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electronics today

DECEMBER 1978 INTERNATIONAL

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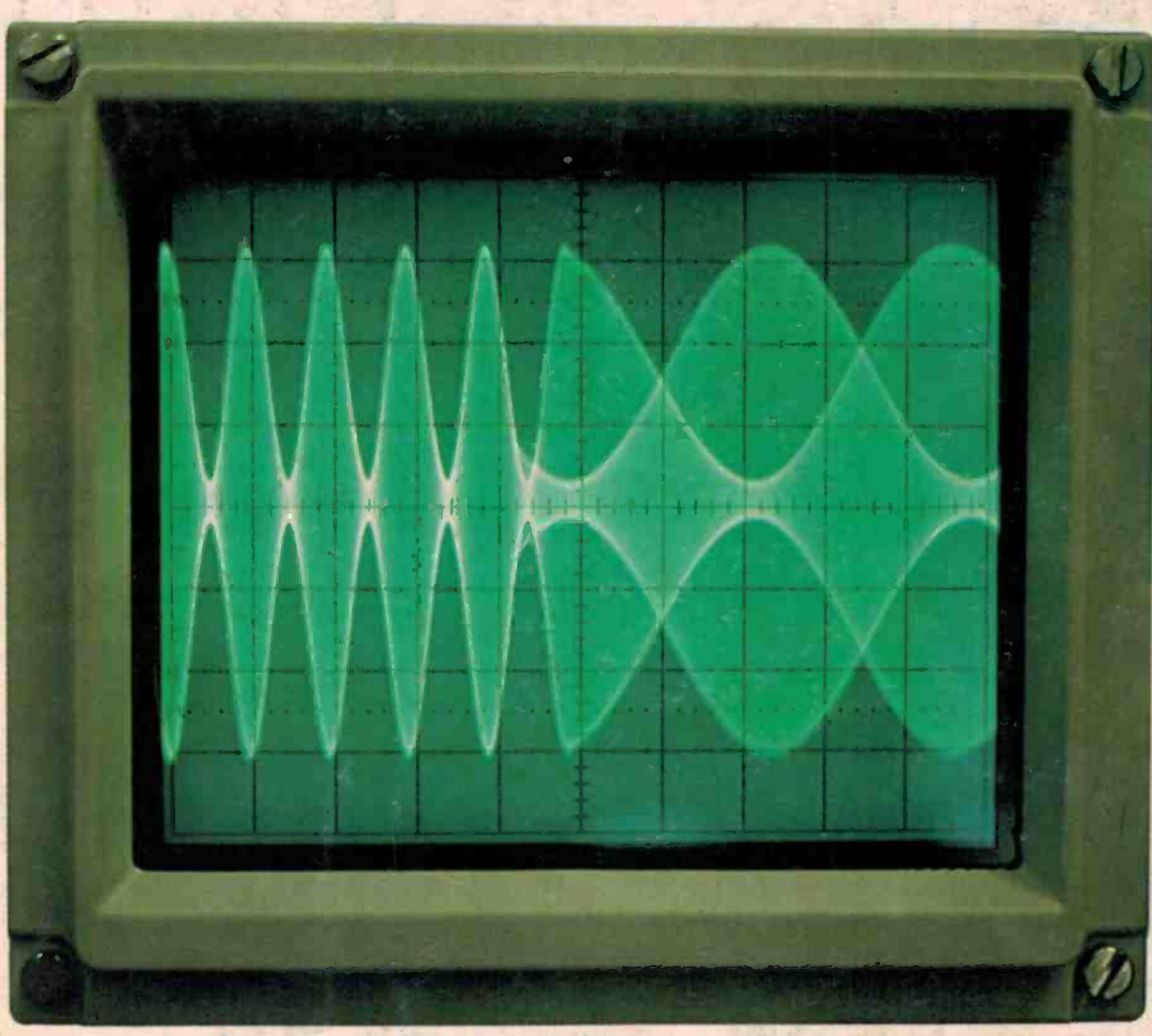

Designing Oscillators

Speech Compressor

Wheel of Fortune

NEWS, REVIEWS, HI~FI, COMPUTERS, SHORT WAVE RADIO...

AUSTRALIAN OWNED AND PRODUCED

December 1978, Vol. 8. No. 12

electronics today INTERNATIONAL

Editorial: Les Bell

Managing Editor: Collyn Rivers

PROJECTS

FEATURES

NEWS & INFORMATION

Cover: This month we're running an article on designing oscillators, but if you can design an oscillator to produce this kind of waveform, we'd like to know about it! If you're curious, we used a Tektronix 475A oscilloscope and a lot of ingenuity to get that waveform!

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News Digest

The Inmos Saga

By now, many of our readers will have learnt of the formation of UK Government-sponsored Inmos, a British company which will attempt to catch up on US technology by producing a 64K dynamic RAM. In order to perform this feat, the management of the infant Inmos went head hunting in the Santa Clara Valley (Silicon Valley) for engineers who were already experienced in memory design, NMOS technology, etc. Having this kind of expertise is obviously crucial to the success of the venture. Several of the engineers they employed came from Mostek, who, understandably, felt that they were having their brains picked, and attempted to get an injunction against Inmos for misappropriation of trade secrets, in an effort to stop the raids for staff. However the charges were dismissed and Inmos seemed set to go.

The latest news, though, is that the three ex-Mostek engineers who were at the centre of the controversy have now left Inmos to set up their own design company, which will do work on a contractual basis for Mostek exclusively. Ward Parkinson, one of the founders of Micron Technology, claimed that he simply saw a better opportunity in working for himself. Although we hesitate to read between the lines, there is room for a lot of speculation in this story . . .

Datalogger 2000

United Systems Corporation, Dayton, Ohio, introduces their Datalogger 2000, a data information center that performs microprocessor-based functions such as signal processing, formatting, alarm assignment and interfacing.

The Digitec Datalogger 2000 measures up to four mixed parameters selected from temperature (Thermocouple, Thermistor, RTD), DC voltage, DC autoranging, AC voltage, True RMS and transmitter output. With up to 20 channels internal (expandable to 1000) and ± 25,000 count display of measured data, the Datalogger 2000 offers skip-channel capability and provides up to 1200 individually assignable alarms. It displays and records accurate time and date with a crystal controlled clock. Also displayed and recorded are channel number, measured data and parameter symbol with the printout of English messages that identify alarm status without look up tables. The 2000 offers data outputs that include isolated BCD, isolated RS-232-C or TTY compatible with selectable baud rates from 110 to 9600.

The Digitec Datalogger 2000 measures 430mm x 222mm x 355mm and weighs 9kg. A brochure is available with complete specifications from *NIC Instrument Company, Matthews Avenue, Airport West, Vic 3042.*

Earthquake Protection

How do you protect a nuclear reactor from an earthquake? The answer suggested by the UK's Malaysian Rubber Producers' Research Association is to mount it on giant rubber springs. In tests to be conducted jointly with the University of California at Berkeley, models of power stations will be constructed in the New Mexico desert and subjected to tremors from underground explosions. Instruments will record the performance of the rubber springs, which, if successful, will be installed in future reactor designs.

Student Scope Project

Students of the Electronics Department at Box Hill Technical College have combined talents to produce oscilloscopes for basic test equipment for students' personal use. Senior students are offered experience in the construction of complex equipment, design exercises, components research, board layouts, prototype testing and documentation under the guidance of staff.

The Department has quite a few student projects on the go; but the oscilloscope project has been the most adventurous and challenging due to the complexity of the oscilloscope as a piece of test equipment according to Jim Tregellas, teacher in charge of the project. Already a Power Supply project has been devised while a signal generator and an electronic voltmeter are other basic test equipment projects in the pipeline.

The technical specifications of the oscilloscope include:

Band width	– DC to 5 MHz
Sensitivity	– 10 mv/div.
Timebase	– AC, DC, Auto and Line Triggering to 0.3 micro seconds per division
Probe	– compensated (adjustable)

Cost of materials to students – approximately $130 tax paid.

The oscilloscope and other test equipment programs are produced by staff and students involved in the College's Certificate of Tehcnology (Electronics) course which is a post Year II, two year course plus 2 years of work experience. The 20 staff in the College's Electronics Department have had considerable industrial experience.

The photograph shows staff member Jim Tregellas (centre) discussing the oscilloscope with Steve Edmonds (left) and Phillip Dew (right) graduate Certificate of Technology students of the College.

Portable TV/Radio

National Panasonic has just released the Model TR-5010A portable black and white TV receiver with 13cm screen and built-in AM/FM radio. This model, which sells at a recommended retail price of $215 can be operated from domestic AC mains, car or boat battery or its own internal batteries.

The unit is ruggedly constructed for the outdoor/portable life expected of such a versatile unit, and is available from selected electrical retailers, department stores and discount houses throughout Australia.

TI Embarassed

Rumours have been rife for an awful long time now about TI's personal computer, which will no doubt be the greatest thing since sliced bread, etc, etc, when it appears. The reason it hasn't is that TI are still suffering considerable embarassment following the unrelease of their processor-controlled CB, about which the technical press (that's us) went berserk. TI don't want the same thing to happen with their personal computer. However, here are the latest rumours, hot from the mill:

Since the project got under way, there have been no less than four major hardware design changes to provide performance improvements. The software specs were changed twice, giving Microsoft, who are developing the software under contract, a bit of a hard time. In fact they had to have their contract extended, and only delivered the final software in July.

Incidentally, TI are avoiding the phrase 'personal computer', preferring to use terms like 'home information system'. The magic box, when it appears, will work with a domestic TV set. Whether this will mean a delay while the system is redesigned or modified for the Australian market is not yet clear.

16K Static RAMs

Hot on the heels of Texas Instruments' announcement of a 16K static RAM design comes a similar product from Matsushita. The Japanese chip uses a double-layer cell structure and packs 101,000 transistor elements on a 15.7 mm^2 substrate. Access time is 110 ns and power consumption is 145 mA when running and 30 mA on standby. The package is a 24 pin type, and probably (though we don't know for certain) follows TI's lead in being pin compatible with the 2716/2516, with a 2K x 8 organization.

Advanced Submarine Communications

The latest technique to be investigated by the US Navy for communication with submarines is to use a high energy proton accelerator and aluminium bar system to produce a narrow beam of neutrinos which could be aimed through the earth at detectors on the other side of the world. The neutrinos would follow a straight path through the earth at the speed of light and radiation from the collision of neutrinos and water can be detected by submerged submarines. The system is expected to be jam-proof.

New Image for Dick Woods

Dick Woods Electronics is expanding its horizons. Now owned and operated by Dwell Pty. Ltd., the company is seeking (and achieving) a new image. The range of products handled has been expanded to include video cassette recorders, micro TV units, 'Snoopers' and an extensive range of car stereo systems, plus a range of components from TTL chips to nuts and bolts, many of which are directly imported.

Dwell has been appointed North Shore distributor for Plessey and have stocked a broad range of Foster speakers and speaker systems, in both complete and kit form.

Microcomputers will form a major part of the company operation. Systems handled at present include 'Synertek's VIM-1'; E&L MMD-1 8080 Mini-Micro Designer; 'Rockwell' AIM-65; a 6502 Micro System which includes a full ASC11 keyboard, a 20 digit alphanumeric display and a 20 column printer; and Micropolis 5¼ floppy disc systems, which store from 143,000 to 946,000 bytes (formatted) per drive.

Available shortly will be the Exidy 'Sorcerer' personal computer which is one of the most cost effective systems on the market. As standard it is fitted with a Z80 CPU, 20K bytes of memory, 1920 character display, graphics with a resolution of 122,880, a typewriter keyboard with a numeric cluster and full S100 capability.

Further details are available from: *Dick Woods Electronics, 77 Edgeworth David Avenue, Hornsby NSW 2077* Phone 4873111.

Chequebook Calculator

National Semiconductor Corporation has announced the Data Checker, a new thinline "cheque-book" calculator with three continuous memories. This unique memory feature allows a user to maintain and update both chequebook balance and balances for any two selected charge accounts. The three memories are simple to use, and do not interfere with usage of the calculator.

Balances are maintained even when the unit's power is off, and automatically updated as each new transaction is made. Balance figures, as well as calculator read-outs, are displayed on large Liquid Crystal Display (LCD), with 6mm digits.

Suggested retail prices for the Data Checker is $39.95 with Chequebook case and pen included.

News Digest

Microwave Exposure Levels

Research at the Institute of Occupational Medicine at Lodz in Poland is claimed to show that successive exposure to microwave radiation can have a cumulative effect, that excessive exposure can cause cataracts, and that the US Standard of 10 mW/cm^2 is too high. Researcher H. Mikolajczyk has found that RF fields below that level can alter the function of the pituitary gland in rats. Poland has introduced a system of RF standards to cover the frequency ranges 100 kHz to 300 MHz and 300 MHz to 300 GHz. In the higher range, 0.01 mW/cm^2 is reckoned to be 'safe' for the general population, while an 'intermediate' classification of 0.2 mW/cm^2 applies to electronics workers who may be exposed all day. 10 mW/cm^2 is the 'danger' limit at which 'exposure is not permissible except in urgent situations'.

Sanyo VCR

Sanyo Australia enters the colour video cassette recorder market early in December with their "Betacord" model. Developed after 10 years' design and production of VCR units, Sanyo were the first company to produce a truly portable video recorder.

The Sanyo VCR, using the Betacord system, is specifically applicable to Australian conditions. It utilises the U-shape loading system, the most widely used system in use in the world to-day. Among its special features are an "every-day" switch allowing you to go on holidays and record, for example, a half hour favourite programme for up to six consecutive days. Another important innovation is the remote pause switch which allows in-use editing while the programme is actually being recorded. With the Sanyo VCR, the remote pause unit is included as standard equipment and is not an optional extra.

The Sanyo VCR has a 12/12 warranty, comes complete with dust cover and a complimentary two-hour blank cassette. Sanyo will instal each unit at no cost to the consumer.

Fairchild Sues Data General

Remember Data General filed a suit against Fairchild over the Fairchild 9440 microprocessor, which executes the instruction set of the Data General Nova minicomputer? Well, just to even the score a bit, Fairchild have filed a $30 million dollar antitrust suit against Data General, charging unlawful marketing practices in the licensing of software for the Nova. Fairchild allege that this is designed to block competition with the 9440. Data General tie marketing of their software with that of the hardware, refusing to license their software to non-users of the Nova 1200 computer.

The Fairchild suit is backed up by similar charges filed by several other small computer companies, who manufacture computers which are software compatible with the Nova. Their case rests on whether it is reasonable for Data General to claim as 'trade secrets' the Nova instruction set, which they have published in manuals and books. The results of these cases could have very important consequences for the computer industry.

TI Calculator

A new calculator which has been released by TI in the UK stores the last 20 entries the operator makes. The TI-2550-IV is a four-function-with-percentage hand-held with memory which is designed to replace printing calculators by letting the operator review calculations and 'edit' them if necessary. The replay facility is activated by one key, and there is also a 'back-step' key. Corrections can be made at any point by keying in the correct entry and hitting the equals key.

Fibre Optic Kit

A new, complete fiber optic link for data communications applications that requires no expertise in optical design, calibration or adjustment, has been introduced by Hewlett-Packard.

The new HFBR-0010 low error rate fiber optic link system makes the use of fiber optics simple and practical for a broad range of customers. It comes ready to hook up, and consists of a digital transmitter, a digital receiver, a single fiber 10 meter connector/cable assembly and complete technical literature. Each of the components is available separately, and the connector/cable assemblies come in five standard lengths, with a maximum distance of 100 meters.

Typical applications of the new link include: Large computer installations; distributed processing systems; hospital computer systems; power plant communications and control; process control; voltage or electromagnetic field research; remote instrumentation systems; and factory data collection.

The new systems are point-to-point links intended for logic-to-logic communications over short to intermediate distances in industrial or laboratory environments. Processor-to-processor or processor-to-peripheral interconnections are prime applications.

"Applying a system design approach, we were able to remove the complexities, to enable OEM systems designers or end users with data communications problems to begin using fiber optics links without having to become expert in the various disciplines involved," said Peter Manno, product marketing manager for HP's Optoelectronics Division.

For further information, contact HP's representatives, Amtron Tyree.

Programmable Power Opamp

A programmable power operational amplifier with a unique electronic shut down capability that allows it to "float" in the "off" mode, passing only microamperes of current, has been developed by National Semiconductor. Designated the LM13080, the 50 by 50 mil bipolar device is internally compensated and can be programmed to allow the user to optimize the amplifier performance for his individual application.

The LM13080 has been designed primarily for those applications that require load currents from the output of 50 to 250 mA, either sink or source. Applications include audio amplifiers, power comparators, DC-DC converters and servo drivers for motor speed control.

According to Chris Mason, Applications Engineer, the user establishes the bias for the amplifier's input stage by means of an external resistor and as a result can control a number of the device's performance characteristics, including: input bias current, input offset voltage, and frequency response. Using resistors ranging in values from 100K ohms to 3M ohms, the input voltage varies up to 15 mV and the input bias current goes from less than 50 nanoamperes to 2 microamperes. With a 680k ohm resistor, for example, the amplifier is unity gain stable while the offset voltage is approximately 3 millovolts. If a tight offset voltage is needed, a 100k ohm resistor would allow an offset voltage of less than 1 millivolt, with minimum closed loop gain of 6.

Unlike similar devices on the market, the LM3080 has an electronic shutdown without the need to carry load currents in the control device. The device is unique, said Mason, in that the bias circuit for both input and output stages can be bypassed so that the entire circuit is turned off. This allows both stages to "float" while drawing only a few microamperes of quiescent current devices. By means of a saturated NPN switching transistor, the input programming (set) resistor and the output stage control pin are connected to ground for normal operation. In the "off" mode, the switching transistor is turned off and both the output and input stages are allowed to "float". This feature according to Peter Moon of NS Electronics, makes the LM13080 very useful in portable battery-powered applications. Because the average quiescent current in battery-powered systems may be 100 to 1000 times lower than that of other systems, using the LM13080 would result in less drain on the battery. Moreover, because it would not need to handle lead currents, the external switching device could be smaller and less expensive.

The LM13080 is designed to operate from both single and dual power supplies, and will operate from as little as 3 volts (DC). Available now, the LM13080 is priced at $0.72 each in 100-up quantities.

The new Grundig "Picture in Picture" 26" colour T.V. enables the viewer to watch two programmes at the same time — the normal programme plus a superimposed programme on the same screen. The main colour picture can be selected and, if required, an alternative programme which is visible on the same screen approximately the size of a postcard, in black and white. The alternative programme always appears in the same spot, in the middle of the bottom of the screen.

FAST Logic

Soon to be released is a new logic family called FAST – Fairchild Advanced Schottky TTL with low power consumption and propagation delays around 3 ns. 66 circuits will be available by the end of the year, at 'competitive' prices.

Gadget of the Month

Following hot on the heels of electronic popcorn and yoghurt, the latest gadget to be electronified is the cigarette lighter. A new design of solar-powered gas lighter has been announced by Yoshinaga Price Co. of Tokyo. It can run for six months, 40 lights per day, without requiring recharging. 5 min of bright sunlight will recharge this little marvel.

900 MHz CB for US?

The FCC Safety and Special Radio Service Bureau has ordered the drafting of a notice of inquiry for public comment on whether CB radios should be allocated a section of the spectrum around 900 MHz. The Commission reckons that expansion of the CB allocation is necessary, partly to stimulate the depressed CB industry.

Scribofoon?

The Scribofoon is a development of Philips Telecommunicatie Nederland which can transmit diagrams and written text over telephone lines. At the transmitter, a plastic pad, with X axis wires on the top side and Y axis wires below which are pulsed sequentially, is used to encode the position of a pen. A sequence of pen positions is transmitted over the phone lines to the receiver, for display on a screen. The system requires no modification to the telephones at each end, and will cost about the same as an ordinary colour TV.

Appliance Timer

General Instruments have announced the release of an appliance timer IC similar in concept to the STAC timer featured in last month's issue. Intended for use in cookers and similar appliances to replace the old stay clocks, the AY-3-1251 has keyboard entry, direct digit drive and four outputs. Further information from GI distributors.

INTRODUCING THE AR9. FOUR-ON-THE-FLOOR PLUS "ELECTRO-AUTOMATIC TRANSMISSION."

Bookshelf and mid-size speakers have been AR's act for 25 years.

Nobody builds them better, tests them more thoroughly or backs them with a stronger warranty.

But the flagship of most speaker lines is a big, floor-standing job. A heavy hitter that will blow your socks off. And our flagship has just come in.

The AR9 is a four-way, floor-standing speaker, 52¾ inches tall, with 5 drivers and the ability to handle amplifiers capable of delivering up to 400 watts *(gasp!)* continuous power per channel. (With amplifier being driven to clipping 10% of the time on normal music source material.)

The price: approximately $1250 a copy.

But the AR9 is a lot more than big and expensive.

The thing sounds simply fantastic.

Flat as a pancake all across the sound spectrum and virtually unaffected by room placement.

Each speaker contains two 12-pound, 12" diameter woofers. The two of them are linked by a kind of electronic automatic transmission." Deep in the low end where volume falls off as frequency goes down, the "automatic transmission" cranks up the woofers to maintain volume without the usual break-up and distortion.

Crossover points have been rearranged so that the 8" low mid-range driver handles the critical range of human voice . . . a design refinement that contributes to the startling clarity of the AR9 sound.

There is a new semi-horn on one high-frequency driver.

Improved liquid cooling.

A tweeter voice coil made with new high-temperature materials.

Refinements of proved AR engineering concepts abound throughout the system.

And the results are absolutely startling.

Our ears tell us, and our test instruments confirm, that the new AR9 is nothing less than the most perfect speaker system possible today.

To get a more complete write-up, contact your AR Dealer or us.

But better yet, listen to the AR9.

Then tell us it's not the fantastic speaker system you've ever heard.

ANOTHER TRIUMPH FOR TRUTH IN LISTENING.

Acoustic Research Australia
P.O. Box 21 — 7 Ford St.,
Greenacre. NSW. 2190
Phone: 642-3458

Portable TV Combo

National Panasonic has just released a versatile new portable unit which offers 3 programme sources as well as three separate power sources at very reasonable cost. The unit, designated Model TR-5000A is a combination black and white television, AM/FM radio and cassette recorder which can be operated from a domestic power unit, car or boat battery or its own internal batteries, which makes it ideal for outdoor living in car, camp, caravan or boat.

Television reception is excellent, even in bright outdoor locations on the 13 cm diagonal monochrome picture tube, and the powerful AM/FM radio receiver and cassette recorder give a wide choice of audio/video entertainment.

It comes complete with a sunshield for outdoor viewing, 3-way level/tuning meter and bass/treble controls, and at all all-up weight of only 4 kg (just under 9 lbs) without batteries it is light enough to go anywhere yet sufficiently strongly constructed to withstand the knockabout life of the portable. Recommended retail price from National dealers is $330.00.

Digital Watch Patents

Commodore (of PET fame) has received patents on two techniques for digital watch operation. One covers the use of a piezo-electric crystal to vibrate the watch as an alarm, while the other is more important and covers the use of one button to select the display of time, seconds and date – a technique used by virtually all manufacturers.

Home Computer Show

Box Hill Town Hall (Box Hill, Melbourne) will come alive to the sound of printers on the weekend of 9-10 December as it is the venue of the Home Computer Show being organised by Australian Seminar Services Pty Ltd of Melbourne. Judging by the bookings for stand space, the show is bound to be a success, with lots of interesting hardware on display. The success of the recent ACS-8 Computer Fayre in Canberra also augurs well for this show. Many companies who advertise in ETI will be there, and some interesting new products will be on display.

Among the exhibitors will be: Rod Irving Electronics, Abacus EDP Services, Futuretronics Pty Ltd, ASP Microcomputers, S M Electronics, Pennywise Peripherals, A J Ferguson, Sontron Instruments, the Byte Shop, the Caldor Corporation, Dick Smith Electronics, Warburton Franki, Philips, Computer Portraits, South West Electronics, Box Hill Technical College, Computerland, Texas Instruments, Delta Scientific Products, Automation Statham and, of course, ourselves – ETI.

We shall be displaying a selection of the ETI microcomputer related projects, including the ETI 640 VDU, the ETI 641 printer, the STAC timer from last month's issue, and some other goodies which we're sure you'll find interesting. The show is being held at the Box Hill Town Hall, Whitehorse Road, Box Hill, from 10 am to 10 pm on Saturday 9 December and from 10 am to 6 pm on Sunday the 10th. The admission fee is $2 for adults and 50 cents for children.

See you there!

Synergistic Beer Drinking

Well, last month we all turned up as usual, carrying bound volumes of ETI, ready to answer your questions, expecting to be overwhelmed, but we were rather disappointed by the turnout! We think the problem must be that we've arranged the Synergistic Beer Drinking for the first Wednesday of the month, but that is just before the magazine has been appearing, one month after the last one and so you've all forgotten about it. So, from this month, its going to be on the *second* Wednesday of the month; as you read this, that's probably next Wednesday. Now there's no excuse.

