono, complete with attractive case, all manuals, BASIC tape. Cheaper than parts cost. Phone Michael Wise, bh (02)662-3789, ah (02)51-2335.

32K SORCERER, new condition, including serial data cable, books, $1050. Sorcerer development pac, books, $95. G. Dawson, Braleys Lane, Glen Innes NSW. (067)32-2082.

FOR SALE: TRS-80 LIE graphics package, Gunslinger Battlezone twice, Rantan, plus try winning using Lotto Analysis, $6 per cassette. Geoff Egel, 18 Sturt St, Loxton 5333.

'12 IN 1' CIP-Debug 3 utility. 'Clear' screen, Step-Trace, auto in. no., call Jn, view, bell supp. etc. All-key control. Interface any monitor. 8K, 16K. $15. Jankowski, Otalo RD1 Timaru, N.Z.

SYSTEM 80 OWNER would like to exchange programs. Please send list of programs to Mark Fairbairn, 8 Shelley St, Spring Gully, Bendigo Vic. 3550. (42-4450).

WANTED: Compucolor II with or without additional disk drive. Phone W. Woods, (02) 230-5279 (bus), (02)84-6764 (ah).

TO SWAP: System 80/TRS-80 programs. Send SAE for list of software to D. Brighton, Franklin Rd, Huonville, Tasmania 7109.

SELL: DREAM 6800 with PSU, plenty documentation, sockets throughout, software cassettes, no bugs, $160. Contact Gerald, 34 Margot St, Chadstone 3148. (03)277-4870 ah.

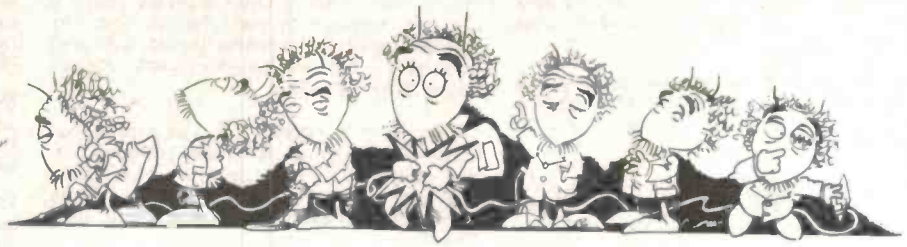
THE INAUGURAL MEETING of the Brisbane Super 80 users' group will be held on Wednesday 10th February 1982 at 7 pm in room 21, first floor, Trades Hall, Wickham Terrace, City — ALL WELCOME.

SN74259N 8-BIT addressable latch, qty 750, at $8 per 10. F9334 8-bit addressable latch, qty 1925, at $8 per 10, plus P+P. Phone (03) 570-6620. (John).

SALE: 160 new 3M 50-way straight wire wrap headers, type 3433-4005. Only $10 each. E. Crockett, 32 Anne Ave, Seven Hills NSW. (02)622-9614.

FOR SALE: TI-59 programmable calculator, printer, extra software. Retail $750, asking $450. Ultra-powerful number cruncher. Phone Michael Glasson, (089)89-9211.

DREGS



AN ASSOCIATE of ours purchased a semi-detached house in a trendy inner-city suburb some years ago. In the course of renovations, he struck up relations with his semi-detached neighbour. Naturally enough, the neighbour had a hi-fi system — of sorts — and was introduced to the delights of ETI readership. On occasion, the semi-detached neighbour was wont to turn up the 'wick' on his sound system. This occasioned some discomfort in our associate's house, until he hit upon a remedy. Figuring that the sound system next door was of some vintage, and probably unprotected against the ravages of electromagnetic interference, our associate tried an experiment. When the sound system next door began to sound like it was no longer next door, he retreated to his ham shack and fired up on 14 MHz. At full power. All 400 watts of it.

The ham antenna, being but a scant few metres from the semi-detached sound system, had little difficulty in overloading the sound system with RF energy. The sound system protested — delivering plenty of the protest via the loudspeakers, and the occasional smoke signals. The semi-detached neighbour, not being familiar with such things, assumed his sound system had developed a fault and promptly turned it off. Naturally, he looked to his electronically-inclined neighbour for assistance. Our associate obliged and requested a demonstration of the fault. But . . . miraculously, it had disappeared! Hmm, perhaps it might be best if you keep the volume down, our associate advised.

The semi-detached neighbour heeded the advice . . . for a while. When next the semi-detached sound system reached an unbearable crescendo our associate decided it was time for a lengthy 'CQ DX' call on the ham rig. The semi-detached sound system mysteriously quieted.

The 'arrangement' worked well — until the semi-detached neighbour decided an upgrade was in order and built a pair of Series 4000 loudspeakers. When the Series 5000 equipment appeared in ETI last year, he decided a complete upgrade was called for. Semi-detached neighbour was proud of his achievement . . . and the volume the system would deliver.

This is where the 'arrangement' broke down. Our associate is now muttering dark things about David Tilbrook's Series 5000 design — it's immune to any sort of brutal RF overload he can devise!

Does anyone have deaf parents interested in inner-city living, close to all amenities, in a trendy, renovated house, nothing to spend?

Enter the state of higher fidelity with the new Walkman 2 stereo player, the world's smallest Hi-Fi. It's a sensational way to listen to music on cassettes and raise your awareness of sound. Walkman is so light it practically feels weightless. So small it's hardly bigger than the plastic case that cassettes come in. And so personal, with headphones that weigh next to nothing, that HiFi has never been more intimate.
The new Sony Walkman. It can make your experience of sound infinitely wondrous.

The World's Smallest HiFi
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