Here's all the relevant info, once again. The ETI technical staff will be at the *Bayswater Hotel, Bayswater Road, Rushcutters Bay,* (near the Rushcutter Bowl), on the *second* Wednesday of the month, to talk about electronics, hi-fi, computers, radio, anything! If you come along, we'll be glad to talk to you (we love a captive audience)!

ETI Price Increase

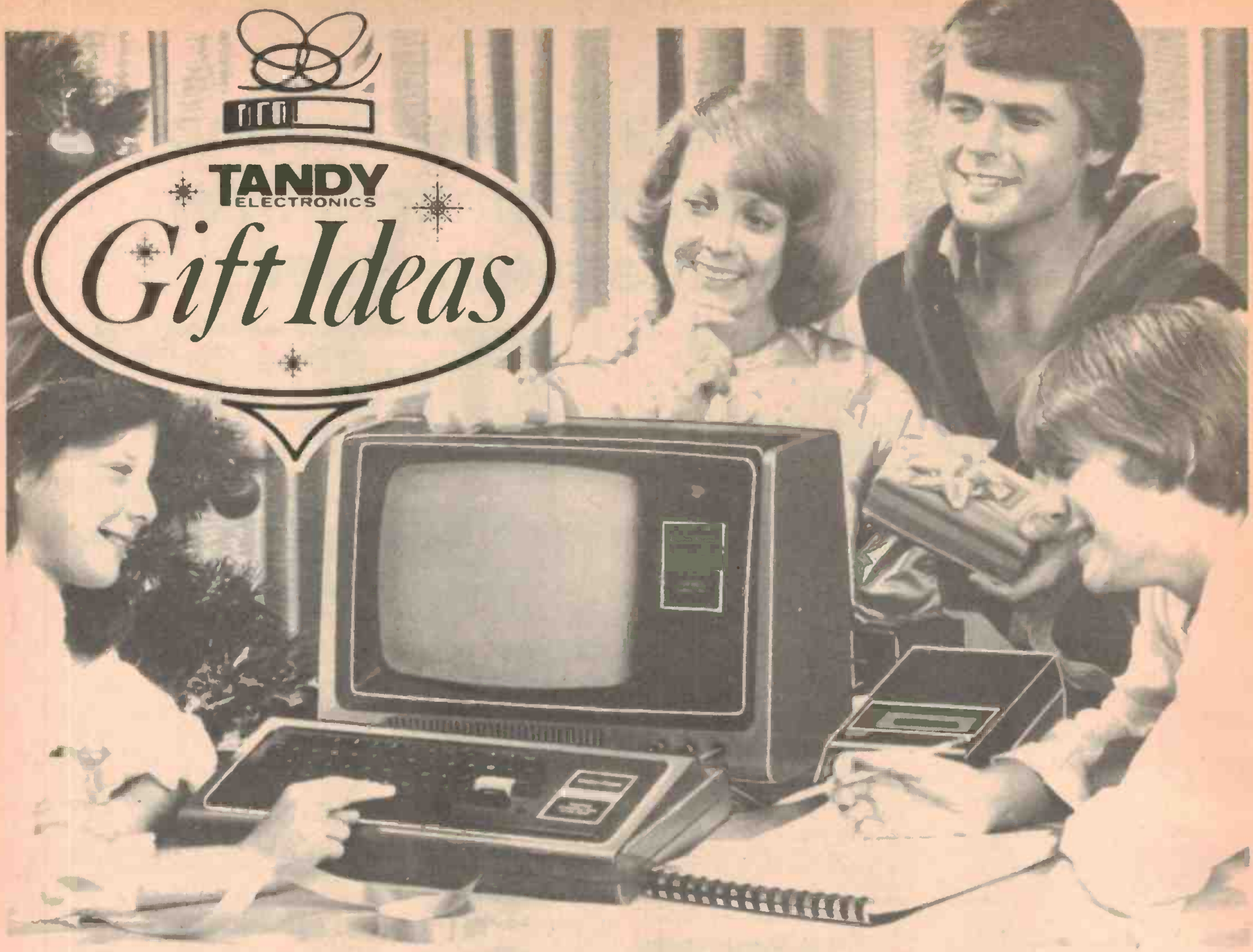
We regret that, starting with the January 1979 issue, the cover price of ETI will increase to $1.40. This is due to increasing costs, but we hope that you will continue to think that ETI offers good value for money.

ETI/Unitrex Calculator Contest

The October contest got a good response, and not many of you were stumped for the correct answer, which is, of course, $73.36. The winner for October is Mr Indry, of Kingsford, NSW, who will receive a Unitrex Calculator.

This month's problem was suggested by Mr B V Takach, of Wahroonga. He asks 'Our technical library displays the bound volumes of *The Diecasting Engineer.* Six issues, each of sixty pages, are bound into hard covers and placed on the book shelf in order. A busy bookworm chewed through the first page of Volume 22 to the last page of volume 23. How many pages have been chewed through?'

Seal an empty envelope, write your answer on the back of it, and send it to: Unitrex Calculator Contest (December), ETI Magazine, 15 Boundary Street, Rushcutters Bay, NSW 2011. The closing date is Friday, 5 January 1979.



The priceless gift of learning now has a price: $799.95 And a name: the Radio Shack TRS-80® Microcomputer. And now, at last, your child has a chance to discover Tomorrow on Christmas morning.

"Tomorrow" is an electronic world, based on computers—and it's already here. In it your child can be a number in a machine. A robot. Because he or she does not understand either the number or the machine. Or your child can be pleasurably elevated into this brave new world with a gift that has only become affordable in recent months

Advice for Parents Who Care

In your lifetime the possibility of owning or giving a computer—up to now—was unthinkable. A computer? That can teach? Remember? Display on its own screen? Play games? Complete with a standard typewriter keyboard? Unthinkable—up to now.

But now the Tomorrow Machine is not only thinkable but practical, affordable and available through every Tandy store and participating dealer. The TRS-80 personal computer system? For the kids? For Christmas?

TRS-80 manual, written by an educator, is 232 pages of instruction for a beginner.

TRS-80 system includes everything in this picture and, of course, the manual.

TRS-80 is expandable and can grow in power and utility. Everyone in the family becomes involved, entertained, informed.

INDEPENDENT TANDY ELECTRONICS DEALERS MAY NOT BE PARTICIPATING IN THIS AD OR HAVE EVERY ITEM ADVERTISED

TCOec78

DESIGNING OSCILLATORS

One of the problems in electronics is stopping amplifiers from oscillating, another problem is getting oscillators to oscillate . . . Tim Orr explains.

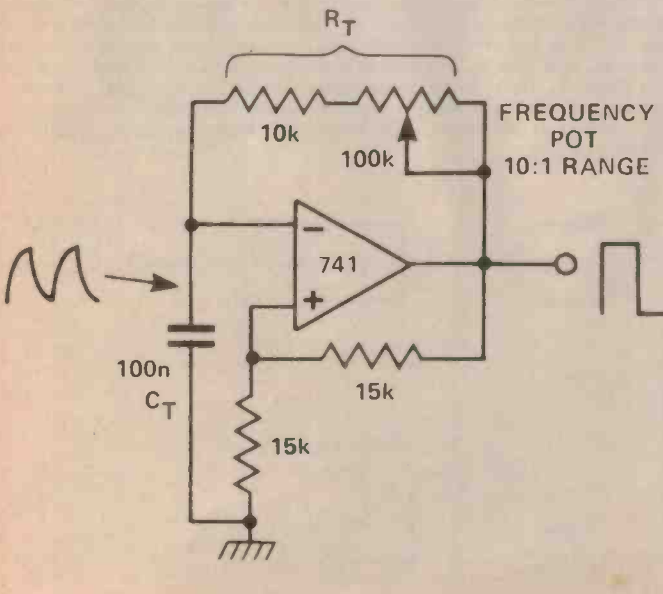
AN OSCILLATOR IS BASICALLY an amplifier with positive feedback applied around it. The feedback must be AC coupled otherwise a DC latch up condition would occur. Having got some sort of oscillation, one of two things can happen. The oscillation can build up in amplitude until clipping occurs due to the power supply voltage levels. At this point a stable, but truncated waveform will be generated. Alternatively if the gain of the amplifier is too low the oscillation will die away. To produce a pure sinusoidal oscillation the level of the signal in the system must be accurately controlled. There must be some amplitude limiting or automatic gain control such that when the peak signal level tries to exceed the reference voltage, the amplifier's gain is reduced. This is in fact what limiting does. To maintain stable oscillation, the overall gain of the system must be exactly unity. Any less and the oscillations will never start. If the gain is more than unity, the oscillations will occur, but amplitude limiting will cause gross distortion.

A very common method for stabilising the oscillations, which is often used in Wein bridge oscillators, is to employ a very sensitive thermistor as an AGC. However, the thermal time constant of this component often produces an annoying amplitude bounce with occurs when changing to a new frequency.

Other methods are diode limiters (which tend to cause large amounts of distortion) and FET AGC circuits. The latter method can be used to generate super low distortion sinusoids by allowing the system gain to stabilise over tens of seconds.

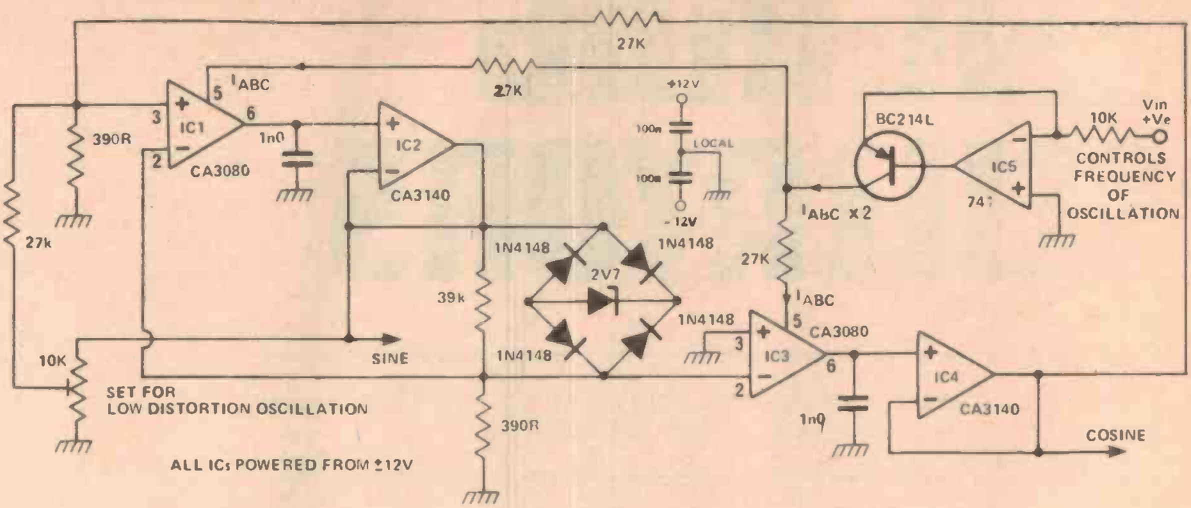
The oscillation frequency is mainly determined by the feedback around the amplifier. By making the feedback a reactive network, the phase of the feedback will vary as a function of frequency. Oscillations can only occur when the feedback is positive and thus the phase response of the feedback will determine the frequency of oscillation, assuming that the overall gain at this frequency is at least unity. By varying the phase response of the feedback, the oscillation frequency may be altered.

An oscillator should be thought of as being a circuit which continuously generates a waveform, no matter what the shape of the waveform. There are very many circuit techniques for generating these signals which range from relaxation oscillators to piece wise approximations using square waves. Some of these methods will now be illustrated.



Manually Controlled Oscillator

In this circuit there are two feedback paths around an op-amp. One is positive DC feedback which forms a Schmitt trigger, the other is a CR timing network. Imagine that the output voltage is +10V. The voltage at the non-inverting terminal is +5V. The voltage at the inverting terminal is a rising voltage with a time constant of $C_T R_T$. When this voltage exceeds +5V, the op amp's output will go low and the Schmitt trigger action will make it snap into its negative state. Now the output is −10V and the voltage at the inverting terminal falls with the same time constant as before. By changing this time constant with a variable resistor a variable frequency oscillation may be produced.

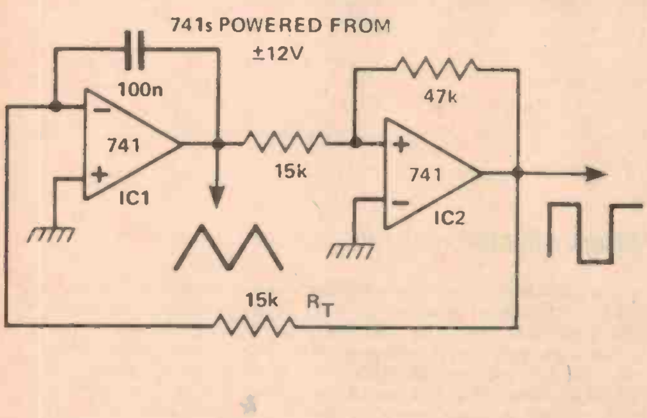


Dual Integrator Quadrature VCO

This is a sinusoidal oscillator which uses frequency dependent feedback and zener diode amplitude limiting. IC 1, 2, 3 & 4 form a dual integrator circuit which is an analogue model of a second order differential equation! There is some positive feedback around IC1,2 which is analogous to having a zero damping factor in the equation. This means that the oscillations will build up. The positive feedback is controlled by the 10k preset. IC1,3 are integrators and IC2 and IC4 are voltage followers with high input impedance. The phase shift produced by the integrator is 90° so there is no overall feedback around the loop (IC1 is non-inverting, IC2 inverts). Thus we have all the conditions for oscillation, and in fact oscillations will occur when the preset is adjusted to give the correct phase shift around the IC 1, 2 stage. Amplitude limiting is produced by the 2V7 zener inside the diode bridge. By placing it inside the bridge the same diode is used for both positive and negative signals and the limiting is symmetrical. The integrators are two quadrant multipliers (CA3080s), so the gain of the loop can be controlled by the current I_{ABC}. In the solution of this second order differential equation, the gain of the loop is proportional to the resonant frequency. Thus, by varying I_{ABC}, or rather by varying V_{IN}, the frequency of oscillation may be altered.

As the integrators produce a 90° phase shift, the two sinusoid outputs are in phase quadrature, i.e. one is a sinewave, the other a cosine wave. The cosine output is lower in distortion than the sinewave, because the amplitude limiting (and hence the distortion) is produced at the IC1,2 stage.

The second stage (IC3,4), acts as a filter and hence produces a purer sinusoid. Using this circuit a 1000 to 1 continuous frequency sweep can be obtained. However, the inaccuracies in the CA3080's will cause some amplitude variations and it may be necessary to set the positive feedback a bit high (and hence attract more distortion), to maintain stable amplitude limiting over the sweep range. This circuit is an oscillating filter and if you turn down the positive feedback and inject a small signal through a 100k resistor into IC1 pin 3, a bandpass and low pass response is obtained from the sine and cosine outputs respectively.

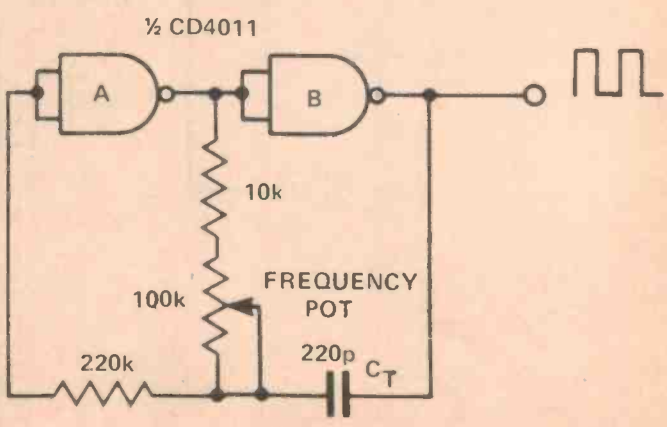


Simple Triangle Square Wave Oscillator

This circuit simultaneously generates a triangle and a square waveform. The triangle could be 'bent' by a diode function generator to produce a sinewave. The circuit is always self starting and has no latch up problems. IC1 is an integator with a slew rate determined by C_T and R_T and IC2 is a Schmitt trigger. The output of IC1 ramps up and down between the hysteresis levels of the Schmitt, the output of which drives the integrator. By making R_T variable it is possible to altar the operating frequency over a 100 to 1 range. Three resistors, one capacitor and a dual op amp are all that is needed to make a versatile triangle squarewave oscillator with a possible frequency range of 0.1Hz to 100kHz.

CMOS Oscillator

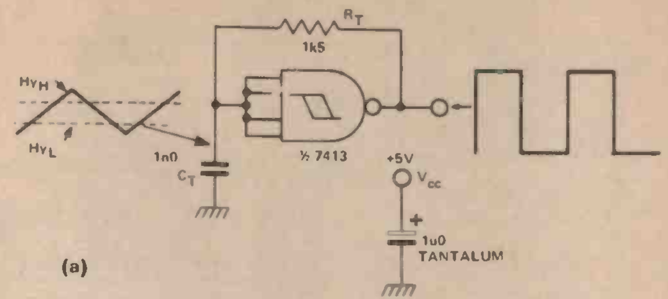
Two CMOS gates can be used to produce a simple oscillator. Imagine that output B is high. Then the input to A is also high due to it being coupled via the capacitor C_T to output B. Thus output A is low, input B is low and output B is high, which is as we would expect. However, capacitor C_T is being discharged via the 100k pot and 10k resistor to a logic 0. When this voltage reaches the crossover point for A, output A goes high, and thus output B goes low. Now the capacitor is charged up to a logic 1. Thus the process repeats itself. Varying the 100k pot changes the discharge rate of C_T and hence the frequency. A square wave output is generated. The maximum frequency using CMOS is limited to 2MHz.

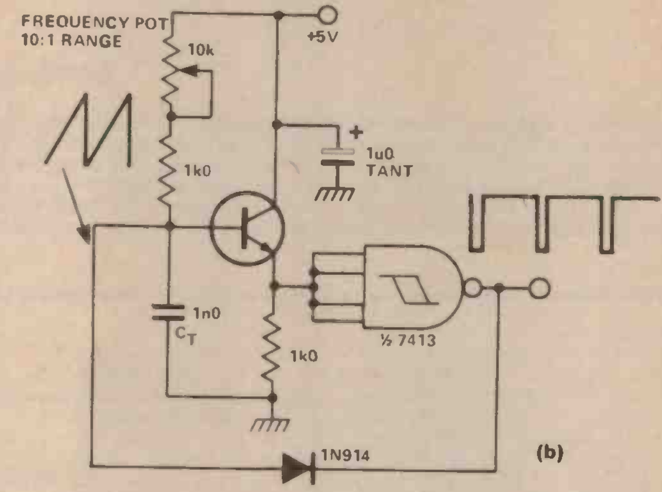


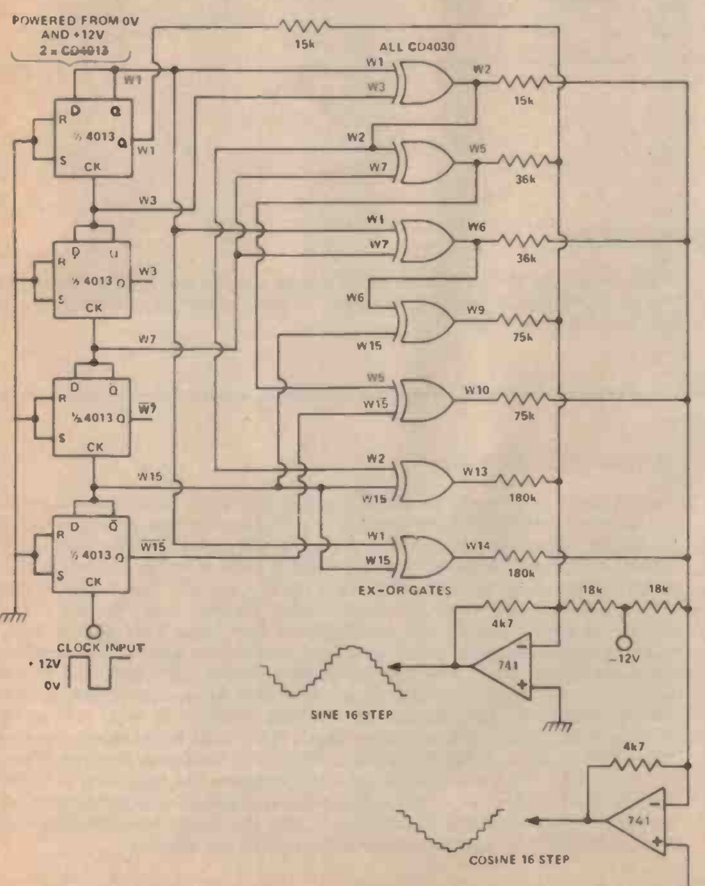
TTL Oscillator

A simple relaxation oscillator can be made using a TTL Schmitt trigger. The circuit (a) is the most simple version that can be produced. Imagine that the output is high. Capacitor C_T is charged up via R_T. When the upper hysteresis level (HyH) is reached, the output goes low. CT is now discharged until the low hysteresis level (HyL) is reached whereupon the output goes high. Thus the oscillator generates a square wave, with an uneven mark to space ratio, due to the input current requirements of the 7413. The frequency can be set at any value up to several megahertz by varying C_T and R_T. C_T can be an electrolytic but R_T must not be more than about 1k5 or it will not be able to pull down the Schmitt trigger inputs. (If you use a CMOS Schmitt this does not apply). The output is a nice fast squarewave capable of directly driving several TTL loads. One problem to be encountered is frequency jitter. When the input is very near to a hysteresis level, noise in the system may cause the oscillator to prematurely trigger, thus making that period slightly shorter and producing a noise induced frequency jitter. Also using two Schmitt triggers from the same IC is sure to cause interaction and thus jitter. To reduce power supply noise effects the IC should be decoupled with a 1uF tantulum capacitor actually at the V_{cc} and GND ins of the package.

Diagram (b) shows the same oscillator, but with a 10 to 1 manual control of frequency. The timing capacitor is charged up by the 10k pot and the 1k resistor. This voltage is then buffered by the emitter follower and fed to the Schmitt trigger. When the upper hysteresis level is reached the output of the Schmitt goes low and the capacitor is rapidly discharged via the diode until the lower level is reached. The process then repeats itself. As the discharge period is so fast, it can be as short as a few hundred nano seconds, the period can be thought of as being determined by the charging time, which is controlled by the 10k pot.



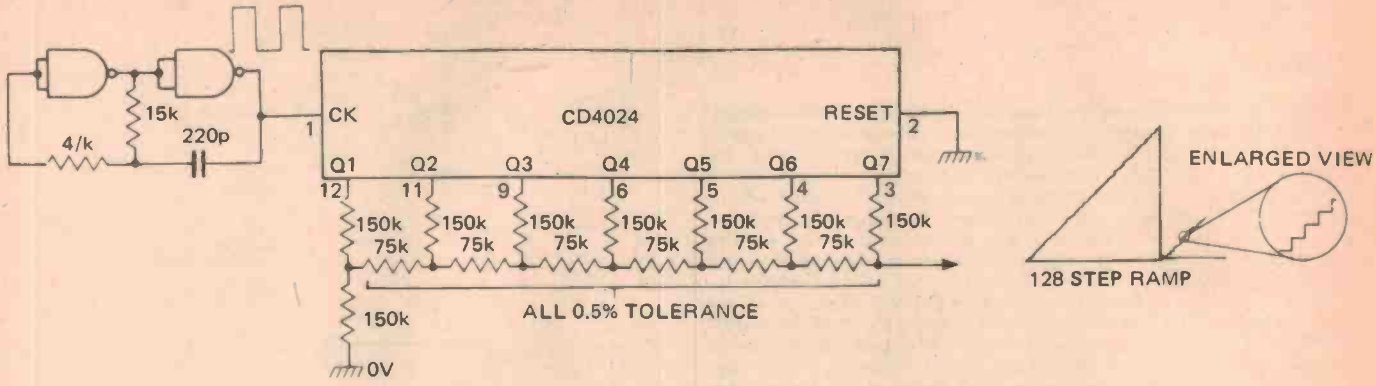




Walsh Function Generator

The mathematician Fourier said that any repeating waveform could be made up out of harmonic components. These components are sinusoids which are integrally related to the fundamental period of the waveform in question. This is a convenient conceptual approach, but as a way of practically synthesising waveforms it is not on. You would have to generate a whole series of harmonically related sinewaves which might prove a little difficult. However, a man called Walsh said that you could do the same thing as Fourier, but will square waves. So, instead of using sinusoidal Fourier sets, we can use square wave Walsh functions to synthesise waveforms. There are various techniques for calculating the Walsh function co-efficients for generating particular waveforms but these are beyond the scope of an article such as this. The diagram shows the circuit for generating a sine and cosine waveforms using 16 steps. Walsh functions are orthogonal functions, just as sine and cosine are orthogonal, and so the generation of these two waveforms is relatively simple using this technique. The 4013 dividers and the exclusive OR gates generate the Walsh functions, which in turn are converted into analogue waveforms by use of the correctly weighted resistor networks. Note that you only need 4 resistors to generate a 16 step sinewave approximation.

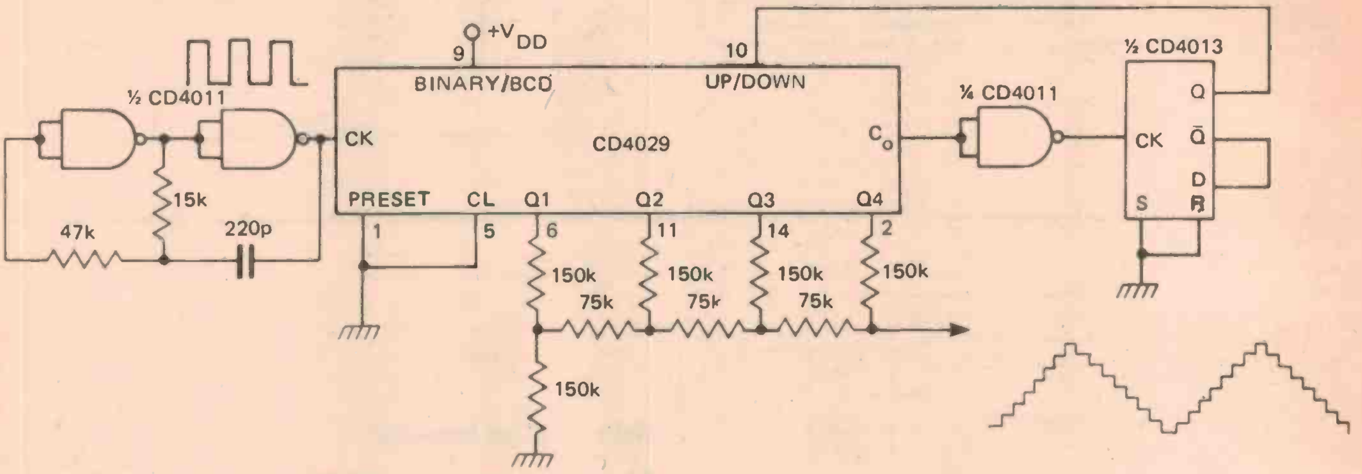
The resultant outputs can be easily filtered by fixed or tracking filters to produce pure sinusoids. The output frequency is 1/16th of the input clock frequency. The clock can be stopped and the outputs will remain fixed; try that with analogue trchniques!



R-2R Staircase Generator

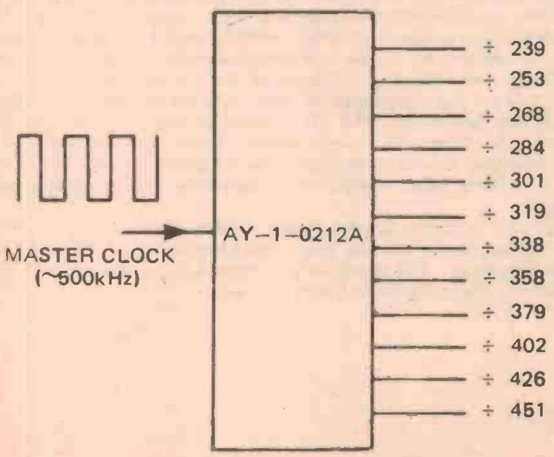
Waveforms can be constructed by building them up out of separate elements. In this case a linear ramp waveform is generated out of 128 steps. The CB4024 is a seven stage binary counter. It is being driven from a CMOS clock oscillator similar to that already described.

The Q1 to 7 outputs divide this clock frequency by 2,4,8,16,32, 64 and 128 respectively and the divided outputs are then fed into an R,2R ladder network. This is in fact a Digital to Analogue Converter (DAC) and as the counter is merely counting up, then the converter will generate a linearly rising waveform made out of 128 steps. When the counter overflows, the ramp waveform resets and the process repeats itself.



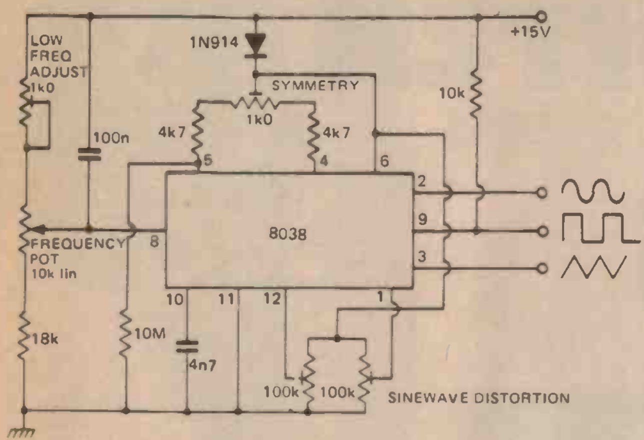
R-2R Triangle Generator

This circuit is similar to the previous except an up down counter is included. A clock signal is applied to the 4029 counter. When it has counted 16 clocks a Carry signal is generated. This clocks a D type flip-flop (4013), which changes state and reverses the up down mode of the 4029. Thus the circuit counts up, down up etc. The counter is converted via an R,2R ladder into an analogue output, a triangle waveform made up out of several steps.



Master Tone Generator

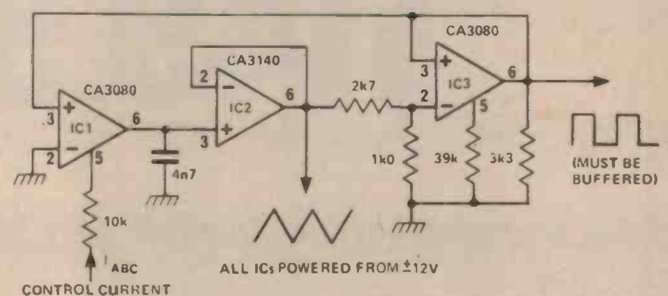
If you have ever made an electric organ, piano or string machine you would have had to produce the twelve notes for the top octave by some means or other. More expensive organs might use 12 master oscillators which would be tuned to the top twelve semitones on the keyboard. This gives a nice free phase quality to the sound. The notes in the octaves below are made by using binary dividers and filtering. Very expensive organs would use an oscillator per note. This allows every note to be individually tuned and produces a very good sound quality. However, there is an easy way of producing the semitones and this is with a master tone generator chip. This is a pre-programmed divider having one input and twelve or thirteen outputs. A high frequency master clock is put into the chip which is deivded by numbers ranging from 239 to 451. These divisions produce the semitone outputs. Thus, by using one master oscillator and one master tone generator a lot of the work of making an organ is removed. It is possible to produce more accurate intervals using 12 oscillators, but the speed and efficiency of the chip usually wins in the lower price end of the market.



8038 Function Generator

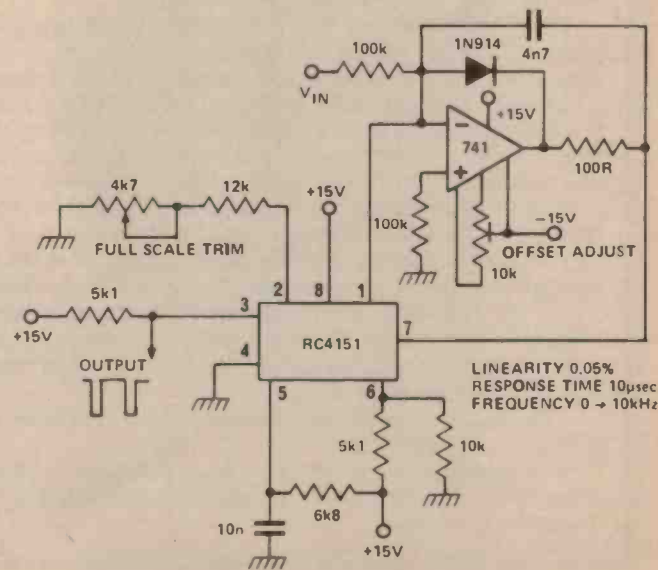
There are several ICs availatle which perform some sort of oscillator function. One such is the Intersil 8038 which is a VCO with sine, tirangle and squarewave outputs. The basic oscillator is a triangle squarewave. The frequency is voltage controllable but is not a linear finction. The triangle symmetry and hence sinewave distortion are adjustable with a preset but change when the frequency is altered. Operation up to 1MHz is possible.

Triangle Squarewave ICO Using CA3080's



This circuit is very similar to that of the simple triangle/square oscillator, except that the operating frequency is controlled by a current I_{ABC}. (ICO stands for current controlled oscillator, as opposed to VCO, voltage controlled oscillator). Using this circuit, a sweep range of 10,000 to 1 is possible (for I_{ABC} 500 uA to 50 nA). The CA3080 is a two quadrant multiplier and the CA3140 is a MOS FET op-amp. IC1 is used as an integrator. IC2 is a high input impedance voltage follower and IC3 is a Schmitt trigger. The CA3080 has a current output which in the case of IC1 is used to charge up a capacitor. The voltage on this capacitor is buffered by the CA3140 and fed into the Schmitt IC3. The CA3080 (IC3) forms a very fast Schmitt trigger but as it has a current output, it cannot be loaded in any way without affecting the operating frequency. The output of the Schmitt is used to make the integrator inverting or non-inverting. Thus the operation is as follows. The integrator ramps upward until the positive hysteresis level is reached. The Schmitt flips over, the integrator then ramps downwards until the negative hysteresis level is reached. The Schmitt flips back and the process is repeated. The ramp rate is determined by the size of the current I_{ABC} and is linearly proportional to the oscillation frequency. At very low currents the triangle waveform may become very asmmetrical. This is due to current mirror mismatches inside IC1 and this device may have to be specially selected for continuous symmetry.

Precision Voltage Controlled Oscillator



The RC 4151 is a precision voltage to frequency converter. It generates a pulse train output which is linearly proportional to input voltage. The linearity for the circuit shown is 0.05%. The IC compares the input voltage with an internally generated one. It dumps controlled pulses of charge into a parallel RC network and compares this generated voltage with the input. If the input is greater it puts more pulses of charge into the RC network until the two are balanced. To get a larger sustained voltage in the RC network the frequency of the pulses must be increased. Thus the frequency of the pulses generated is made to be proportional to the input voltage.

The output is a pulse waveform and is intended to drive some sort of counting system, the chip being used as simple analogue to digital converter. It can also be used as a frequency to voltage converter. A maximum frequency of 10kHz has to be observed.

SPECIAL OFFER

Chess Computer $149.95!!

The Chess Champion Mk 1 is a self-contained microcomputer which has been programmed to play chess - and play it very well!

To play a standard game of chess, the machine is switched on and the desired level of play is entered - there are six levels, which vary the time per move from immediate response to the highest level, at which the Chess Champion Mk 1 will compute for up to two days! Once the level has been entered, the mode is keyed in. More on this later.

Play can now commence, with moves being entered in a standard notation. For example, the white king is on square E2 at the beginning of a game; if it is moved forward two spaces, the player keys in 'E', '2', 'E', '4', and then presses the 'PLAY' key.

The machine will now start computing its move, simultaneously flashing the level number. After a while it will display its move. You move its piece for it (you didn't think it was that smart, did you?), and can now make your reply.

The Chess Champion Mk 1 has provision for special moves, such as castling or taking 'en passant', through the use of a double move key. It also has a nasty habit of promoting any of its pawns that reach the last row to a queen - in fact, it doesn't miss a trick!

In Mode A, the machine sets up the board for a standard game, but in Mode B, the user can set up situations, using the 'EP' (Enter Pieces) key. This is of particular value in solving chess problems. There is also a 'Find Pieces' key, which lets the player locate all the pieces in case he suspects he has made an error (it couldn't have been the Chess Champion Mk 1).

The Chess Champion Mk 1 is a very competent chess player indeed, and will provide hours of amusement for even the most skilled chess players.

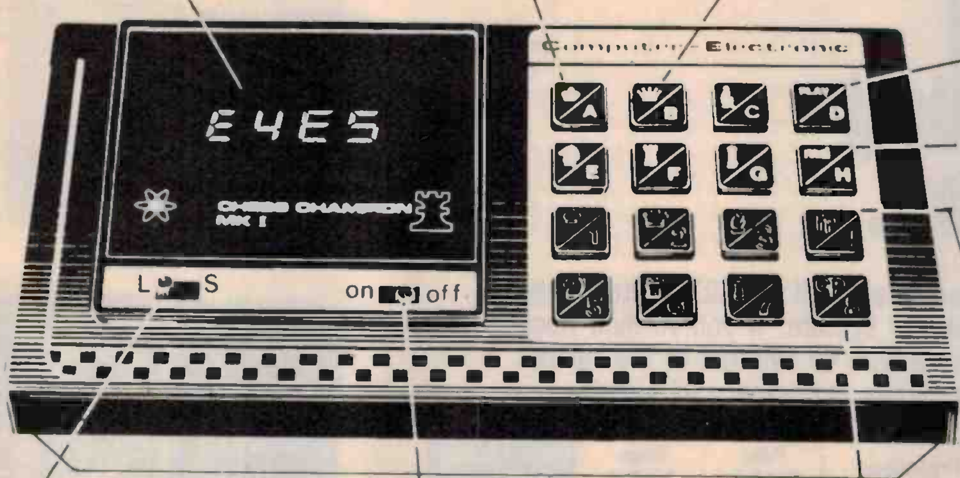
Electronics Today International has arranged for the Caldor Corporation to make the Chess Champion available to our readers for $149.95 (plus $3.95 postage, handling and insurance).

NOTE: This offer is made by the Caldor Corporation and this magazine is acting as a clearing house for orders only. Cheques should be made out to 'Chess Offer' and sent together with the order form or a copy thereof to 'Chess Offer', Electronics Today International, 15 Boundary St, Rushcutters Bay, NSW 2011.

This magazine will process the orders and send them on to the sponsor who will send out the goods by certified mail.

As a special incentive to ETI readers Caldor will refund $50 to the first twenty readers ordering these units! The full names and addresses of these readers will be made available to Electronics Today International.

$50 refund to first twenty buyers!



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SOUND

Reality?

Occasional Audio Correspondent Wally Parsons doesn't seem too troubled if he loses touch with reality.

IN ANY FIELD of endeavour based on sophisticated technology it's very easy to become so wrapped up in the technology itself as to lose sight of one's purpose, the end to which this technology is directed. This is especially true in a field such as audio which is not only in a state of rapid evolution but is also heavily consumer oriented. Thus we find hardware promoted for applications which are, at best, questionable, and at worst, quite impossible. Thus, persons may want to use graphic equalizers to correct frequency response irregularities caused by improper component mating (e.g. impedance mismatch), or simply bad design of a particular component, such as a speaker, or failure to deal with strong standing waves in the listening room.

Or perhaps we attempt to add "ambience" or equalization in a misguided effort to restore proper balance, without having the slightest idea of what the "proper" balance is. We want to obtain a reproduction which is "accurate", whatever that's supposed to mean, and faithful to the original, even though the original may never have existed; that is, the performance was created on the recording.

Now it is not my intention to knock progress. On the contrary; so many advances over the years have produced the capability of recording and broadcasting with a degree of fidelity inconceiveable not too many years ago. But much of this technology is wasted if we forget basics and lose sight of our aims. This may be why it's taken 70 years for some pressers to figure out how to put the centre hole in the centre of the record.

Listening

In these pages "Audio" is presumed to refer to those areas of sound reproduction which aim at a high level of performance quality. In establishing performance criteria attention must first be paid to the type of programme material to be reproduced most of the time.

The classical music concert goer is especially likely to be a purist. His reference standard is live music, heard with some frequency. This might give the impression of being a pretty tough act to follow, yet this is the audiophile most likely to be fooled into accepting reproduction which deviates grossly from his intended ideal. The reason is quite simple; human memory seems to be quite unreliable where sensory information is involved. If you go to a concert it's usually in the evening. Chances are you won't be operating your sound system before the next day, at least at concert hall levels. By that time your memory of last night's performance will have become less clear and unless your system has some gross obvious faults, it will sound pretty good. If the low bass is missing, your mind fills it in, or if a voice is projected a little too forward, your mind pushes it back. And then, if you can only get gallery seats and a recording was made with an up front perspective you no longer have a reasonable reference. This points to a need for considerable listening experience and helps explain the difficulty of becoming a first rate sound man at an early age.

Then too, it's so easy to be impressed by the extremely wide stage reproduced by two speakers and forget that at the live performance the stage angle was so much narrower that if you closed your eyes you really wouldn't know the exact location of the oboe and the trumpet. As for front to back depth, there really isn't much of that either.

Remember that speaker which reproduced such silky smooth string tones? Surprise: massed strings often have an edge to them which verges on the wiry. And why not; sound is produced by drawing a bow across stretched wire.

Many a great speaker has been criticized because cellos and basses have a resonant and woody quality often attributed to cabinet resonance. Well, it's resonance all right, the resonance of the belly of the instrument. Tympani really do sound hollow and a concert bass drum really is boomy. A good speaker does not reproduce its sound as a "Wump".

Production

The collector of predominantly rock music is in a different position. The technical key to set production is the multichannel recording chain, which, when used creatively, permits sonic effects which are quite impossible to produce by any other means, but which all too often makes possible the production of tracks by musically illiterate dullards who wouldn't be able to play the same tune together using conventional means. Unfortunately they are often put together by producers and engineers of similar mentality, who frequently exercise their toys on real music. With good material. engineered with taste, imagination, and good judgement, the result can often be magnificent. Obviously, the legitimate aim in reproduction is to realize the sonic image heard by the producer. In other words, to achieve what he wanted the listener to hear. The catch is, that you don't know what he wanted you to hear. So you may not be able to achieve it without duplicating the exact conditions which existed during the final mixdown. However, taste and judgement often prove to be a good guide here.

Where it becomes a little sticky is in the realm of more traditional popular music and some jazz forms in which these techniques have been used. Here we have at least the possibility of finding a live performance for comparison. With multitrack what we usually end up with is two channel monophonic sound which has been highly processed to produce an artificial stereo image. How successful these efforts are may be judged by the increasing number of equalizers, noise-reduction

"Why a frequency response of up to 40kHz when your ears can't handle 20kHz?"

In virtually all recorded music, there is little to listen to above a frequency of 16kHz, especially when you consider that few of us can hear beyond 15kHz anyway. The reason for the heightened response rate is to improve musical quality within the audible range. Music waveforms are complex, often with steeply rising and falling sides. Any vertical compression or attenuation of this waveform, as takes place in most average speakers, must cause a flattening of the wave with a consequent lack of sharpness and definition in the upper registers.

To solve this, Pioneer research arrived at the HPM-150 speaker with a frequency response ranging from a low of 25Hz to a high of 40,000 Hz. Pioneer developed the radically different supertweeter, shown opposite. In fact, it's the world's first made from high polymer film, made famous by Pioneer in their revolutionary SE-700 headphones. The three-inch cylindrical diaphragm of the supertweeter is loaded on a system of five vertical-sectoral horns for improved coupling and a horizontal dispersion of sound through 270°. With the HPM-150 you are assured of hearing all the super-highs which the human ear is capable of enjoying.

Taken all round, the HPM-150 is nothing short of remarkable. It's a four-way, four-speaker system rated at a nominal 125 watts input. Naturally, a speaker design of this sophistication needs power to perform. So it's no surprise that Pioneer advise a minimum of 50 watts per

channel with a maximum input of 300 watts per channel on a continuous power basis.

A short specification

Enclosure:	Bass-reflex, floor standing.
Speakers:	40 cm woofer, carbon fibre cone type.
	10 cm mid-range, cone type.
	4.5 cm tweeter, cone type.
	7.5 cm supertweeter, high polymer film horn-loaded omni-directional.
Impedance:	6.3 ohms.
Frequency Range:	25Hz-40kHz
Input power:	125w nominal 50 to 300w recommended range.
Dimensions:	450w x 985h x 450d (mm)
Weight:	75 lb (37.3 kg)

All Pioneer speakers are covered by warranty for three years. Excellent service facilities are available throughout Australia via a network of Pioneer approved outlets.

Please mail me (Tick as required)
☐ HPM-150 Speaker Folder
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PIONEER®
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units, time delay devices and other signal processors commercially marketed and the demand for construction articles by readers of ETI.

An Art

I've long felt most of the art produced in any time to be worthless and generally forgotten with time. Perhaps in the area of music recording we must view software engineering from the same point of view. Like the discriminating music lover, then, we must establish clear values in our own minds as to what we are trying to accomplish, and evaluate new developments, equipment and concepts from this point of view.

I expect to get back to more specific aspects of this theme from time to time, but in the meantime, consider the virtue of the word "why".

Products And Developments

Basically there is little difference between the shape of the groove cut on the early Berliner disc and that of a modern stereo LP. Both are cut with a modified V-groove with some rounding at the bottom, and each modulation occurs on both groove walls. The only real differences have been in dimensions, included angle, and modulation angles.

Playback styli, too, have evolved from steel ploughs to precision instruments as more was learned about the dynamic relationship between stylus and groove wall. Generally, though, styli have been conically shaped with the tip ground to a spherical arc, and later an elliptical cross-section with bi-radial tip. This latter was developed mainly to improve the stylus' ability to trace high frequency modulations in the stereo groove. But even this proved inadequate to handle the very high frequencies (up to 45 kHz) involved in CD-4 recordings. Consequently other shapes were developed, most notably the complex Shibata and other types. With luck, most of the various four-channel systems will hibernate for a while, while we figure out what we really want to do with all these channels, but in the meantime some of the things learned have spun off and been applied to conventional two-channel stereo recording and play-back.

Quadrahedral

One of these was Stanton's "Quadrahedral™" stylus configuration, basically a stylus of elliptical cross-section with a very wide ratio of lateral to transverse dimension. Now, ordinarily this would result in a very small contact area and a consequently high unit contact pressure when used at any realistic tracking force. However, by forming the stylus into a hyperbolic shape, when viewed from the front, a larger area is placed in contact with the groove walls. The result is low unit pressure, and because this extended contact is along the vertical, smoother more extended high frequency response, with better tracking at high frequencies, aided by the improved groove wall contact.

In optimizing for CB-4 performance some sacrifice was made in tracking ability and transient response when playing stereo discs, with the result that Stanton's 780/4 DQ pickup lacked the presence and impact which characterized the 681 series. Even so, the new stylus shape combined with a redesigned pole structure did produce a certain smoothness and cleanness.

An outgrowth of this experience is the "Stereohedron™" stylus similar to the CD-4 unit but optimized for stereo use and available in the 681 EEE/S and the new Calibration Standard 881S. I've had the opportunity to use the EEE/S version for several months, and it seems to be an effective and worthwhile development which, if not in its present form, at least in some other variant, is likely to become as commonplace as the elliptical tip is now. So far I haven't found anything which it will not track including some pretty heavily equalized sibilants. Probably because of the different mating surface involved, recordings which showed signs of damage due to mistracking on previous plays either were cleaned up, or the noise component seemed to dissociate itself from the signal, thus reducing its obstrusiveness. The same is true of surface imperfections which appear as separate signals. The effect is something like noises which may come from an audience, one is aware of them, but they can be tuned out. Bright instruments like brasses and cymbals sound bright, yet there is no artificial effect added. Stereo imaging is wide, and solid, with a lovely but not exaggerated presence on voices and solo instruments, and a clean separation of individual voices on choral music.

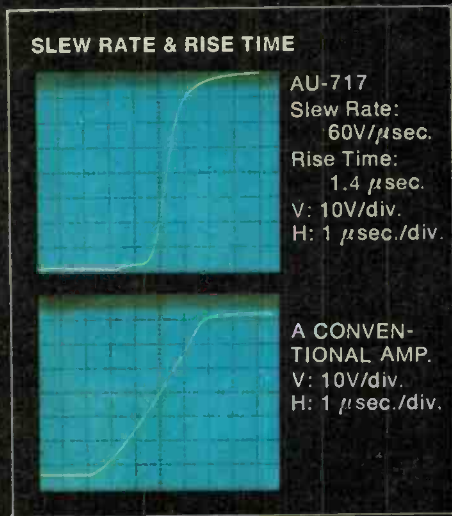
Now for the kicker. Stanton advises that the assembly be used only in the 681 EEE body. Well, I've got news; I'm using it in both the older 681 EE and the 780 Bodies. In the latter it performs to spec, although it requires a load of 27k and 100pF capacitance, while with the former it provided a significant up-grading in performance, and in both cases at considerably less cost than a complete 681 EEES. The different loading requirements are due to the different inductances used in each body. Now, Stanton has always designed their pickups for operation into a much lower capacitive load than most other manufacturers, using higher inductance coils to achieve reasonable output. This may account for the variable reports on performance. They tend to be a little tricky to install, and one wold be well advised to use very low capacitance cables even if it means adding lump capacitance to bring it up to the specified value.

Sansui's all-new integrated amplifiers have absolutely astounding specifications. Compare them with any others in their class, and Sansui comes out far ahead. But what really makes Sansui's new amplifiers so superior is that all these great specs have a single purpose — outstanding sound quality.

Take response speed, for example. Your amplifier doesn't move, but it does respond. The more rapid its response, the cleaner and the more accurate the sound. That's why the AU-717, for example, features an advanced DC power amplifier design. Sansui's DC amplifier eliminates all capacitors in the signal path and even in NFB loop so amplification is direct without coloration and phase delay. Response is astoundingly rapid — the proof is in the ultra-high (60v/μsec.) slew rate and ultra-rapid rise time (1.4μsec).

But Sansui didn't strive for such outstanding specs just to be able to print impressive figures. On the contrary, Sansui research showed that to achieve accurate reproduction and reduce signal loss, lightning-fast response was essential.

In addition, special circuits were incorporated to achieve new levels in stamping out TIM (transient inter-modulation distortion), a type of distortion that is now receiving high priority. Still another important benefit of Sansui's DC amplifier is the ultra-wide frequency response from zero (DC) to 200,000 Hz.

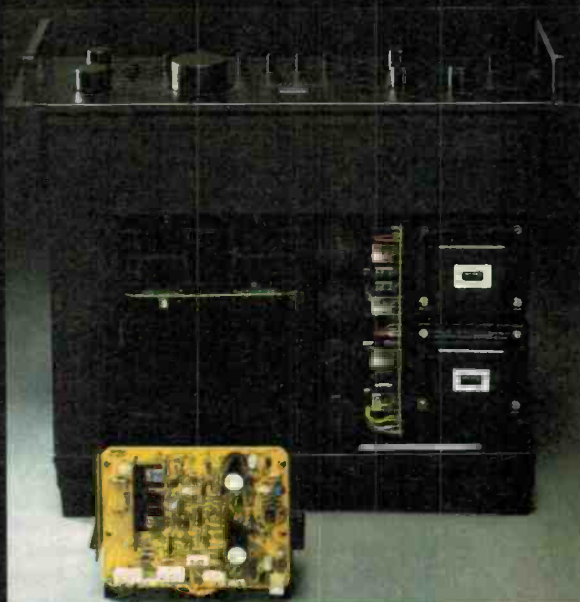


The final result is music with a purity and clarity that must be heard to be believed. All the dimensions of complex musical sounds — the wide dynamic range, the sudden pulsive signals, the nuances of barely perceptible but critical overtones in the ultra-high frequencies — all these are now crystal clear, all are proof of Sansui's new levels in superior sound quality. Impressive power is 85 RMS watts per channel, 20—20k Hz, and total harmonic distortion at rated output is 0.015%. That means it can be considered non-existent as far as the human ear is concerned.

Keep in mind that though the AU-717 is special, it's not special for Sansui. Each and every amplifier on the left-hand page embodies the same Sansui commitment to outstanding sound quality. All controls have been carefully thought out and designed for their specific purposes. Sansui has no place for gadgets and gimmicks in its dedication to the ultimate in hi-fi.

The AU-517 and AU-317 also feature the same DC power amplification as the AU-717. and offer 65 and 50 RMS watts respectively. The AU-217 and AU-117 offer 30 and 20 RMS watts respectively, but are not to be under-rated. In fact, they represent exceptional values in low distortion and true hi-fi performance.

Sansui for specs with a purpose — outstanding musical quality.



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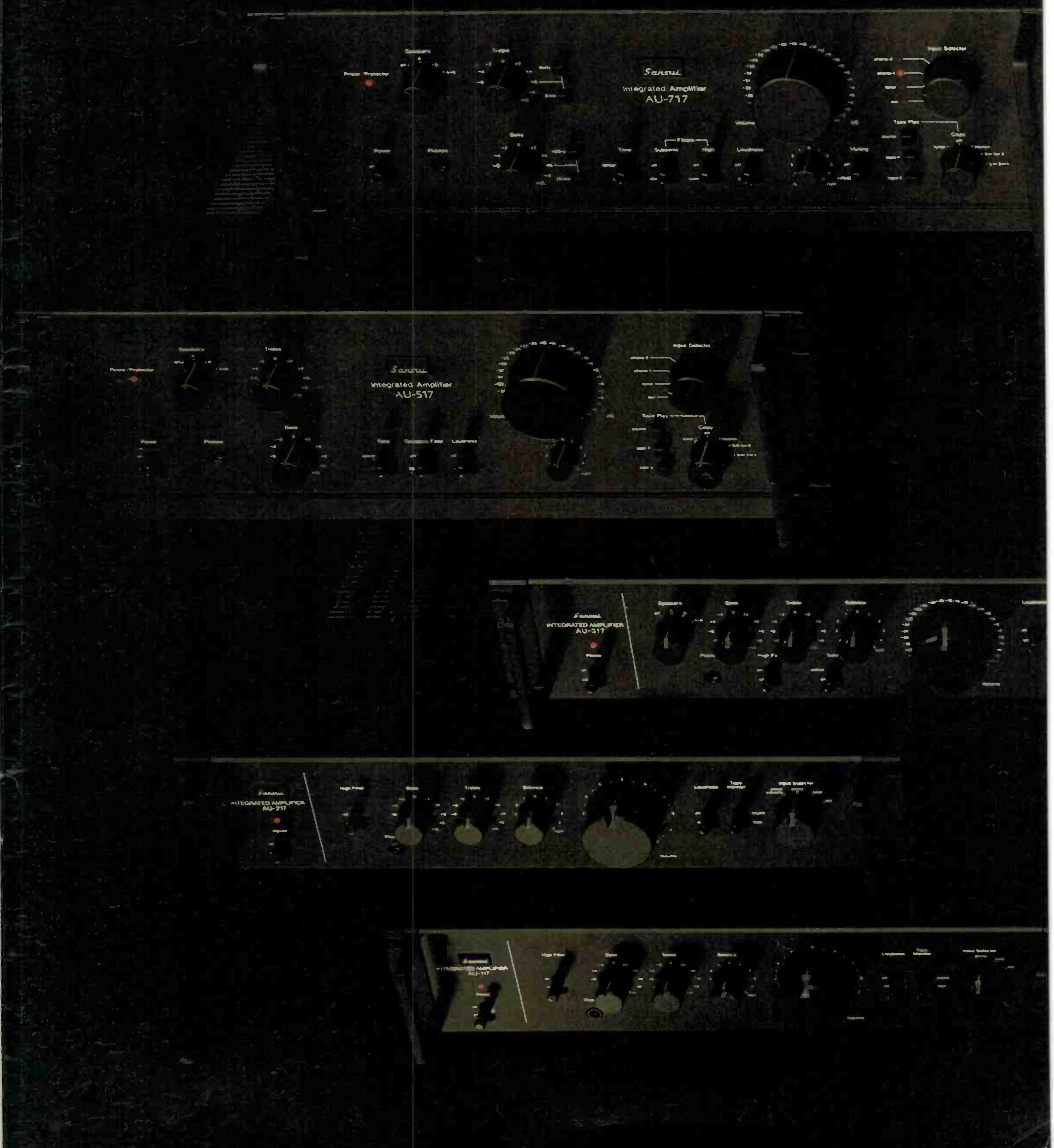
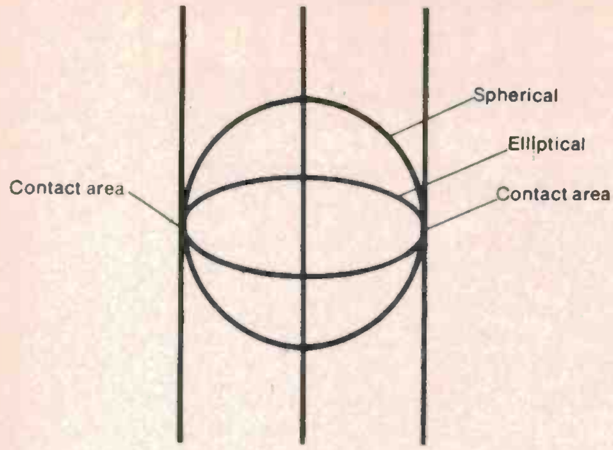
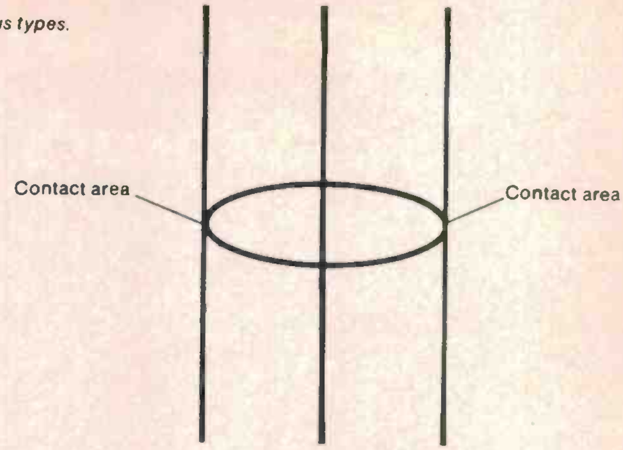
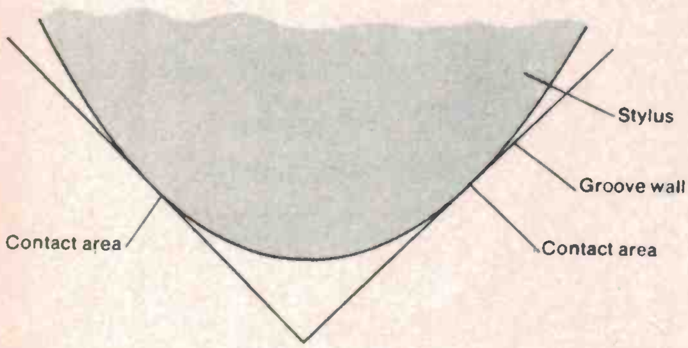
Specs with a purpose!
Sansui's new amplifiers



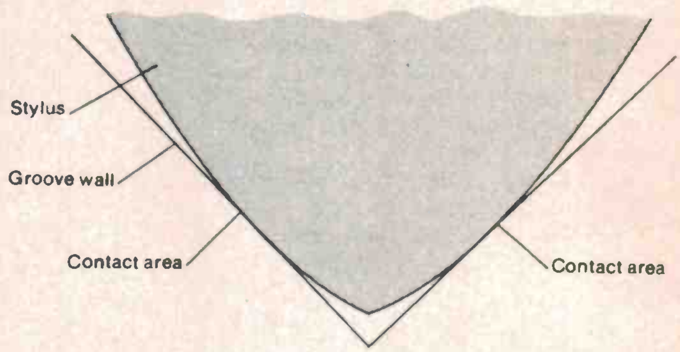
Diagrams of stylus types.







Elliptical and spherical styli.



CD-4 derived stylus (typical).

On the other hand, none of the products exhibit the excessive compliance which has become a fashionable design characteristic in recent years, so they can be used in arms of moderate mass.

Moving Magnet

The 881S represents a return to the moving magnet system, unlike Stanton's other products which use a moving iron principle. Therefore, its stylus cannot be used in the other bodies. They claim to have achieved a lower effective tip mass by using a very high energy magnet material and reducing its mass.

If you're using one of the earlier Stanton models this is a good way to upgrade. If not, but have considered using a professional pickup, the 681 EEE/S or the 881S would be worth considering. And incidentally, because of the close relationship between the companies many of the Stanton and Pickering styli and bodies are interchangeable. Thus, the Pickering 4500Q appears similar to the Stanton 780/4DQ, while XSV/3000 claims the same magnet system and stylus as the Stanton 881S. I'm not suggesting that you purposely mix and match bodies and styli, but if you already have the body, you might want to give it a new pointy head.

Shure Bros. has recently launched an advertising campaign which emphasises the point (if you'll forgive the pun) that there is a lot more to a good pickup than the stylus and its shape and other characteristics. This is one of those obvious things which most of us take for granted. After all, we no longer use thorn needles held in place by a set screw. However, it is only natural that a manufacturer should lay emphasis on some particular aspect of design which distinguishes a new product from others, and at the present time this happens to be stylus shape.

But it is equally true to say that there is more to a pickup than the pickup; there is its termination, which is also the interface with a pre-amplifier. All too often the only aspect of pickup termination considered is the load resistance. Since this has been essentially standardized for stereo pickups at 47k, it is no longer something with which we need concern ourselves. Figure 1 shows the equivalent circuit of a magnetic pickup including its load and the preamp. Coil inductance L and load capacitance (including cable, preamp and strays) constitute a resonant circuit whose Q is controlled by the internal resistance R_S and load resistance R_L (including preamp input resistance).

Complimentary Characteristics

All too often it's assumed that the recommended load capacitance for a pickup is a maximum figure, and it doesn't matter what actual value is used as long as it does not exceed this figure, and that too much capacitance will reduce high frequency response. Nothing could be further from the truth.

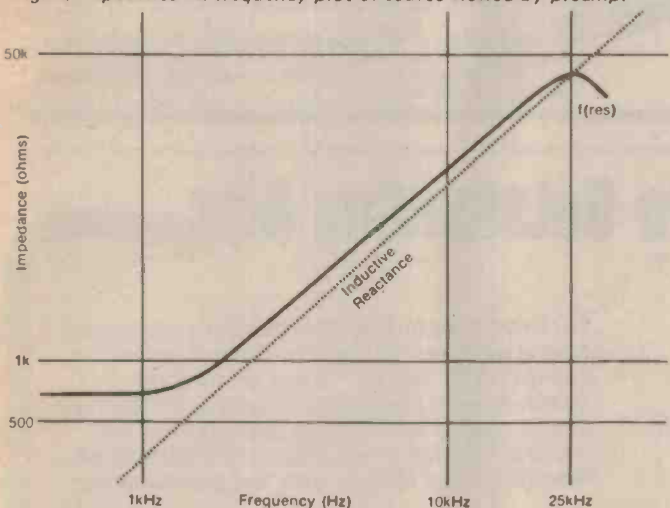
The moving system of any pickup has a natural resonant period which results from the effective mass of the moving system referred to the tip, and the compliance of its suspension. This produces a resonant peak which may be damped to a greater or lesser degree. This results in a particular response curve due to the mechanical system. In order to achieve a flat response to a constant velocity, the electrical circuit must have a response which is complementary, and this response is shaped by the circuit elements shown in Fig. 1. In order to achieve specified performance then, we *must* provide the specified loading conditions.

Nothing Is Ever Simple

Since R_L includes the preamp's in-out resistance, including it in the calculations of fixed resistance is simple, provided either that R_{in} is very high, or is a constant value. But this is seldom the case, especially when feedback is applied to the input stage, and is further complicated when equalization is incorporated in the feedback loop. Feedback alters the amplifier input impedance, and a feedback equalizer introduces a feedback factor which is frequency dependent, therefore, the input impedance is frequency dependent. It is important therefore that the preamp be designed in such a way as to ensure that its input impedance makes a negligible contribution to the pick-up load. With commercially built equipment we rarely have any control over these characteristics, and in any case manufacturers seldom supply such information.

Is it any wonder then that a pickup may deliver outstanding performance with one preamp and prove quite disappointing with another of similar, or even better quality? It's worth noting that moving coil pickups when matched to a pre-preamp are less subject to these conditions, and the pre-preamp's output being resistive is affected less by the preamp-equalizer's input characteristics, as compared to other magnetic types, and this may be a major factor in the audibly superior quality of such units. It also goes a long way toward explaining the fact that many radio stations achieve excellent sound considering that pickups used are chosen with ruggedness in mind and frequently will deliver unacceptable performance in a home system.

Fig. 2. Impedance vs. frequency plot of source viewed by preamp.



Looking From The Other Direction

The circuit shown in fig. 1 provides the source impedance for the preamp, and this impedance may look something like fig. 2. This is quite a bit different from the simple resistance often assumed when designing a preamp. Since most preamps in use today use series summing the feedback factor is modified by this impedance characteristic, and equalization accuracy is impaired. In addition, a complex and often unpredictable phase characteristic is introduced to affect the stability margin.

One solution is to use a differential input, but this is a noisier configuration. However, since the final noise figure is influenced by the source impedance this may not always be a problem. In other words, the noise figure which results from the variable source impedance may be sufficiently higher than the theoretical minimum that in reality we end up with the same noise figure no matter which circuit is used.

Another solution for use with preamps which already exist is the addition of series resistance to the input (figure 3a), although one would at first expect this to increase noise level, the more nearly constant source impedance allows input stage current to be optimized for the series resistance itself, with the additional benefit of allowing a better match to a wider variety of pickups. It can also be helpful in reducing rf pick-up, especially if circuit layout permits insertion directly at the base lead of the input stage. It also means that pickup load capacitance can be provided exclusively by the connecting cables and fixed capacitors. A suitable value for this resistance would be around 15k for most pickups, and should, if possible, be connected after the 47k load resistor, otherwise an additional load of 200k will be required, as in fig. 3c.

If a pickup-preamp combination does not perform as well as the quality of each component suggests it should, there is a good chance of the kind of hidden mismatch which many people seem to think is mysterious. It isn't really, it's just a matter of looking at all the facts, and considering the interaction of all circuit elements.

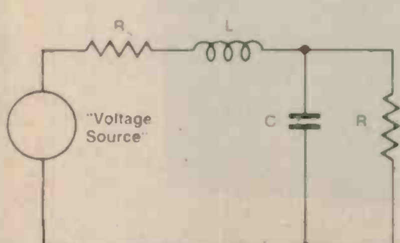


Fig. 1. Equivalent circuit of a magnetic pick up including load and preamp.

Fig. 3a. Preferred method of "swamping" cartridge Inductance by adding series resistance Rs.

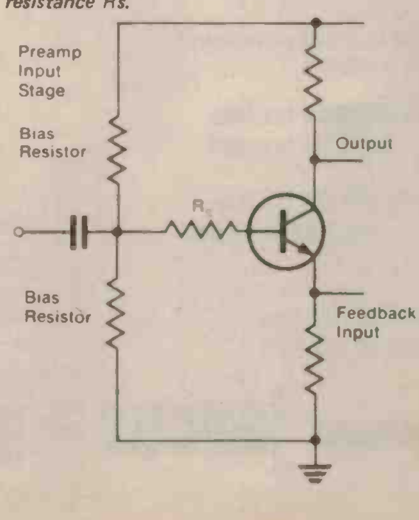
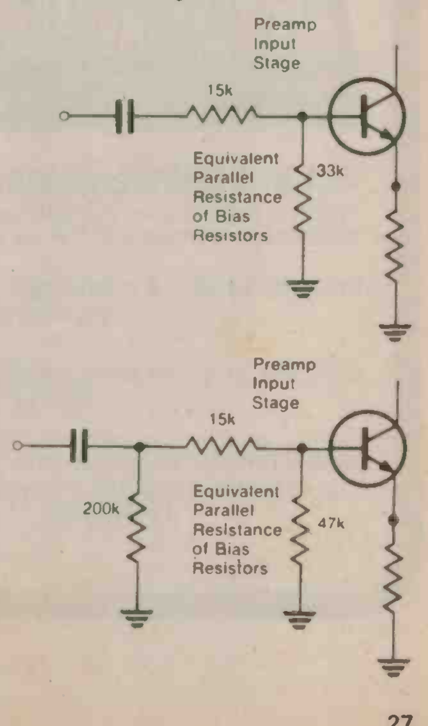


Fig. 3b,c. Two alternatives modifications to existing preamp input stages depending on bias resistor arrangement.



Two New Technics Turntables

Two new high-performance elegantly styled, Technics belt-drive turntables have just been released in Australia by National Panasonic. They are the Model SL-220 semi-automatic and the Model SL-230 fully automatic types.

Both feature a recently-developed new-type frequency generator servo-controlled DC motor and advanced IC circuitry, which put them in a performance class approximating to top-quality direct drive models.

New Lathe Driver

Matsushita, working in conjunction with Teichiku Records Co, in Japan have developed a new drive system for disc cutting lathes. The system is said to reduce unevenness in the disc revolution to one eighth of present systems using a special kind of motor with a strong turning force and highly sophisticated electronic control of the speed. The system will be marketed world-wide by Matsushita.

PCM Standards

Several manufacturers have developed working pulse code modulated record players and records but none has been actually put into production due to lack of an agreed industry standard.

Present systems vary in record size and playing speeds, recording methods, pick-up devices etc. Hitachi, Mitsubishi, TEAC and Sony for instance use laser pick-up devices but Matsushita's recently exhibited device uses a mechanical arm.

Now though, a multinational digital audio disc council has been set up to try to formulate industry standards.

The first meeting was attended by representatives from RCA, MCA, Discovision, Thompson CSF, Philips, Victor, Sony, Sanyo, Toshiba, Matsushita, Pioneer, Hitachi, Mitsubishi, TEAC, Sharp, Atwa, Akai, Onkyo, Trio, Nippon, NEC ect etc.

Audio Adaptor For VCRs

An interesting highlight at the recent Tokyo audio fair was Sanyo's pulse code modulation audio adaptor which enables all types of video tape recorders (including Beta and VHS-format units) to be used as super-fidelity audio systems . . . A generally similar unit is currently available from Sony but is not compatible with VHS systems.

Sanyo's unit is still in prototype form but nevertheless Sanyo apparently intend to present it at the forthcoming Tokyo Audio Society Research Committee with the aim of having it accepted as an industry standard.

45 rpm Linn – official

Linn Sondek have at last accepted that some records do go round and round at 45 rpm and that owners of them would like to play them on their Linn's. Whilst the company still apparently claims that 45 rpm records are inherently inferior to 33s they've bowed to the inevitable and have produced a machined pulley sleeve adaptor. Involves removing the platter however. It's not quite as simple to use as Audiolab's two-speed frequency convertor (see this section ETI January 1978) but should be a lot cheaper.

Sound Cancellation

Many attempts have been made to produce 'anti-noise' – that is, audio signals 180° out of phase with unwanted sounds, such that they are substantially cancelled.

A research team at Britain's Chelsea College has been investigating the technique for some time using mock-ups of that traditional trouble maker, the noisy ventilator duct.

In simple form a microphone samples fan noise, this noise signal is then delayed sufficiently to phase invert it and then fed to a loudspeaker close to the open end of the duct. This works to a point, but standing waves set up in the duct cause the microphone to receive a cyclic signal thus reducing overall effectiveness.

A more advanced system is currently being experimented with – this involves a second speaker placed part way along the duct. This second speaker is fed with sound which is 180° out of phase with the total sound travelling down the duct. The result is an area of standing waves between the two speakers but very little noise from the end of the vent. Actual figure quoted are an average reduction of 16 dB over the range 30 Hz to 700 Hz and peak reductions of 20 – 25 dB.

BRAINS AND COMPUTERS

Man is just a machine, or is he? Is his brain the ultimate mechanism or could it be improved by bio-engineering techniques? How can we develop artificial intelligence to match the abilities our own brains and what do we have to learn from it? By S. McClelland.

EVEN IF THE HUMAN BRAIN is regarded as being a digital computer it must be considered to be far more complex than anything man can devise — or is likely to devise in the foreseeable future. In a volume of tissue far less than that of a football it packs some 10^{10} (that's 10 000 000 000) active elements, the nerve cells. In computer terms, its capacity to store information must run onto the 10 thousand megabit range *at least*.

Its organisation matches its abilities -- on average in a normal human being it's been estimated that 1 nerve cell dies every 10 seconds throughout our lives. It is never replaced, for brain cells alone in the body cannot reproduce, and yet we never notice the loss since the brain is so well organised that many of its circuits are redundant and can be replaced by alternative channels should they fail -- this has been the case even after serious injuries have been inflicted on the brain.

How much power does all this require? It's enough to make an engineer cringe — a meagre few watts!

What about the brain's higher capabilities — such as its capacity for inventiveness or 'original' thought? What was special about Mozart's brain circuits that enabled him to start composing music before he was 5 years old, or in Leonardo da Vinci's case, to design flying machines 500 years ahead of his time?

Sadly as yet we have no idea since so little is known about the brain!

Inputs and Outputs

All this uncertainty has not stopped a growing number of systems engineers and scientists from looking at the brain's organisation and operation (possibly with the idea of wanting to copy techniques in future systems!).

We can certainly find some aspects of central nervous system operation in common with computers. Both systems have of course what might be loosely termed 'input' and 'output' peripherals, for example. In the case of the brain the inputs are from the senses of the body, not only the primary ones of sight, hearing, smell and taste but also from many thousand of receptors near the surface of the body for various parameters such as temperatures and pressure.

Its outputs go to activate all the muscles in the body. This flow of information demands an enormous number of nerve fibres to convey it — up to a million nerve fibres are estimated to be associated with each major limb alone.

All of this of course prompts the question: "How does this information transfer take place?" To understand this we have to look at the most basic component of the whole system — the nerve cell itself.

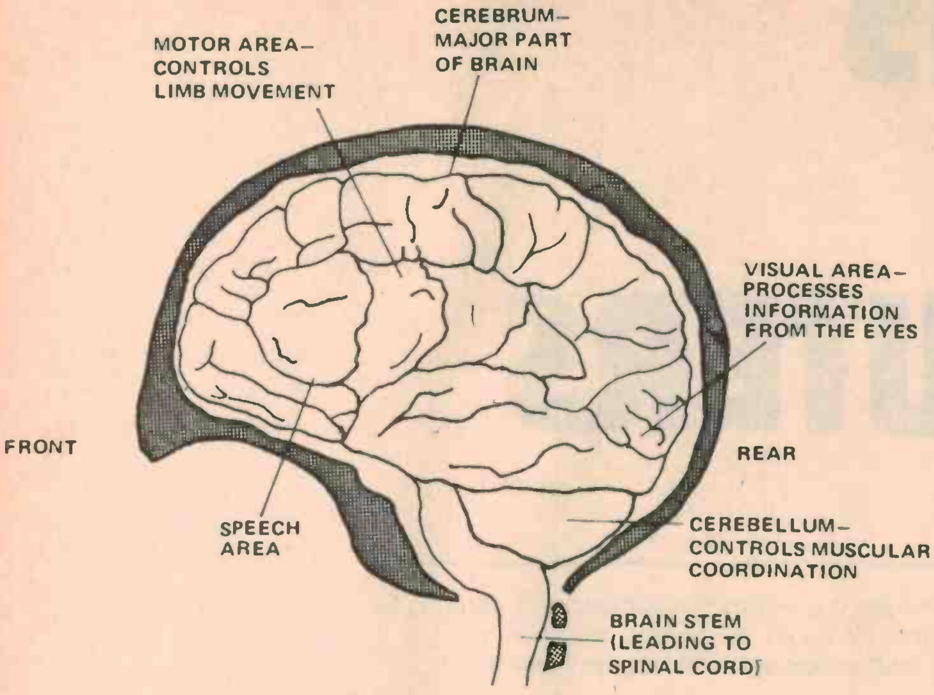
Neurons

If we could remove a typical nerve cell from our bodies and look at it under a high power microscope, it would look something like Fig 1. Remember, this cell is probably only a few micrometres in diameter so what we're about to describe is a microscopic system-within-a-system.

The cell picks up signals from the other cells in its vicinity and these are fed down to the main part of the cell (containing the nucleus) and propogated along the long transmitter branch (axon) to the next cell.

It's along the inside of these long membranous branches that the electric impulses (or action potentials) are transmitted by the nerve.

The axon is no mere passive wire, however. If it was, the signals would soon be drastically attenuated by the leakage of the membrane to the outside after a very short travel. The cell membrane instead acts as its own signal booster to maintain the impulse at constant amplitude (about 100 mV) at any point on the axon. The action potential is either there or it isn't — there is no in-between state. A digital system? Perhaps. In fact, it's the frequency at which the action potentials are signalled that carries the information. We can now see why so many nerve fibres are needed to carry information. Each cell — and probably many others for the



sake of redundancy — carries one 'bit' of information. The importance of this information depends on the frequency it is being signalled and it is likely that a high frequency signal establishes a higher priority than a lower frequency signal a particular context — rather like signalling an 'interrupt' in a computer system.

Simple as it is, a frequency-dependent system carries its own problems. The sense organs must make amplitude-to-frequency code conversions for transmission down the fibre and at the other end, the brain must find a way of coping with a frequency-dependent signal.

A secondary point is that all the nerve cells concerned with a particular function or sub-function work in parallel. The advantages of parallel processing are fairly evident. It's faster than serial and has a higher signal-to-noise ratio (even if it does need more channels).

So we can visualise action potentials — small spikes of voltage — being flicked up and down all the nerve fibres in the body at varying frequency, but not nearly as fast as electrical impulses through cables. However, even in this, nature squeezes all the performance it can out of the human nervous system. Each nerve cell is wrapped in several layers of fatty tissue with 'nicks' or 'breaks' in the fat at intervals along the axon. The effect of these 'breaks' or 'nodes of Ranvier' as they are known is to increase the speed of transmission of the action potentials down the nerve axon to about 100 metres per second.

Delaying Tactics and Logic Gates

If neurons propagate the action potentials, then it is the junctions between neurons (synapses) that route them. It's the synapses which work out if the incoming signals are of the right type and frequency to trigger the following cell to produce an action potential. From the point of view of the system, the synapses are the delay lines, one-way valves, triggers and gates all rolled into one.

It takes an electron microscope to even *see* the synapse regions and even then they don't look very special — they're merely bulbous terminations where nerve cells meet each other. Except that they don't meet each other — they're always separated by the absolutely microscopic distance of about 200 A — so tha action potential never gets across even the gap, let alone down the other side.

What actually crosses the gap is not the electric signal itself but a very small quantity of hormone which is released from the transmitter bulb. The hormone crosses to the receptor membrane where (by a process that's not fully understood) it causes the generation of another action potential. Even across so small a gap the chemical transmission takes a finite time and is susceptible to interference by foreign chemicals (drug addicts please note — your synapse may be switched off!).

Some synapses, instead of generating an action potential in the receptor membrane actually inhibit it from doing so — so we've found the on-off switches for the nervous system. Can we identify Boolean logic, gating arrangements in the nervous system? It's possible to speculate in thos terms and certainly the basic mechanisms seem to be there, but unfortunately not enough is known about even simple neuron groups to permit an answer to this question.

Don't Believe Your Eyes!

The nervous system can do some very sophisticated things to the input signals it receives by way of data processing. It can, for example, selectivity inhibit the triggering of neurons that carry no useful information in favour of ones that do.

This so-called 'lateral inhibition' not only cleans up potentially noisy channels by making them more 'contrasty' but in some animals is known to help the eye resolve very efficiently the boundaries between dark and light edges in an image. It probably occurs in the human nervous system as well where it is thought to give rise to some of the more common optical illusions as a by-product.

So much processing sophistication backing up the senses means that the brain can work on far less sensory information than it usually gets. For example, the brain really only requires a few per cent of the data it receives from the eyes in order to form a valid judgement as to the nature of the image. The same applies to the ear — speech has to be very badly distorted before the brain cannot recognise it. There is obviously a very close and complex interaction between the senses and the memory, which is continually generating possible 'best-fit' models to match the latest information received. Each model is discarded until the brain is satisfied with the result.

Our senses show a fantastic sensitivity to the world around us — we *can* hear a pin drop in a quiet room. More staggering still, the vibration amplitude of the ear drum which the miminum audible sound creates is *less than the diameter of one hydrogen atom . . .!*

Down Memory Lane

Digital computers have clearly-defined memory locations which are usually addressed under the control of a clocked pointer in the system. The human brain on the other hand seems to have no all-powerful organ of memory — attempts to find one have so far proved inconclusive. Rather, memory is a property of the system as a whole.

Secondly, data storage on a computer tape or disc is permanent until deliberately erased but information flow through the brain is far more dynamic and its retention more selective. Information floods into our brains from our senses at every living moment. Seen in this light it is neither desirable nor even possible to store it all. 'Store only the information that is important' the brain says to itself — but what is counted as being important?

Basically, we pick out the information about the *changes* in our environment, because it's the changes in it which may be threatening our immediate survival.

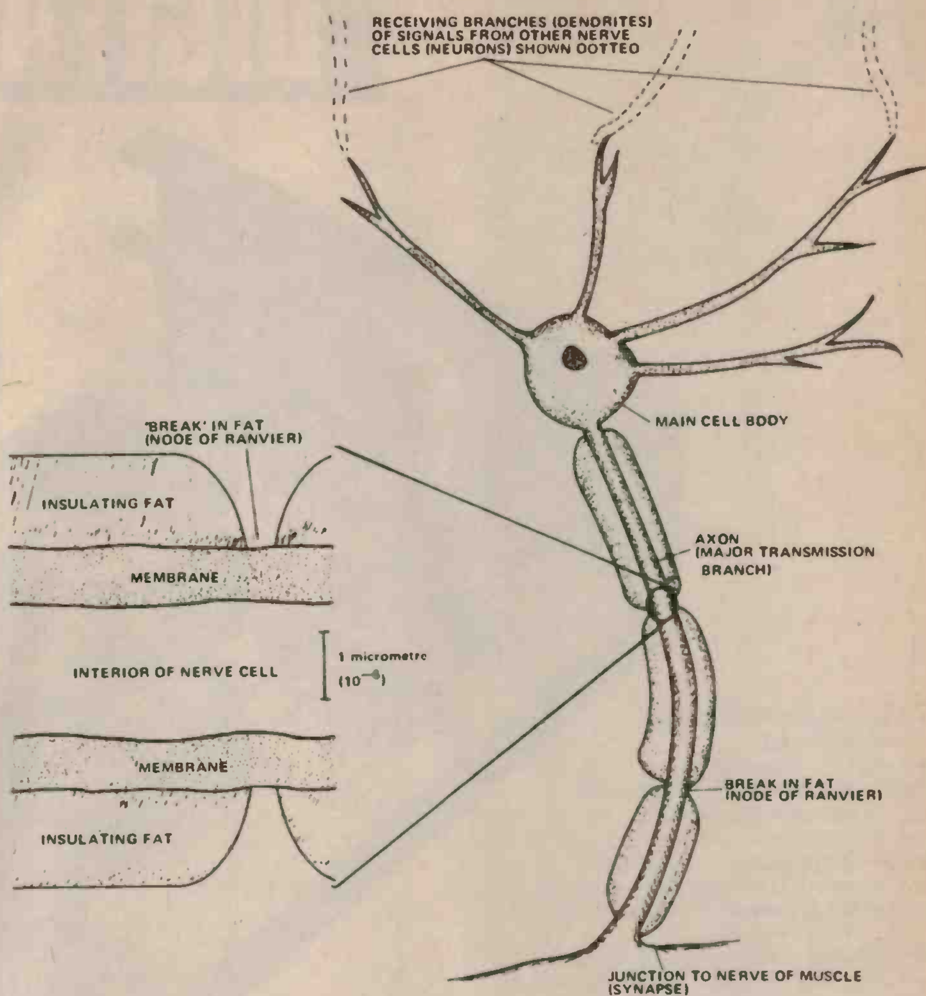
On a motivated level, we can store items deliberately. We remember by repetition (e.g. a telephone number). Most importantly we store information which is associated with something which has caused us great pain or pleasure in the past. How do we recall information once stored? It's clear that association plays a critical role. After all, we store not isolated events but connected ones — 'trains of thought' if you like. The memories are recalled when the right key of stimulus is provided. This stimulus may well be a piece of information associated with the group.

For example, the question "What do you remember about November 22nd 1963?" would probably elicit a blank reply from most people until (as various commentators have pointed out) they are told it is the day when President John F. Kennedy was assassinated. Many people can recall where they were or what they were doing — it's a memory that persists over 14 years because it is associated with such a traumatic incident.

In this way we can visualise the human memory almost as 'conglomerates' of memories — pieces of information tied together in some fashion only requiring the right input trigger to push it all out.

Some very intriguing hypotheses about how the memory operates have been suggested. One exciting and topical suggestion is that it records information as a hologram records 3-D images in laser light. A particular part of the image is not localised to a particular part of the hologram — in fact even a fragment of the hologram can theoretically recreate the entire image, a property which makes it very similar to the brain.

We must wait for more basic information on the brain to confirm or disprove this.



Tuning into Brain Waves

We can get some idea of what all this electrical activity is like by strapping electrodes — connected to a sensitive amplifier and chart recorder — to the skull.

We will obtain a rather confusing output of signals — referred to as an *electroencephalogram* or EEG. The EEG is usually a very weak signal — a few tens of uV amplitude at a range of frequency components are present.

The most well-known component of the EEG is the o-wave. Present in about 90% of all individuals, this signal (with a frequency between 8 Hz and 13 Hz) is at its most active when the subject is relaxed and his eyes closed. It disappears as soon as the subject opens his eyes or starts to concentrate on something like mental arithmetic.

What does it mean? Basically, we don't know. Nor do we know where or how it's generated, although its source (there may be more than one) *seems* to be located to the upper rear of the brain. Correspondingly little is known about the other EEG components.

Although the EEG doesn't give a great deal of information about the working of the brain (indeed we'll probably have to wait until further studies of the brain explain the EEG!), it has found great use in diagnosis of brain disorders such as epilepsy. But could the EEG have a more fundamental significance than that? My own pure piece of speculation — for what it's worth — it that it's the brain's clock, although it's too low in frequency to cope with many of the fast muscular actions of the body. Even so the 'ticking' of a brain might have a biological significance similar to a digital system's 'clock frequency'!

ETI 318
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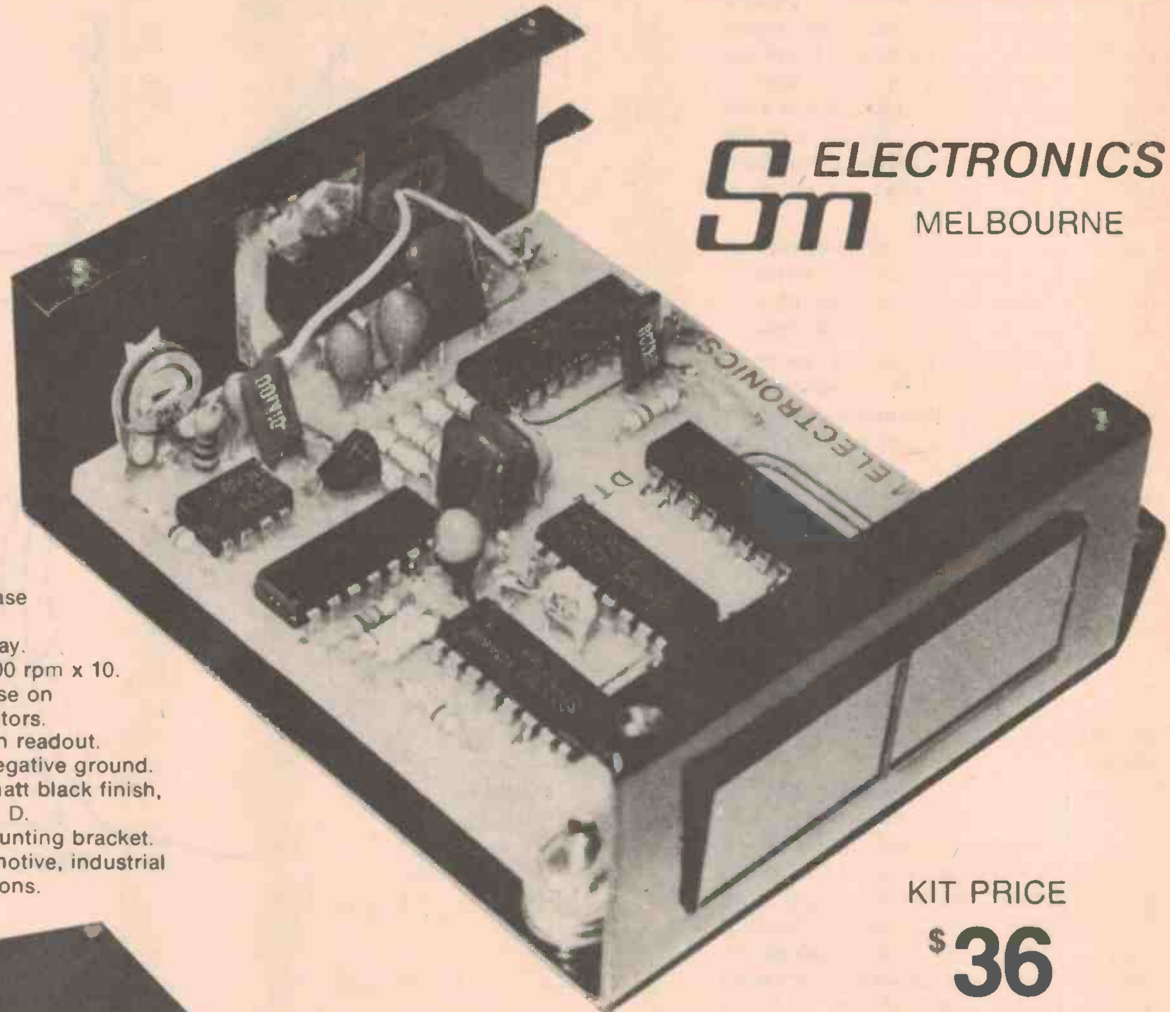

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1N4733	5.1v	1 W Zener	.25
1N753A	6.2v	500 mW Zener	.25
1N758A	10v	"	.25
1N759A	12v	"	.25
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4017	.75
4018	.75
4019	.35
4020	.85
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4025	.20
4026	1.95
4027	.35
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4046	1.25
4049	.45
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MC 14419	4.85
4511	.95
74C151	1.90

– T T L –

7400	.10	7473	.25	74176	.85	74H72	.35	74S133	.40		
7401	.15	7474	.30	74180	.55	74H101	.75	74S140	.55		
7402	.15	7475	.35	74181	2.25	74H103	.55	74S151	.30		
7403	.15	7476	.40	74182	.75	74H106	.95	74S153	.35		
7404	.10	7480	.55	74190	1.25			74S157	.75		
7405	.25	7481	.75	74191	.95	74L00	.25	74S158	.30		
7406	.25	7483	.75	74192	.75	74L02	.20	74S194	1.05		
7407	.55	7485	.55	74193	.85	74L03	.25	74S257 (8123)	1.05		
7408	.15	7486	.25	74194	.95	74L04	.30				
7409	.15	7489	1.05	74195	.95	74L10	.20	74LS00	.20		
7410	.15	7490	.45	74196	.95	74L20	.35	74LS01	.20		
7411	.25	7491	.70	74197	.95	74L30	.45	74LS02	.20		
7412	.25	7492	.45	74198	1.45	74L47	1.95	74LS04	.20		
7413	.25	7493	.35	74221	1.00	74L51	.45	74LS05	.25		
7414	.75	7494	.75	74367	.75	74L55	.65	74LS08	.25		
7416	.25	7495	.60			74L72	.45	74LS09	.25		
7417	.40	7496	.80	75108A	.35	74L73	.40	74LS10	.25		
7420	.15	74100	1.15	75491	.50	74L74	.45	74LS11	.25		
7426	.25	74107	.25	75492	.50	74L75	.55	74LS20	.20		
7427	.25	74121	.35			74L93	.55	74LS21	.25		
7430	.15	74122	.55			74L123	.85	74LS22	.25		
7432	.20	74123	.35	74H00	.15			74LS32	.25		
7437	.20	74125	.45	74H01	.20	74S00	.35	74LS37	.25		
7438	.20	74126	.35	74H04	.20	74S02	.35	74LS38	.35		
7440	.20	74132	.75	74H05	.20	74S03	.25	74LS40	.30		
7441	1.15	74141	.90	74H08	.35	74S04	.25	74LS42	.65		
7442	.45	74150	.85	74H10	.35	74S05	.35	74LS51	.35		
7443	.45	74151	.65	74H11	.25	74S08	.35	74LS74	.35		
7444	.45	74153	.75	74H15	.45	74S10	.35	74LS86	.35		
7445	.65	74154	.95	74H20	.25	74S11	.35	74LS90	.55		
7446	.70	74156	.70	74H21	.25	74S20	.25	74LS93	.55		
7447	.70	74157	.65	74H22	.40	74S40	.20	74LS107	.40		
7448	.50	74161	.55	74H30	.20	74S50	.20	74LS123	1.00		
7450	.25	74163	.85	74H40	.25	74S51	.25	74LS151	.75		
7451	.25	74164	.60	74H50	.25	74S64	.15	74LS153	.75		
7453	.20	74165	1.10	74H51	.25	74S74	.35	74LS157	.75		
7454	.25	74166	1.25	74H52	.15	74S112	.60	74LS164	1.00		
7460	.40	74175	.80	74H53J	.25	74S114	.65	74LS193	.95		
7470	.45			74H55	.20			74LS367	.75		
7472	.40							74LS368	.65		

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9301	.85	95H03	1.10
9309	.35	9601	.20
9322	.65	9602	.45

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LM301	.45	LM320T15	1.65	LM340K24	1.25	LM741 (8-14)	.25
LM308 (Mini)	.95	LM324N	1.25	78L05	.75	LM747	1.10
LM309H	.65	LM339	.75	78L12	.75	LM1307	1.25
LM309K (340K-5)	.85	7805 (340T5)	.95	78L15	.75	LM1458	.65
LM310	.85	LM340T12	.95	78M05	.75	LM3900	.50
LM311D (Mini)	.75	LM340T15	.95	LM373	2.95	LM75451	.65
LM318 (Mini)	1.75	LM340T18	.95	LM380 (8-14 PIN)	.95	NE555	.35
LM320K5 (7905)	1.65	LM340T24	.95	LM709 (8, 14 PIN)	.25	NE556	.85
LM320K12	1.65	LM340K12	1.25	LM711	.45	NE565	.95
						NE566	1.25
						NE567	.95

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MM5316	3.50	8251	8.50
2102-1	1.45	8255	10.50
2102L-1	1.75	8T13	1.50
2114	9.50	8T23	1.50
TR1602B	3.95	8T24	2.00
TMS 4044-	9.95	8T97	1.00
		2107B-4	4.95
8080	8.95	2708	9.50
8212	2.95	Z80 PIO	8.50

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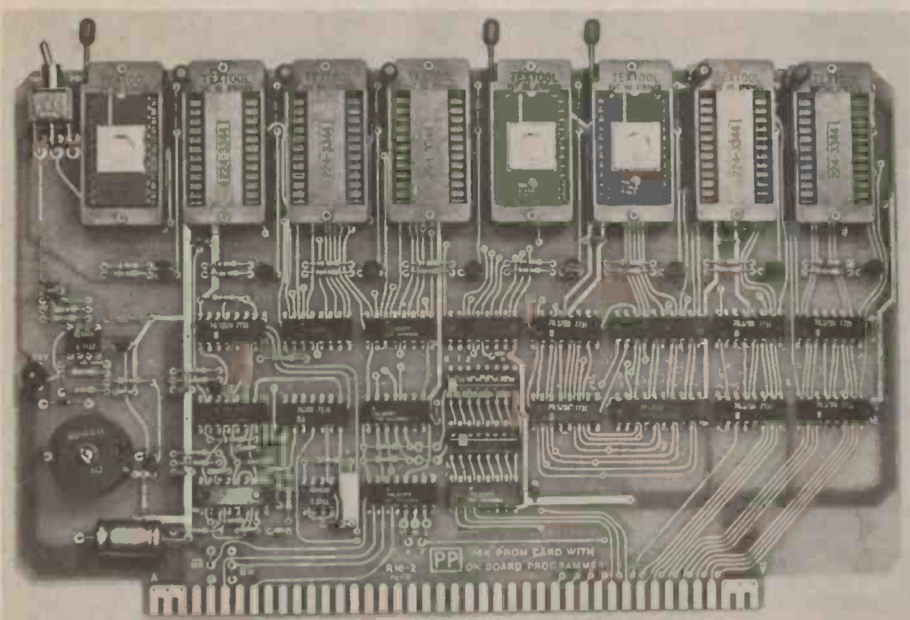
PRINTOUT

ETI's COMPUTER SECTION

NEWS

16K 2716 PROM Card

This versatile memory card from Pennywise Peripherals provides 16K of 2716 PROM storage together with an integral programmer which can program any PROM location on the card. The card is extremely easy to use. It plugs directly into the microprocessor bus and needs no other control signals apart from the normal memory READ/WRITE lines. It looks, to the processor, just like ordinary RAM memory.



PROMs can be read, using ordinary memory reference instructions, or have programs executed out of them just as for a simple PROM memory card. All PROMs not actually in the process of being read or programmed are automatically held in the "power-down" mode thereby minimising power consumption.

To program a location in any of the PROMs, the microprocessor simply stores, with a normal memory write instruction, the required data in the actual address on the PROM Card. The data and address are latched, V_{pp} is raised to 25V, and the selected PROM is automatically pulsed for the correct time. All setup and hold times can detect when programming of the location is complete simply by reading the same address and checking the validity of the data: invalid data is automatically returned until the programming cycle is completely over.

The 25V supply required during programming is generated on-board by a switching supply so that the whole Card runs from only +5V. Because any of the 16K locations on the Card can be programmed by a single store instruction, data can be "typed" straight in using the usual microprocessor monitor command to "change memory" or "insert in memory".

The 16K bytes on the Card are divided into two 8K blocks each of which is switch selectable to any 8K area within 64K. A write protect switch is provided to prevent accidental programming of

COMPUTER CLUB DIRECTORY

Sydney: Microcomputer Enthusiasts Group, P.O. Box 3, St. Leonards, 2065. Meets at WIA Hall, 14 Atchison St., St. Leonards on the 1st and 3rd Mondays of the month.

Melbourne: Microcomputer Club of Melbourne, meets at the Model Railways Hall, opposite Glen Iris Railway Station on the third Saturday of the month at 2 p.m.

Canberra: MICSIG, P.O. Box 118, Mawson, ACT 2607 or contact Peter Harris on 72 2237. Meets at Building 9 of CCAE, 2nd Tuesday of month at 7.30 p.m.

Newcastle: contact Peter Moylan, Dept. of Electrical Engineering, University of Newcastle, NSW 2308. (049) 68–5256 (work), (049) 52–3267 (home).

Brisbane: contact Norman Wilson, VK4NP, P.O. Box 81, Albion, Queensland, 4010. Tel. 356 6176.

New England: New England Computer Club, c/- Union, University of New England, Armidale, NSW 2351. (New club; not restricted to students)

Auckland: Auckland Computer Club, P.O. Box 27206, Auckland, N.Z.

Computer clubs are an excellent way of meeting people with the same interests and discovering the kind of problems they've encountered in getting systems 'on the air'. In addition, some clubs run hardware and software courses, and may own some equipment for the use of members. Try one – you'll like it!

If your club is not listed here, please drop us a line, and we'll list you. The same applies if you are interested in starting a club in your area. Also, if established clubs know their programme of forthcoming events, we can publicise them.

Centaur Industries

THE S100 SPECIALISTS
PO Box 37243, Winnellie, N.T. 5789

SEATTLE COMPUTER PRODUCTS, INC.

S-100 static RAM. Top quality assembled and tested boards backed by a full year's warranty — will work in any known S-100 system: no clocks, no refresh, no problems with DMA peripherals, no "hidden gotchas"!

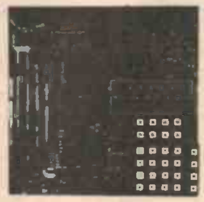
16k-250 ns	$439	8k-450 ns	249
16k-450 ns	399	4k expansion kit (450 ns)	83
8k-250 ns	279	4k expansion kit 450 ns)	93

GUARANTEED FOR ONE FULL YEAR

S.D. SYSTEMS

Top quality S-100 kits at unbeatable prices (also available assembled and tested). All boards feature sockets for all ICs, and first quality plated-through PCBs.

Z80 STARTER KIT



The ideal choice for the beginner, this is a complete Z80 system on a board. Includes 1k static RAM with sockets for another 1k, powerful 2k ZBUG monitor, extra PROM socket PLUS on-board PROM programmer. There's also a Kansas City standard cassette interface, hex keyboard and six digit display, twelve command keys, four counter/timer channels, two eight-bit parallel I/O ports, and room for you to expand: a generous 2½" x 8" wire-wrap area for custom circuitry AND S-100 INTERFACE WITH POSITIONS FOR TWO S-100 EDGE CONNECTORS ON BOARD.

Comprehensive documentation including full operating and programming guides. Power requirements: +5v at 1A, +25v at 30 ma. (for PROM programming).

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assembled and tested $399

SBC-100 SINGLE BOARD COMPUTER — much more than just a CPU board, it combines the Z80 CPU with 1k RAM, four PROM sockets for 4k or 8k of ROM storage, fully programmable synchronous/asynchronous serial I/0 (RS232 or 20 ma. current loop), parallel input and output ports, 4 counter/timer channels and 4 vectored interrupts.

Replaces 3 or 4 boards in many systems!

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assembled and tested $369

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THE BEST VALUE IN FLOPPY DISC CONTROLLERS $159
assembled and tested 239

SHUGART FLOPPY DISC DRIVER

SA-400 5" minifloppy	$379	SA-400 cable	35
SA-800 8" std. floppy	575	SA-800 cable	39

SOFTWARE

CP/M disc operating system — the industry standard, complete with 8080/Z80 assembler and BASIC-E plus editor and utilities, on 5" or 8" floppy disc ... $125
Versafloppy control software on 2708 EPROM 25
SD Monitor (includes Versafloppy control) on PROM 50
Z80 Disc based assembler 70

LOW COST CASSETTE INTERFACE

Kansas City 2400/1200 Hz, 300 Baud. Comes partly assembled with oscillator and phase locked loop pre-tuned for trouble-free assembly. Mates with either 22 pin edge connector of 8 pin Molex connector $19.95

NEW RELEASES:

VDB-8024 VIDEO DISPLAY BOARD — Full 80 x 24 character display, complete cursor control, forward and reverse scroll, blinking, underline, reverse and field protect.

Controlled by a dedicated on-board Z80, it includes keyboard power and signal interface, plus both composite and separate video and sync.

KIT PRICE $319
assembled and tested $369

S-100 EDGE CONNECTORS — Imsai type, gold plated to suit Starter Kit and our motherboards $6.00

MEMTECH CO.

MEMTECH ARITHMETIC PROCESSOR INTERFACE

This unique product brings the number crunching power of the fabulous AM9511 arithmetic processing chip to the S-100 computer user. Full 32 bit floating point multiply in as little as 42 us. — and a full complement of transcendental functions, all far faster than software routines.

Also available is BASIC-M, a modified BASIC-E on CP/M compatible diskette which takes full advantage of the APU performance.

APU interface (without 9511 chip) $159
assembled and tested $179
APU interface with 2 MHz 9511 .. $385
assembled and tested $399
APU with 4 MHz 9511 .... $485
assembled and tested $499
BASIC-M on 8" CP/M format floppy disc $29

Available soon: modified versions of CP/M compatible FORTRAN and PASCAL compilers

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CENTAUR S-100 POWER SUPPLY

Professional quality power supply with rugged, generously rated transformer, top grade filter capacitors (the ones NASA use!), fully fused, transient protected, AC line filter — gives +8v at 22A. ±16v at 3A, AND +28v at 3A for floppy discs and/or PROM programming supplies $349

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EXPANDOPROM BOARD — Takes either 2708 or 2716 EPROMS for up to 32k. Comes complete with all support chips and sockets etc. (EPROMS not included). KIT PRICE $99
assembled and tested 189

EXPANDORAM — High density dynamic RAM, compatible with SD Systems Z80 CPU boards and the Versafloppy controller. Designed to work with 8080 and 8085 CPUs as well, these boards come in 32k and 64k models, which can be purchased partly populated for later expansion if needed.

32k model (uses 4115 RAM)			64k model (uses 4116 RAM)		
Size	Kit	A&T	Size	Kit	A&T
8k	$199	$379	16k	$499	$595
16k	299	449	32k	689	849
24k	399	519	48k	869	1099
32k	475	599	64k	1049	1299

STRUCTURED SYSTEMS GROUP — Quality business-oriented software designed for use under the CP/M operating system.

CBASIC — Runs on any 8080 or Z80 system with 20k or more and CP/M. Powerful disc access features — random and sequential files including variable length records. Enhanced control structures (WHILE . . . WEND, optional ELSE clause and STATEMENT LIST improvements to the IF statement), source library facility, machine language routine linkage, powerful PRINT USING, 14 BCD digit arithmetic for accurate financial calculations, and many more powerful features make this the BASIC for business applications. CBASIC is a compiler, so your programs run faster, use less memory, and are much more secure against software piracy

ON 8" CP/M FORMAT DISKETTE WITH USER MANUAL $99.95

QSORT — Runs on any CP/M system. A full disc sort/merge package — easy to use and very flexible.

ON 8" CP/M FORMAT DISKETTE WITH USER MANUAL $95

NAD — A complete name and address database system with a number of powerful user options. Requires CP/M, 32k and a 132 column printer — it can select records on any field including a user-definable field — print mailing labels — many powerful uses can be easily programmed.

ON 8" CP/M FORMAT DISKETTE WITH USER MANUAL $79

WAMECO, INC: QMB-12 S-100 MOTHERBOARD — 13 slot motherboard complete with all parts and connectors. Features extensive ground plane and termination of all signal lines, I/O area with 3 regulated voltages.

KIT PRICE $125
assembled and tested $145

COMING SOON —

Centaur 2000 disc based S-100 business system.

Post, packing and insurance included in price — add 15 percent sales tax. Dealer enquiries invited.

PROM locations. All bus signals are buffered with low powered schottky TTL and the bi-directional data bus is driven by tri-state buffers.

The PCB is 247.5 x 152.5mm and has plated through holes with a solder resist coating. The edge connector is for the Motorola EXORcisor[R] bus (43 x 2 way 0.156") and used by the popular MEK 6800D2 Kit. However, the read/write control logic is jumper selectable for a variety of schemes other than the M6800, such as 6502, 8080/85, 2650, SC/MP.

The Card is available fully assembled and tested with low insertion force sockets standard for the 2716s. Zero insertion force sockets are provided as an optional extra. The standard price is expected to be $197.30 excluding sales tax plus $38.70 for all zero insertion force sockets. 2716s are extra. Pennywise Peripherals, 19 Suemar St, Mulgrave, Vic, 3170. (03) 546 0308.

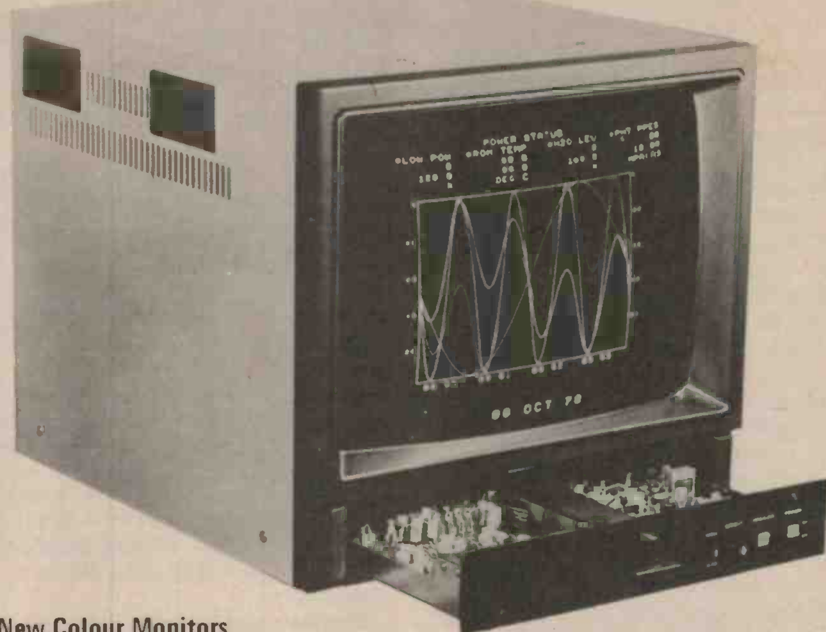
Marrickville Microcomputer Society

On the 11th September, the Marrickville Microcomputer Society was formed at the Addison Road Community Centre (in Marrickville, obviously). The initial meeting featured a display of four of the more popular microcomputer systems, and was well attended, mainly by local supporters of the centre. The objectives of the Society have not yet been formally set out, but obviously involvement with youth and community is high on the list of priorities. As the Society's secretary, Justin Walsh, told us, 'The young unemployed members of the centre were a little untimidated by all the expertise and I suppose that was to be expected; after all, computer people are all supposed to be super whiz kids with above average intelligence. A lot of patience will be needed to convince these kids that they, too, can learn to use these machines and a university degree is not absolutely necessary'.

Although the club does not yet have a regular meeting place, plans are in hand for fund raising activities, including a raffle with a TRS-80 computer as first prize. Anyone interested in assisting the club in their various endeavours should contact Justin Walsh at 26 Malakoff Street, Marrickville 2204 or phone him on 569 5689.

Monash Club

A new club, the Monash Personal Computer Club, is now operating at Monash University. At present all members are students at the University, but membership is open to any member of the public. Contact them at: Monash Personal Computer Club, c/- Union Building, Monash University, Clayton, Vic 3168.



New Colour Monitors

Aydin Controls of Fort Washington, Pennsylvania, has released a series of new high resolution red-green-blue colour video monitors which are specifically designed for the display of computer-generated text, graphics and image data, with displayable resolutions of up to 1024 elements or 1024 raster lines. This performance is made possible through the use of ultra-fine pitch shadow mask CRT's and extremely stable video deflection circuits.

The Model 8024 13" and Model 8025 19" monitors have a 15 MHz video bandwidth and a horizontal frequency of 15 kHz to 18 kHz. The Model 8026 is a fast-scan monitor with a 25 MHz video bandwidth and 28.3 kHz to 34.6 kHz horizontal frequency. All units provide easily adjustable, extremely stable convergence circuitry. The convergence adjustments are sectorised to correspond to 10 areas of the CRT screen with independent RGB controls for each of the 10 screen areas which are independent of each other, thus making adjustment of convergence simple and straight-forward.

Full details are available from *Datatel Pty. Ltd., Suite 4, 3 Raglan Street, South Melbourne, 3205.*

IBM Pips TI

Although TI have released their 64K dynamic RAM, they weren't as quick off the mark as IBM, who are not only making the chips, but have released their first product using them. The giant computer manufacturer really shook industry observers by releasing the 8100, a distributed processing system, at half the price everyone expected – partly due to the use of large dynamic RAMs. Looks like the giant wasn't as sluggish as everyone thought; maybe he was only sleeping! If IBM have the technology to make 64K RAMs, it stands to reason they have similar technology in microprocessors. Watch this space . . .

Bit Pad for TRS-80

Computer hobbyists may have noticed ads in US magazines for the Bit Pad, a digitizer which can be used to enter graphics into a microcomputer. A major problem for users of the PET, Apple-II and other 'software oriented' computers has been the construction of a suitable interface to get the data into their system. Summagraphics are now offering an interface for the Bit Pad to the TRS-80 which is supplied with a cassette containing the necessary software. The interface, which costs US$175 in the States, allows the use of all other TRS-80 accessories. Summagraphics, 35 Brentwood Ave., Fairfield Conn. 06430.

Silicon Cast Pascal Processor

Western Digital Corporation has developed a 16-bit computer chip set that directly executes Pascal object programs at least five times faster than is possible with conventional system software and eliminates the previously required host operating system and interpreter. The company will sell its state of the art development both as a chip set and as a packaged software development computer to both OEM's and personal computing stores.

Designated the Pascal *Microengine* product line, the chip set standardizes the version of Pascal offered by the University of California at San Diego. UCSD's language for business, industrial and computer aided instruction applications. It was derived from (and is source compatible with) the original Pascal developed in 1971 at the Swiss Institute of Technology.

'The heart of the UCSD system is the 'ideal' pseudo machine called the 'P-machine' ', Dr. Lotito, Vice President and General Manager, Computer Products Division, explained, and we have implemented this idealized machine directly in a chip set using LSI technology. You might say we have made the first 'sand-casting' of something that previously had been available only as a software product.'

The UCSD software system includes a complete Pascal operating system: Pascal compiler, BASIC compiler, file manager, screen-oriented editor, debug program and graphics package, all written in the Pascal language.

In addition to the expanded business opportunity for Western Digital, Dr. Lotito sees the *Microengine* concept as making a number of important contributions to the computer industry. 'First, we have built an engine to drive well-established, field-proven software,' he said. 'That, in itself, is a major innovation in the computer industry, which has been talked about for many years. We have further increased the performance level of microcomputers to a point where they are competitive with larger, more expensive systems for business applications, industrial control, educational systems, and so forth.

'We have significantly lowered the cost of computer power at the system level by utilizing LSI technology in the disk controller, communications controller, DMA controller and other processor support functions, as well as in the processor itself.' The *Microengine* approach also reduces memory requirements of the UCSD system by a minimum of 25 percent by eliminating the host operating system and interpreter.

'Pascal is becoming one of the world's most popular languages, and we expect that the Western Digital development will contribute toward even more widespread acceptance,' Dr. Lotito said.

UCSD Professor Ken Bowles, who has been deeply involved in development of Pascal in the US, agreed that the Western Digital announcement should 'go a long way towards boosting Pascal's popularity among the user community.

'We are very excited; we've been hoping this would happen,' he said. 'The original version of Pascal was designed for teaching programming, and there were no provisions, for example, for using it with rotating disk storage files. We have attempted to outfit the language with these 'missing links' to make it commercially suitable,' he continued.

Bowles noted that there are more users of UCSD's Pascal today than users of all other versions combined. Western Digital and UCSD have agreed to mutually support this LSI implementation as the true UCSD standard.

Technical Information

The chip set is comprised of four LSI (MOS) components:

An arithmetic chip that contains micro-instruction decode, ALU, and the register file.

A micro-sequencer chip that contains macro-instruction decode, portions of the control circuitry, micro-instruction counters, and 1/0 control logic.

Two MICROM chips (each 22 bits x 512) that contain the micro-instruction ROMs and micro-diagnostics.

Additional features of the *Microengine* chip set include user-defined bus configuration, four levels of interrupts, single- and multi-byte instructions, hardware floating point, stack architecture, 3.0 MHz four-phase clock (75 nanoseconds per phase), and a TTL-compatible three-state interface.

The desktop computer features the 16-bit *Microengine* processor, 32K words (64K bytes) of RAM memory, full DMA control functions, fully-integrated floppy disk controller, two RS-232 asynchronous ports, and two 8-bit parallel ports – all on a single 8 x 16 board, and three power supplies (+12V, +5V and –5V) packaged in a low-profile (5¼ inches high x 16¼ x 13½) stylized enclosure.

Further details will soon be released by *Daneva Control Pty. Ltd., PO Box 114, Sandringham, Vic, 3191* Western Digital Corporation's representative in Australia.

UK Micro Impact Survey

A recent survey by National Opinion Polls Ltd. in the UK has turned up some interesting facts about people's attitudes to automation, microelectronics and computers. These topics have been the subject of intense discussion by Government, unions and the media in Britain, and of course, hit the headlines here during the recent strike by Telecom technicians.

In April the BBC's documentary series 'Horizon' showed a 50 minute film entitled 'Now the Chips are Down', which dealt with the employment consequences of microelectronics and data processing, and the poll was the first indication of public opinion on the matter. The theme of the film was that the microprocessor will change the face of employment and that by the 1980's, unless something is done soon, the UK could face unemployment three to four times higher than the present 6%.

The survey was conducted on a sample of 1 001 people in various types of employment nationally. It showed that 25% of people expected computers to put 'lots' of people out of work and 41% expected them to put 'some' people out of work. Only 16% expect computers to create more jobs.

Breaking the sample down according to type of employment revealed that fears of unemployment are highest among the unskilled. 16% of management expect computers to put 'lots' of people out of work, compared to 35% of unskilled workers who held the same opinion.

On the other hand, when asked 'Should we have more or fewer computers?', 39% said 'more', and 38% said 'fewer', with 23% undecided. Again, differences emerged between the employment classes – management were 56% 'more' and 17% 'fewer', while unskilled workers were 24% 'more' and 48% 'fewer'.

Several other interesting points emerged: when asked 'If you had the opportunity to give up work without loss of pay, would you do so?', 40% said yes and 56% no. The no vote was strongest in the 15 to 24 age group.

The statistics indicated that 7.5 million people, based on current labour statistics, would be willing to undergo retraining providing they suffered no financial loss. This would help to cushion the effects of technology as people move to employment in other areas.

Whatever the survey indicates, it is certain that the introduction of microprocessors-based automation will bring a lot of headaches and cost a lot of money.

64K Dynamic RAM

Sample quantities of a new 64K dynamic random-access memory (RAM) priced at US $125.00 each are now available in the US, Texas Instruments Incorporated announced today. Volume production is scheduled for the first quarter of 1979.

Organized as 64K x 1, the TMS 4164 is expected to be the first available single 5 volt 64K dynamic RAM on the market. It comes in a 16-pin, 300-mil standard dual-in-line package, complying with JEDEC standardized pin-out requirements and allowing upward compatibility with the 16K dynamic RAM.

The TMS 4164 single 5-volt power supply design is TTL compatible, offers considerably lower power dissipation and is more immune to system noise. Five-volt operation also reduces the effective electric field across the gate oxide offering higher system reliability. In addition, a compact layout and optimized design/process combination for 5 volt only operation results in improved performance.

Access times range from 100 to 150 nanoseconds (ns) maximum with minimum cycle times of 200 to 250 ns. Power dissipation is 200 milliwatts (mW) maximum or three microwatts maximum per bit. Comparing the 462 mW power dissipation of the 16K RAM at 375 ns cycle time, total maximum power dissipation of the new 64K RAM is reduced by 60 percent with improved cycle times while bit density is quadrupled. This advancement allows practically an order of magnitude power per bit improvement.

The TMS 4164 features a 256 cycle refresh with a 4 millisecond maximum refresh period, as a result of the lower power dissipation. This refresh period is a 100% improvement over the 2 millisecond refresh period of current 4K and 16K RAMs. The small chip size of 33,000 square mils is a significant contributing factor to lower production costs and improved reliability.

Due to TMS 4164 refresh compatibility with the 16K RAM, the basic refresh controller timing does not require major changes. The only provision required is for an 8-bit refresh counter/multiplexer when upgrading to 64K from a 16K system. Also contributing to higher system operating efficiency is a 1.3 to 1.6% refresh overload time, compared to 2.4 percent on the 16K RAM.

Two clocks, RAS (row address select) control the gating of the 8-bit addresses so that timing characteristics are essentially identical to the TMS 4116 16K RAM. Row address set-up time is zero nanoseconds; hold time, 15 ns. Column address set-up is –5 ns and RAS/CAS spacing is 15 and 50 ns. This allows the system designer a full 35 ns interval to change addresses and bring CAS low, without extending access time beyond 150 ns.

Photomasks for TMS 4164 volume production will be manufactured with electron-beam equipment to control geometries to better than 0.25 microns. Projection printing will also be employed to avoid direct contact between photomask and wafer. Additionally, geometries at several critical levels of the TMS 4164 are 2.5 to 3 microns, demanding use of positive photo-resist for resolution and delineation control as well as dry processing at critical levels. Further details from Texas Instruments.

The Thinker Toys Econoram III

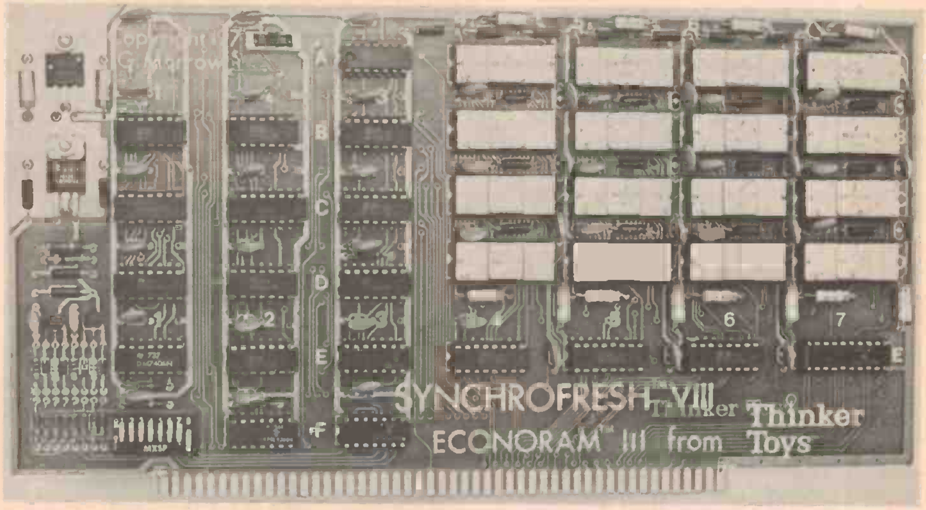
Les Bell reports on a popular, low cost dynamic memory board.

AS I HAVE commented in these pages before (and no doubt will do so again), the biggest and most expensive part of a computer system usually turns out to be memory. Every computer needs memory to store and execute programs, and if you are a computer hobbyist, you will often find yourself in the exasperating position of having insufficient memory to run the programs you want. Most computer hobbyists, in fact, once they have got their system up and running with the basic I/O requirements, spend most of their money thereafter on memory — at least until they start to get I/O-bound because they want to control their ham shack, or some such application.

The pattern is fairly predictable: eager computer freak gets his CPU board, evaluation kit or whatever up and running, using serial I/O to a VDU, and starts writing and running simple programs in machine code using the kit's small monitor program. He's probably only got 256 or 512 bytes of memory, and he's unlikely to fill that if he's programming in machine code, so for a while he's happy writing short games programs or clocks or whatever. But he gets bitten by the bug that gets us all in the end, and wants to write longer programs, preferably using an assembler.

That starts it. He needs more memory, so he buys a couple of 4K boards or maybe an 8K. Now he can run an assembler and all kinds of things become possible. But now is he satisfied? No way, he's had a taste of power, and now he wants to run BASIC.

This is fine; he can get a BASIC that will run in 8K, but soon he notices that all the great programs that appear in the American mags use Extended BASIC with all the fancy string handling functions, PRINT USING, etc. And of course there's no way it will fit in his 8K, which now seems very tiny indeed. So off he goes for another 8K. And so it goes on. . .



The Cure

There's no cure for Memory Madness. You can't do without it. Even if you take up photography instead, you'll just end up with Lens Madness. The only thing you can do is give in to the craving, while trying to stop it bankrupting you.

Being in the market recently for 8K to give my system some 'get up and go', I looked around at what was available, and my eyes came to rest on the Thinker Toys Econoram III 8K RAM card.

Now, this card was designed by George Morrow, alias Morrow's Micro Stuff, whose front panel design was given good reports in this magazine back in August 1977. In fact, a Morrow front panel forms the heart of my system, and based on my experiences with it, and the very cunning logic design on that card, I figured that the Econoram III was a pretty safe bet.

The Econoram III utilises dynamic memory devices of the 2107 type, which offer two major advances over static types — they are cheaper, and they consume less power. Of course, there is a drawback to dynamic memory in the form of the refresh circuitry that is required, and this has been the problem with most dynamic memory cards that have been produced to date, and indeed, is the reason why, even now, most new designs use static RAMs. Early dynamic memory boards suffered from extremely complex refresh logic — one had 35 ICs and a delay line, while another design had to be laid out on a five-layer board!

The Econoram III, however, doesn't have masses of complex logic — instead George Morrow has been very cunning in the design of the refresh circuitry. Many boards operate asynchronously with respect to the system bus, and this is the reason for the use of complex circuitry to arbitrate bus contentions when the processor and the refresh logic both try to access the memory at the same time. Instead of this scheme, Morrow has designed the Econoram III to operate in synchronism with the bus, using a scheme called Synchrofresh.

Synchrofresh

The refresh circuitry of this board assumes that the bus signals are being generated by an 8080 or 8080A microprocessor; in other words, that it is a 'genuine' S100 bus (whatever that is!). The 8080 does not access the memory during certain machine states, for example, when it has just done an instruction fetch and is decoding the instruction to decide what to do next.

Using a finite state machine (really just a counter IC) to decide what type of memory cycle the processor is executing, the circuitry 'weaves' the refresh timing into the processor's memory accesses, without interfering at all.

Because of this, the refresh circuitry is less complex and is more reliable; in fact, it is virtually foolproof.

Of course, there is a drawback: the Z-80 CPU produces slightly different timing waveforms from the 8080, and this can trick the Synchrofresh circuitry; however, Thinker Toys warn of this problem in the manual, and give a list of other boards which are known to 'confuse' the Econoram III, such as the Cromemco Dazzler.

Construction

The board was supplied fully assembled and tested — in the US, Thinker Toys actually charge $10 more for the kit than the assembled version, reflecting the fact that people often have problems with kits this complex, find themselves out of their depth, and have to return them for service. The board is double sided, through hole plated, and finished with a solder mask and silk screening to indicate component locations. The dynamic memory array occupies the top right-hand side of the board, with te refresh circuitry to the left and bus buffers towards the lower edge of the board. All ICs are socketed.

The manual supplied with the board is excellent, and based on it, there would probably be little difficulty in building up a kit, although getting it to work is a different matter, as the circuit operation is extremely cunning. The manual describes the operation of the circuitry in some depth, and covers the configuration of the board, which is basically just setting up the two 4K blocks of memory at the required addresses.

A memory diagnostic program is given which is specially written to punish the address drivers of the dynamic RAMs and will show up any faulty bits. Listings of this program are thoughtfully provided in both octal and hex (there aren't many of us octal freaks around any more you know!).

Upon plugging the card into a system, it got up and ran with no problems at all, although, as mentioned above the CPU is also a Morrow design and one would expect the two to be compatible. From all reports, however, the Econoram III works reliable with a variety of other CPUs.

Thinker Toys warrant the board for one year if it is purchased assembled, or six months in kit form. In addition, if the board turns out to be incompatible with your system, they ask that it be returned for a refund. The price in Australia is approximately $180, assembled and tested, which is extremely good value. The board is available from *Automation Statham, 47 Birch Street, Bankstown, NSW 2200.*

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The Marisat System

Three satellites provide navigational and communications facilities to users around the world. Special ETI report.

THE INSTALLATION OF radio communication equipment on ships has consistently proved its worth since the sinking of the Titanic, when wireless was used to contact the rescue ships. Although we have progressed somewhat from the days of rotary spark gap transmitters and coherer receivers, even the use of sophisticated MF and HF single sideband equipment and VHF radio for inshore communications has not yet provided consistently high quality communications. Although ships are rarely out of communication with essential services such as weather reports, the vagaries of propagation due to the ionosphere often disrupt communications. Because of this a considerable amount of maritime communications is by Telex and even the trusty Morse Code.

The variation of performance on a particular band varies considerably with time of day (as a glance at our propagation predictions will show), and this means that communications with a particular shore station at a particular time must be on the right band. Again, signals are often subject to severe fading as well as interference from other stations, cross-modulation and all kinds of problems. This has essentially been the situation for some time now; there have been very few significant advances in the technology of marine radio since the introduction of single sideband.

The problems are aggravated by the progress that has been made in land based communications. Shipping companies are able to use computers in data communications networks to transmit information between their offices around the world, yet radio communication is unable to carry the volumes of information to ships that the operators would wish.

But here comes the answer to many of these problems — a satellite communications network called Marisat.

A close-up of the fibreglass radome which houses the above-decks antenna assembly.

The Satellites

On February 19th 1976, a Thor Delta 2914 launch vehicle lifted the Atlantic Marisat satellite into its position above the equator at 15 degrees West longitude. The first users of the satellite were the US Navy on March 25th and the first commercial voice message went through on July 9th, 1976.

The satellite, which is one of three which also cover the Pacific and Indian Oceans, weighed almost 655 kg at launch, and just over half that on station in orbit. The Atlantic satellite, from its stationary orbit 35 584 km above the earth, covers an area encompassing the entire Atlantic Basin, and western portions of the Indian Ocean, as well as Pacific Ocean areas off the west coast of South America. Each of the satellites covers an area of approximately one third of the earth's surface — the Pacific Ocean satellite, which is positioned at 176.5 degrees East longitude, covers from the west coast of the US across the Pacific Basin to the Malaysian Peninsula. The Indian Ocean satellite, which at present is only used by the US Navy is situated over the equator at 73 degrees East longitude. The satellites operate on three bands. On C-band the receive frequencies are 6420 — 6424 MHz, and the transmit channels from 4195 — 4199 MHz. On the lower L-band, the frequencies are 1638.5 — 1642.5 MHz and 1537 — 1541 MHz, respectively. There is also a UHF service which is used exclusively by the US Navy.

Each satellite is 3.8 m high and 2.16 m in diameter, and has a triple antenna system mounted on top.

The satellites, however, are only part of the story. What is significant about Marisat is the provision of satellite earth stations on board ships at sea — a hostile environment for equipment of this nature.

The Marisat System

The Shipboard Installation

Radio Officer Ed Watkins, on the 'Robert Miller' operates the Marisat terminal.

The Marisat terminal on board ship is in two sections – the below decks electronics console and the above-deck antenna assembly. The antenna is a 1.3 m diameter parabola, mounted inside a fibreglass radome along with ship motion sensors which operate with gearless servomechanisms to keep the antenna accurately and automatically tracking the satellite.

Since the position of the satellite is accurately known, and the latitude and longitude of the ship is also known, reference to a table will give the true bearing and elevation of the satellite. Once the antenna has been set up correctly the receiver is left on, and thereafter tracking is accomplished automatically. This is done by monitoring the automatic gain control voltage in the receiver, and using it, via servomechanisms to drive stepper motors, thus compensating for changes in the ship's position. Balance against pitch and roll is provided by a motor driven stabilised platform and rate and level sensors.

The 226 kg antenna assembly has an RF amplifier mounted behind the antenna with 32 W output, and the antenna itself has a gain of 23.5 dB. The receive figure of merit is 4 dB/K at 5 degrees elevation.

Below decks is a 150 kg console which contains the bulk of the non-RF electronics – a telephone communications chassis, status and operating panel, antenna control unit, teletype and power supplies.

The Marisat network provides several major communications services:

Voice. The telephone service is of a very high quality and is linked with many international telephone networks.

Telex. The international 50 baud telex network is linked to the Marisat satellite system, and provides a round-the-clock facility for the transmission of important messages. The Marisat telex system is extremely sophisticated and offers many special features. For example, abbreviated dialling is possible, using single or double letter or number codes rather than typing out lengthy numbers and area codes. Multiple addressing allows messages to be 'broadcast' to several points, a camp-on facility will automatically re-try busy numbers, and finally, the system will accept and store messages for later transmission in case delays are expected.

Facsimile. The facsimile facility is extremely useful because of its ability to transmit drawings, daily reports, manifests, weather maps, and other graphic material.

Data. The use of computers in teleprocessing and communications makes the provision of data transmission of increasing significance. Marisat provides a capability for alternate voice/data communications at 1200 and 2400 bits per second.

Further services are under development, for example a high speed data transmission service which would allow data from oil exploration or survey vessels to be transmitted to computers on the other side of the world for analysis in real time.

The Ground Stations

There are two main ground stations which handle the ground-to-satellite end of the communications link, as well as the control signals for the satellites. One is situated at Southbury, Connecticut and the other is at Santa Paula, California. Both stations are equipped with 12.8 m diameter dish antennas.

The Marisat antenna assembly can be seen above the stern of the Robert Miller, berthed at Sydney's Gore Bay.

Each station is a 'network control' point for commercial traffic in its area, and controls the assignment of satellite channels to a particular ship or offshore rig, transmits or receives messages on these channels, and then returns the channels to a common pool for reassignment to other users. Thus, the system is available to a large number of ships.

Offshore Facilities

Marisat is especially useful to offshore exploration and construction industries, because of the integrity of data communicated through the system and because of the reliability of the service. Users range from pipeline projects in the Straits of Magellan to highly sophisticated at-sea construction projects off the north of Scotland.

The 24-hour availability of instant reliable communications provides better management methods, with consequent cost savings because of the enormous daily running costs of these rigs.

Other advantages of Marisat communications include the capability for instant data analysis, which can save days in drilling, well-logging and down-hole analysis time; the ability of crews to call home and speak to family and friends; the ability to make on-site changes in engineering drawings using the facsimile equipment; the ability to transmit payroll data and other information such as the morning report; and improved safety through the Marisat 'Distress' capability which provides immediate contact with Coastguard offices on both sides of the US.

US Navy

A major user of Marisat (and indeed the only user of the Indian Ocean satellite) is the US Navy, which has an exclusive UHF band allocation well clear of the commercial frequencies. Military Sealift Command, for example, hurtled into the 20th Century in 1977 with the installation of Marisat on five of their ships. These oceanographic survey ships were a natural choice for the installation of Marisat because of the large volumes of data technical crews compile at sea.

With the Marisat terminals on board, MSC survey ships can transmit compiled data to computer centres on a daily basis. Previously, mapping and charting data was stored on magnetic tapes and mailed to the data processing centres whenever a ship put into port. Gaps in the coverage might not be discovered for days or even weeks, sometimes requiring a ship to return to an area to repeat part of the survey at great expense. Marisat permits much quicker detection of these problems.

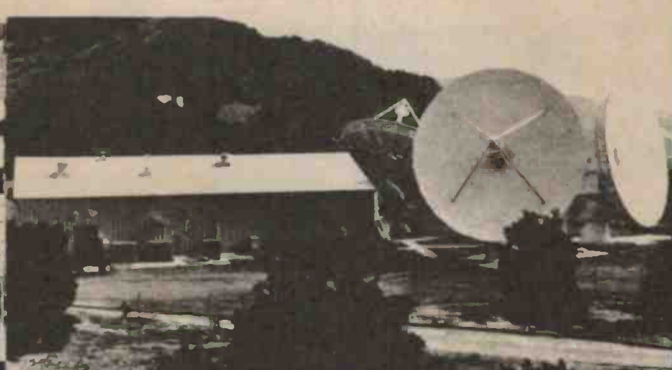
Robert Miller

Two Sydney-based oil tankers are already fitted with Marisat terminals: the 'Robert Miller' and the 'Australian Endeavour'. Thanks to the cooperation of R.W. Miller & Co., and AWA's Marine Division, we were able to take a look at the Marisat terminal on board the Robert Miller in Gore Bay, Sydney, recently. The Robert Miller regularly runs around the South Coast from West Australia we were able to get some good photographs of both the above decks antenna assembly and the console.

Step Forward

Because of its ease of operation, and the high quality of the communications services it provides, Marisat represents a major step forward in maritime communications.

We would like to thank COMSAT General Corporation, R.W. Miller & Co., and AWA Marine Division for their assistance in preparation of this article.



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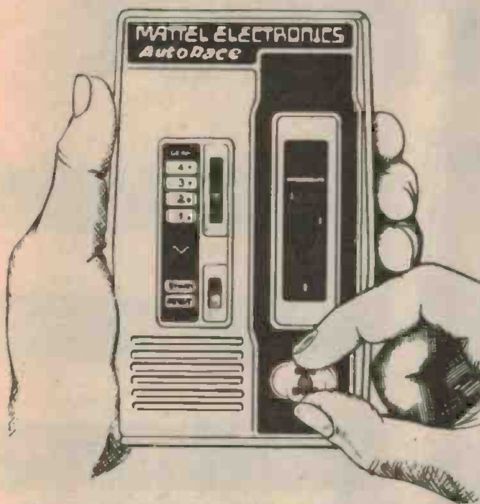

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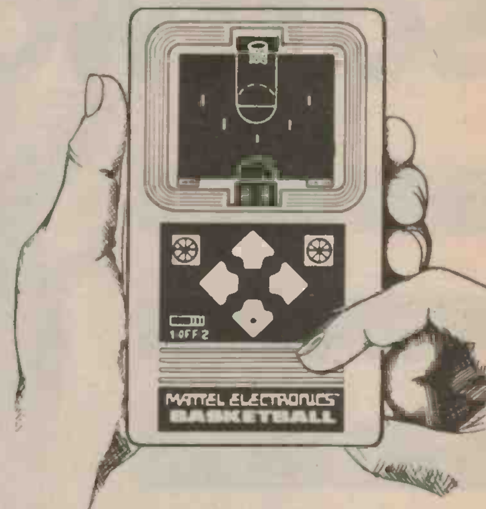

It's only natural. Television affects our lives in an extraordinary number of ways. It is today's major communication vehicle with the world. Innovative scientific efforts have expanded the possibilities of the television receiver console. Teletext, home computers, and programmable video games are just some of the more recent examples.

The Video Trauma

Perhaps most obvious has been the use of television receivers for the playing of video or television games. These games which utilise dedicated chips, often cause family frictions during prime time viewing hours as siblings fight to secure the use of the monitor either as VDU (visual display unit) for game use, or to watch a desired programme on the favourite channel.

The Discovery

MATTEL Scientists realised the possibilities. Using a combination of available microprocessor technology and special miniature circuits, they were able to develop a sophisticated, challenging, portable video game that does not even need a television set.

The Challenge

These little microprocessor marvels are lightweight; you can carry them in your hand, take them out with you to picnics, long car rides, or just sit in the corner while others are watching their favourite television programme.

Now for ETI Readers

We have made arrangements with the Caldor Corporation, who represent Mattel in Australia, for them to offer these games to ETI readers at special low prices – $27.95 for Electronic Car Race or Missile Attack, and $34.95 for Basketball, plus $1.50 postage, handling and insurance for each game. To order, simply fill out the coupon and send to: Video Game Offer, Electronics Today, 15 Boundary St., Rushcutters Bay, NSW 2011, enclosing a cheque made out to Video Game Offer for the correct amount. Please allow three weeks for delivery. The offer closes on the 19th January, 1979.

Send to: Video Game Offer, Electronics Today, 15 Boundary St, Rushcutters Bay, NSW 2011.

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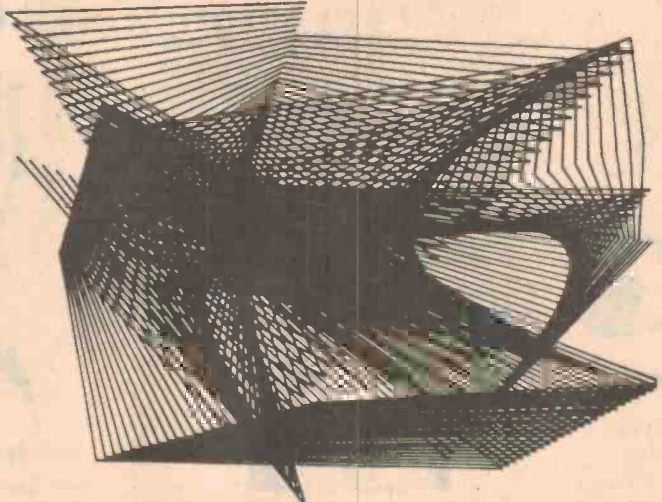
The offer closes on Friday, 19th January 1979 and is open to Australian residents only.

eti/computerland software contest



Last minute exhortation! We launched the ETI/ Computerland Software Contest back in April, and since then it seems to have stimulated considerable interest but, frankly, not as many entries as we'd hoped. For this reason, we have decided to set back the closing date of the contest to the 19th of January 1979, and encourage readers to send in their recent software efforts. They don't have to be very complex; quite short programs could well 'scoop the pool'.

We really aren't looking for professional-style brilliance, just software that works and can be used by people to *do* something with their computers.

The type of applications software we're seeking can be anything from a spelling or arithmetic demonstration program or a mortgage repayment program to the kind of sophisticated software we list here:

* *Mailing list processor.*
* *Address/telephone file.*
* *Point of sale terminal.*
* *Recipe file.*
* *Inventory control.*
* *Circuit analysis.*
* *Music synthesis.*
* *Calendar/clock/reminder list.*
* *Chequebook balancing program.*
* *Applications to help the handicapped.*
* *Small business accounting package.*
* *Computer communications set.*
* *Amateur radio station control.*
* *Burglar alarm with police notification.*

The idea is to get your computer doing something that is in some way useful. The only stipulation we'd like to make is that software must be written either in BASIC or in the form of a well-annotated assembly language listing for one of the popular microprocessors such as Z-80, 8080, 6800, 6502 and 2650. This means that we stand some chance of running your software to check it out. For the same reason, specialised hardware should be kept to an absolute minimum.

The criteria the judges will use to decide upon the winning entries will be: the value of the software to the user; its complexity, i.e. the size of the program; the 'elegance' of the software; the degree of 'human engineering' in the design of software features; and the quality, amount and presentation of the documentation supplied. It is likely that other factors will also influence the judges to some extent, as different criteria will apply in varying degree to different programs. The judges will be Dr R Graham, of NSW Institute of Technology, Rudi Hoess, of Computerland, and Collyn Rivers and Les Bell of ETI.

The prizes? Overall first prize is a Cromemco ZPU Z-80 CPU card while the second prize winner will receive a Vector Graphics 8K RAM kit. Third prize is a Vector Graphics 260 x 260 graphic display generator and fourth prize is a PROM/RAM card from Vector Graphics. In addition, each of the prizewinners will receive a two year airmail subscription to the US computer magazine of their choice and a two year subscription to ETI.

There will also be three special prize categories — the awards for 'Best Documentation' and 'Most Original Application' will each be a two year subscription package, while the 'Most Marketable Software' winner will, subject to agreement, be marketed on a royalty basis. In addition, the winning entries will be published in ETI, and payment for this will be made at our usual (excellent!) rates.

With the promise of all these super prizes, fame, and fortune, it's well worth while tidying up some of the software you've written recently, writing it up and sending it in. You've got nothing to lose and a whole lot to gain!

The closing date for the contest is now Friday, 19th January 1979, which should give plenty time to 'polish up' existing programs. The winners will be announced in the March or April 1979 issue of ETI, but if (as we hope) there is a lot of entries to be checked this may be delayed.

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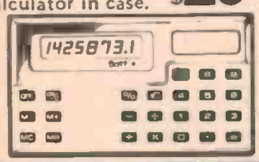

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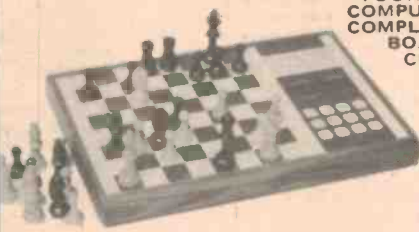

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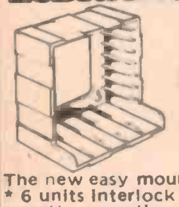

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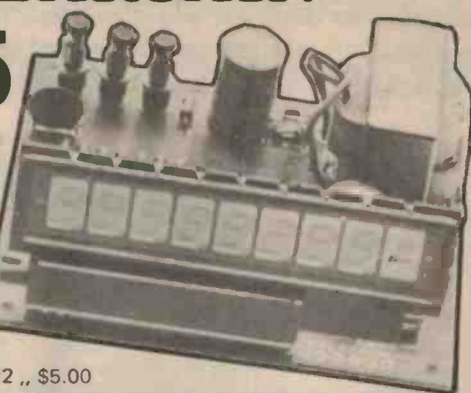

This 240 volt digital clock kit is amazingly simple to build. 12 or 24 hour operation and seconds display with BIG (10mm) bright orange numerals. Kit includes full instructions - build it yourself in a couple of hours!

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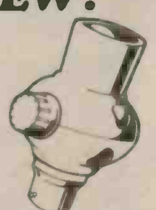

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Incredibly cheap Mercury switch

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Buy 10 or more and pay 75c ea.

PARTS FOR NEW KITS

PLAYMASTER AM/FM TUNER (See Nov/Dec EA)

Complete kit, including instructions	Cat. K-3494	$159.50
SEPARATE PARTS		
Pre-wired and aligned tuner module	Cat. F-4610	$59.00
Set of 4 PC Boards	Cat. H-8357	$9.75
Signal strength meter	Cat. O-2100	$4.95
Tuning meter - centre zero	Cat: Q-2095	$4.95

Most other electronic parts for this project in stock.

MODEL TRAIN CONTROLLER (See October EA)
Not produced as a kit — all parts available from stock:

PCB only	Cat. H-8355	$3.75
Zippy box	Cat. H-2752	$3.75
2N3055 transistor	Cat. Z-2145	$0.95
2N3053 transistor	Cat. Z-2130	$0.80

UNIVERSAL MOVIE MIXER (See September EA)

Complete kit, including instructions	Cat. K-3492	$49.50
SEPARATE PARTS:		
PC Board (only)	Cat. H-8354	$2.95
50k A curve 45mm slider pot	Cat. R-1980	$0.85
Knobs to suit slider pot	Cat. H-3780	$0.40

FET INPUT AC-DC VOLTMETER (See September EA)
Not produced as a special kit - all parts available ex-stock:

PC Board (only)	Cat. H-8353	$2.75
1mA MRA-65B panel meter	Cat. Q-2060	$12.50
Fabricate your own meter scale using the Scotchcal process:		
8005 black Scotchcal photo-sensitive aluminium	Cat. H-5694	$6.00
CA-3140 FET op-amp	Cat. Z-5417	$2.50

VARI WIPER Mk 2 (See September ETI)
Not produced as a kit - most parts available from stock:

Relay	Cat. S-7125	$4.80
C106YI SCR	Cat. Z-4315	$1.00
2N2646 (DS2646) unijunction	Cat. Z-1786	$1.20

UPGRAOEO 40/200MHz FREO. COUNTER (See August EA)
Same style as previous kit, but new circuitry means it is easier to build, set up and is more sensitive. Basic counter is 40MHz — by adding a single 95H90 IC the range is extended to 200MHz.

Complete kit for 40MHz, inc. instructions	Cat. K-3437	$99.50
95H90 IC to extend range to 200MHz	Cat. Z-5360	$12.50
SEPARATE PARTS:		
PC Boards (set of two high quality boards)	Cat. H-8346	$8.50
MC-10116L IC (triple differential amplifier)	Cat. Z-5415	$1.95
MM 5369M IC (oscillator - divider)	Cat. Z-5781	$2.50
74C926 IC (4 digit counter)	Cat. Z-5414	$6.50
3.579545MHz crystal (new low price)	Cat. K-6031	$3.00
LT-303 7 segment display	Cat. Z-4103	$1.50

All other components are normal stock lines at all of our stores.

PHOTO TACHOMETER (See August EA)
Although we do not produce a full kit for this project, all parts are normal stock lines at all of our stores.

PCB (only)	Cat. H-8352	$1.80
FPT 100 phototransistor	Cat. Z-1950	$2.00

NEW 10 GAME TV GAME KIT (See July EA)

Complete kit, including instructions	Cat. K-3491	$49.50
SEPARATE PARTS:		
PCB (only)	Cat. H-8344	$3.95
Fully built RF modulator	Cat. K-6040	$3.00
Fully built audio modulator	Cat. K-6042	$4.50
AY-3-8600 IC	Cat. Z-6852	$15.00

TANK TV GAME (See October ETI)

Complete kit, including instructions	Cat. K-3475	$39.50
SEPARATE PARTS:		
PCB (only)	Cat. H-8620	$3.85
AY-3-8710 IC	Cat. Z-6856	$17.50
Fully built RF modulator	Cat. K-6040	$3.00
Fully built audio modulator	Cat. K-6042	$4.50

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Overland Communications	11/53 Wollongong St, Fyshwick ACT. Ph 804307
Brian Bambach Electronics	68 William St, Gosford NSW. Ph 247246
Crystal TV Rentals Pty. Ltd	66 Crystal St, Broken Hill NSW. Ph 6897
D.G.E. Sales	44 Brown Rd, Broadmeadow, Newcastle NSW. Ph 691222
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Mid States Radio Pty. Ltd	638 Dean St, Albury NSW. Ph 213888
Sound Components	78 Brisbane St, Tamworth NSW. Ph 661363
Trilogy Electronic Supplies	40 Princes Hwy, Fairy Meadow NSW. Ph 831219
Hunts Electronics	18 Neil St, Toowoomba QLD. Ph 326944
Tropical TV	249 Fulham Rd, Vincent QLD. Ph 791421
Sumner Electronics	95 Mitchell St, Bendigo VIC. Ph 431977
A.E. Cooling	6 Trimmer Rd, Elizabeth South SA. Ph 2552249
Gawler C.B. Centre	51 Hillier Rd, Evanston SA. Ph 222149
Hutchesson's Communications	5 Elizabeth St, Mt. Gambier SA. Ph 256404
Altronics	105 Stirling St, Perth WA. Ph 3281599
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PCM Explained

Don Rost explains how pulse code modulation will revolutionize the telephone system.

IN THE 19TH CENTURY certain transmission experiments were performed that involved the coding of speech and music into digital electrical signals using telegraphic techniques. The experiments weren't too successful but these were actually early attempts at *pulse code modulation*, a technique that is much used by the telecommunications industry and recently by recording and audio firms. The basic principles outlined here particularly concern the telephone industry but they are basically the same for most PCM systems.

One of the real problems in telecommunications has been noise and crosstalk (a type of noise induced from adjacent channels), problems that are costly, difficult and often impossible to eliminate using analog transmission methods. Because PCM uses digital signals not dependent on signal amplitude, these problems are eliminated to a high degree.

Time Division Multiplexing

Suppose as in Fig. 1 there are three separate phone signals, on three separate "channels," and they are transmitted to their respective destination each down a pair of wires. Further, suppose that these three calls are being made from two cities located 40 km away from each other.

It would be nice if just one cable pair could carry all three calls instead of three separate pairs. There have been different analog techniques for doing this, the one we will concern ourselves with, because it leads us to PCM, is called *time division multiplexing*. We are still talking analog, the speech signals vary in amplitude as the persons are talking. By sampling portions of these signals at regular intervals all three signals can be broken up and sent along the same transmission line. This is illustrated in Fig. 2.

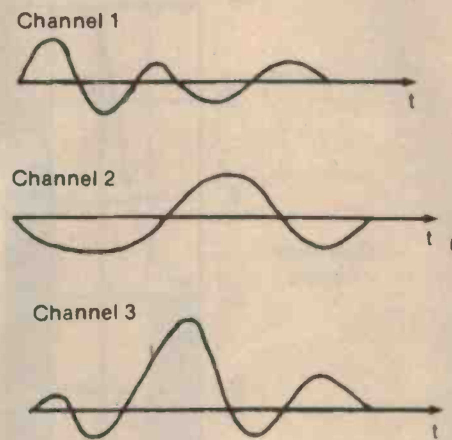


Fig. 1.a. Examples of three signals on separate channels.

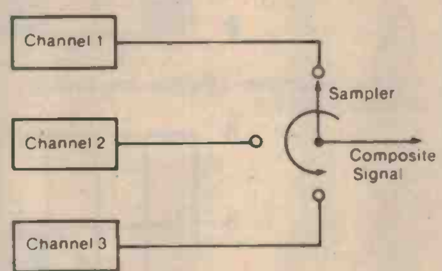


Fig. 1. b. Three channels multiplexed onto a single line by a sampler, here represented as a continuously rotating switch.

This type of composite signal is known as *pulse amplitude modulation* (PAM) because it uses the amplitude samples of the signals multiplexed. The problem with PAM is that it is subject to the same noise and distortion problems as any analog signal. Fig. 10 llustrates this. After a signal has travelled a fair distance the signal will have become attenuated to a great degree and will require amplification along the line. Unfortunately, not only will the signal be amplified but also any distortion and noise now associated with the signal.

To get around this problem a method of digitally encoding the signal was developed. Although Alec H. Reeves patented PCM in 1938, it was not until the development of high-speed solid state switching devices and in particular integrated circuits that the system became practical. PCM changes analog signals into digitally coded pulses and then reverses this process at the receiver to recover the original analog signals. This is accomplished in 3 basic operations: sampling, quantizing and encoding. The basic operation is shown in Fig. 3.

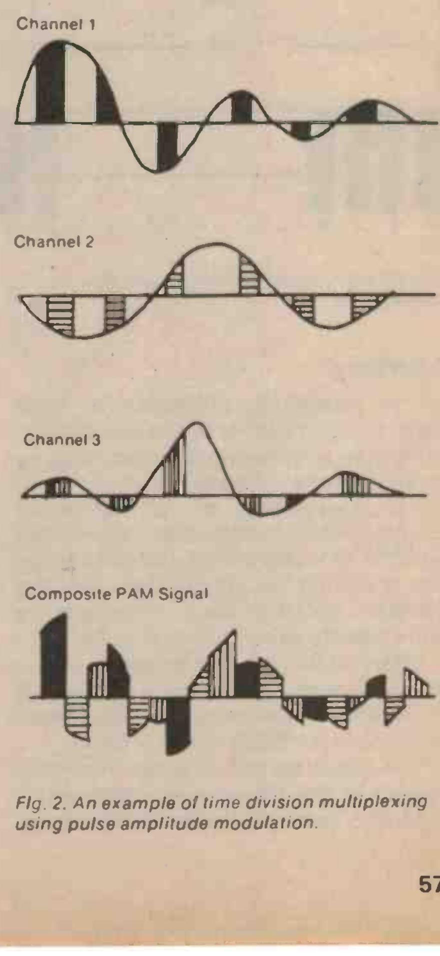


Fig. 2. An example of time division multiplexing using pulse amplitude modulation.

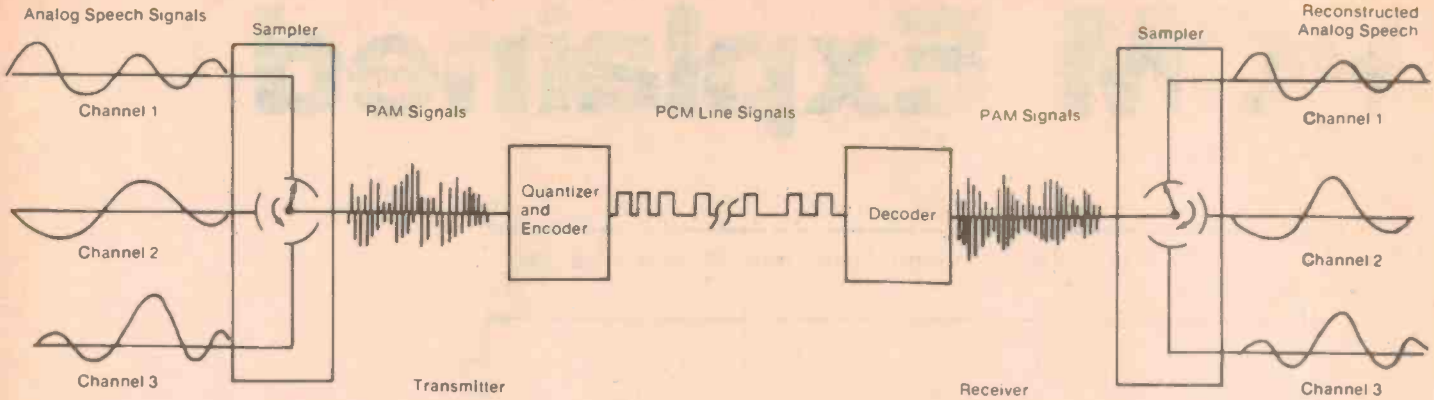


Fig. 3. Basic operation of a time division multiplexed PCM System.

Sampling

For accurate reproduction of the signal a sampling rate of twice the highest frequency is required (this according to a theorem from Nyquist) and in telephone channels this works out to an 8kHz sampling rate. This means that once every 125 microseconds (1/8000s) a channel is sampled. Since telephone lines typically multiplex 24 channels on one line 24 channels are sampled successively in that 125 us time slot, called a *frame.* (Fig. 4)

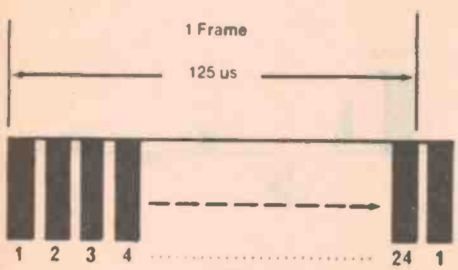


Fig. 4. Twenty four channels multiplexed into 125us "frame".

Quantizing

The sampling produces a PAM signal; to prepare these analog samples for digital processing it is necessary to assign values to each of the samples. This assigning of a value is accomplished by establishing a limited number of levels called *quantum steps* and rounding the amplitudes off to the nearest quantum level. This will be more clearly explained by Fig. 5a.

Channel 3 has samples taken of the following quantum values: 3,5,3,3, 2. A reconstructed wave using just these samples would look like Fig. 5b.

The major source of noise in a PCM system is the *quantizing error* which randomly occurs because the quantum

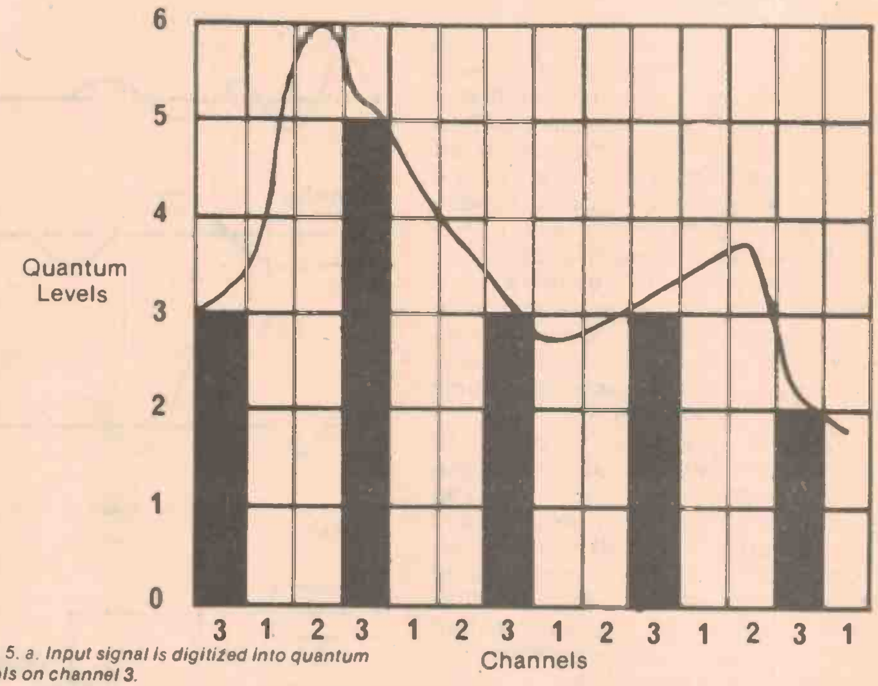


Fig. 5. a. Input signal is digitized into quantum levels on channel 3.

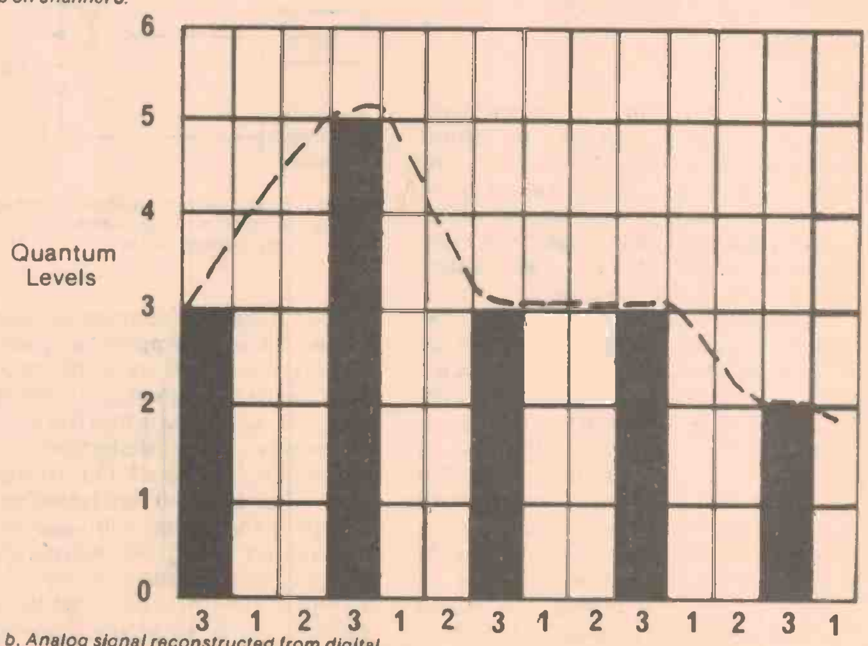


Fig. 5. b. Analog signal reconstructed from digital values on channel 3.

steps are only approximations. By increasing the number of quantum steps the quantizing noise decreases but at the cost of increased bandwidth required in transmitting the data. If quantum steps are assigned in a straight linear fashion (uniform size) approximately 2048 (11 binary bits) are required to provide sufficient signal fidelity. Such a system, however, is impractical in telecommunications due to the large bandwidth involved. To get around this we can do one of two things. Assign small quantum steps at the low amplitudes where it's needed the most and larger steps to the remainder, or what is usually done, *compress* the amplitude *range* before uniform quantization and then *expand* the signal at the receiving end (*companding*). More gain is applied to weak signals than to stronger ones and typically this reduces the amplitude ratio from 1000 to 1 to 63 to 1 or in terms of dB, from 60dB to about 36dB. By using this technique, the number of quantum steps can be reduced from 2048 to 128 (only 7 bits) with the same noise performance. (Fig. 6)

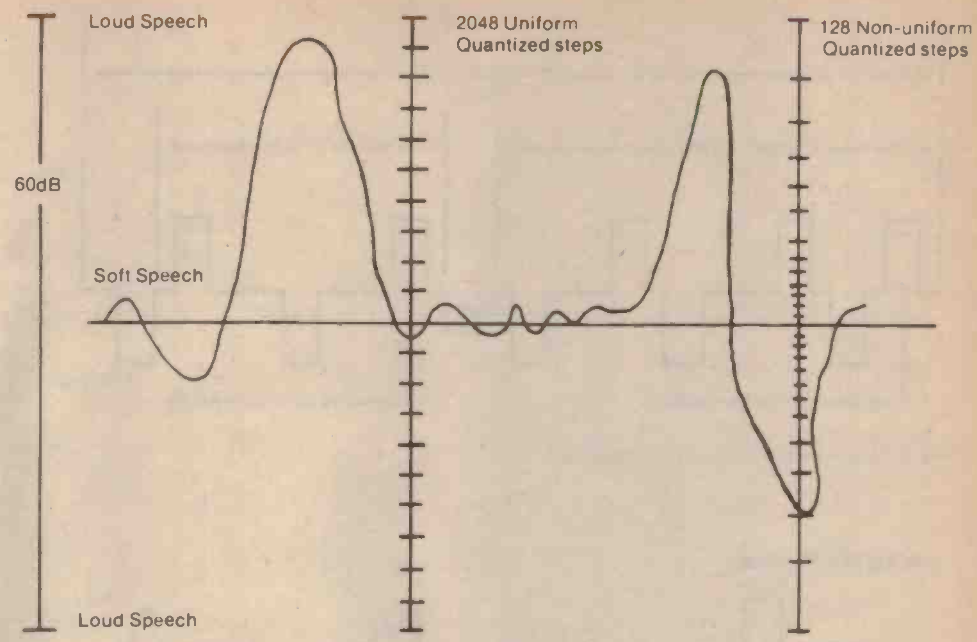
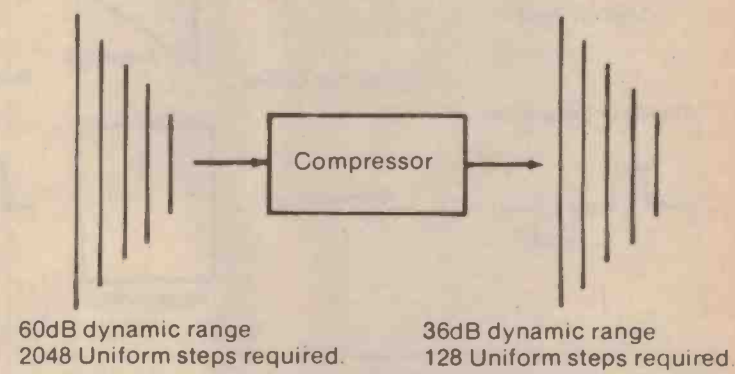


Fig. 6. a. Use of uniform and logarithmic or non linear quantization steps.

Fig. 6. b. An example of compression.



Coding

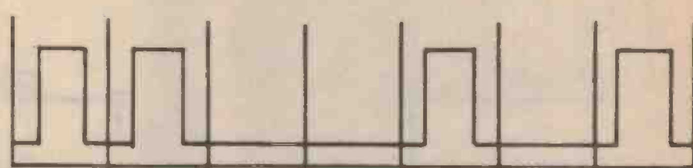
Once a numerical value is assigned to the samples we can convert this to a binary form. Since $2^7 = 128$ we need a 7 bit code to represent the 128 different levels. As an example of how this works suppose we wish to represent the quantum level 101 in binary form. In binary, $101 = (1x2^6) + (1x2^5) + (0x2^4) + (0x2^3) + (1x2^2) + (0x2^1) + (1x2^0)$. (Fig. 7).

So instead of sending an analog pulse amplitude signal on the transmission line we send its equivalent in binary pulses or if you like, 1's and 0's. Another bit, used for signaling and supervision of the previous channel, is added to make a total of 8 bits per sample; this is actually an older system called the "D1." More commonly used today is the D2 system where all 8 bits are used 5 out of every 6 frames to give a larger quantum range (and therefore less quantum noise in the system). This gives the system 256 quantum levels 5/6 of the time and the one bit in every 6 frames is then used as the signaling bit.

Before sending these pulses one further step is encountered and that is to change the pulses to *bipolar* format. This just means that every other 1 is inverted as in Fig. 8. Now the positive and negative pulses are the 1's and the spaces 0's.

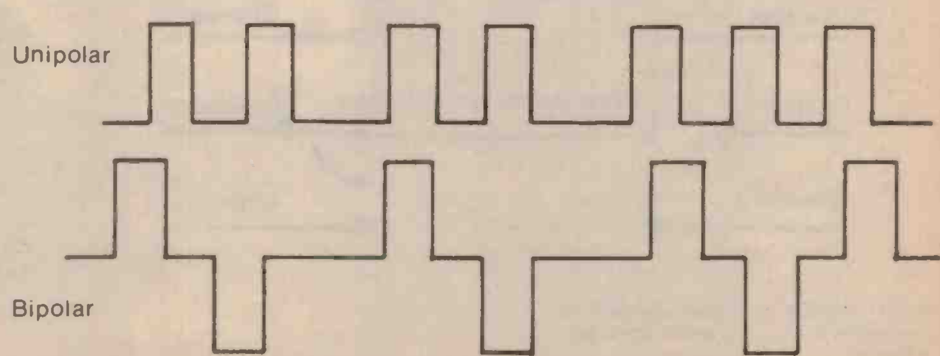
There are several advantages to converting to bipolar format. Most of the energy in the bipolar system is concentrated at ½ the pulse repetition frequency, which results in less energy

Fig. 7. Quantum level 101 shown in digital form.



Binary	1	1	0	0	1	0	1
Decimal	64	32	0	0	4	0	1

Fig. 8. In bipolar format every other binary one pulse is reversed in polarity.



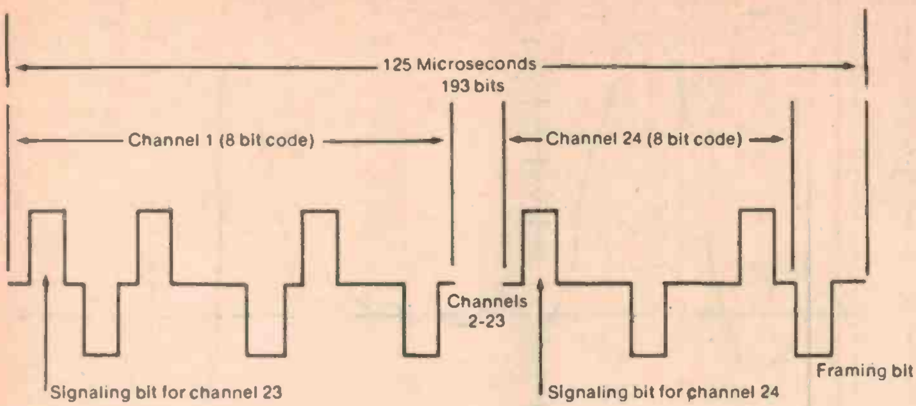


Fig. 9. Typical PCM line signal for a D1 system.

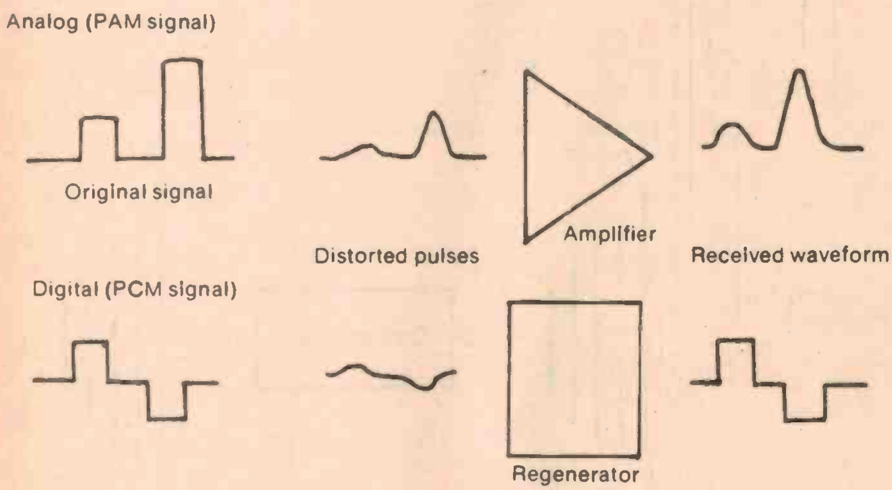


Fig. 10. In a PCM system repeaters regenerate the attenuated signals to look like the original transmitted data.

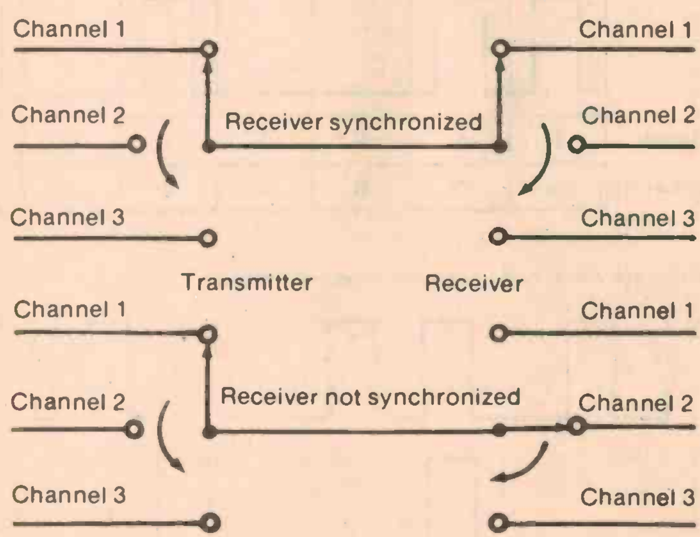


Fig. 11. Improper synchronization with the transmitter will result in random channel selection.

being coupled into adjacent pairs of wire in the cable as crosstalk. There is no DC component so transformer coupling is possible. And error detection is easy since every other 1 bit will be reversed in polarity.

In every frame one additional bit is added as a *framing pulse* to synchronize the receive system with the transmit. Such a 24 channel system then uses 24 x 8 bits + 1 sync bit for a total of 193 bits. Since the sampling rate equals 8KHz, the transmission rate equals 193 x 8,000 = 1,544,000 bits per second. A typical D1 system line signal would look something like Fig. 9. A D2 system would be similar, except every 6th frame would have the signaling bits instead of every frame as in the D1.

Repeaters

Unlike analog signals that would have to be amplified along with their accompanying distortion, PCM signals are regenerated at repeater stations enroute to their destination. Regeneration involves reshaping the pulses to look like the original signal, so even if the pulses accumulate noise before reaching the repeater the regeneration process cleans them up at each repeater. Remember, in a digital system all that counts is either a pulse or no pulse hence the problem of accumulative distortion and noise are greatly reduced in a PCM system. These repeaters are positioned about every 1.8 km. (Fig. 10)

Receiver

The receive side of a PCM system merely operates in the reverse of the transmit section. The PCM line signal is decoded into PAM and then sampled to each respective channel. The key to PCM operation is synchronization so this is where that extra framing bit is important, without it your call would be randomly selected to any one of the 24 channels. (Fig. 11)

This description of PCM has been basic — the complexity of the logic, the analog-digital and digital-analog conversions, and other intricacies of a PCM system make it impossible to go into any great detail here. It should give you some idea, though, of how this technique has benefited the telecommunications industry and promises the audio one with new avenues to reducing noise. Above all, it should be mentioned that because it is a digital method, PCM or something similar can be used extensively in connection with computer based systems. In addition, with fiber optic systems now being field tested PCM lends itself readily to communication via the light spectrum.

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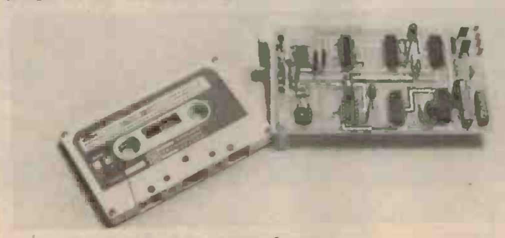

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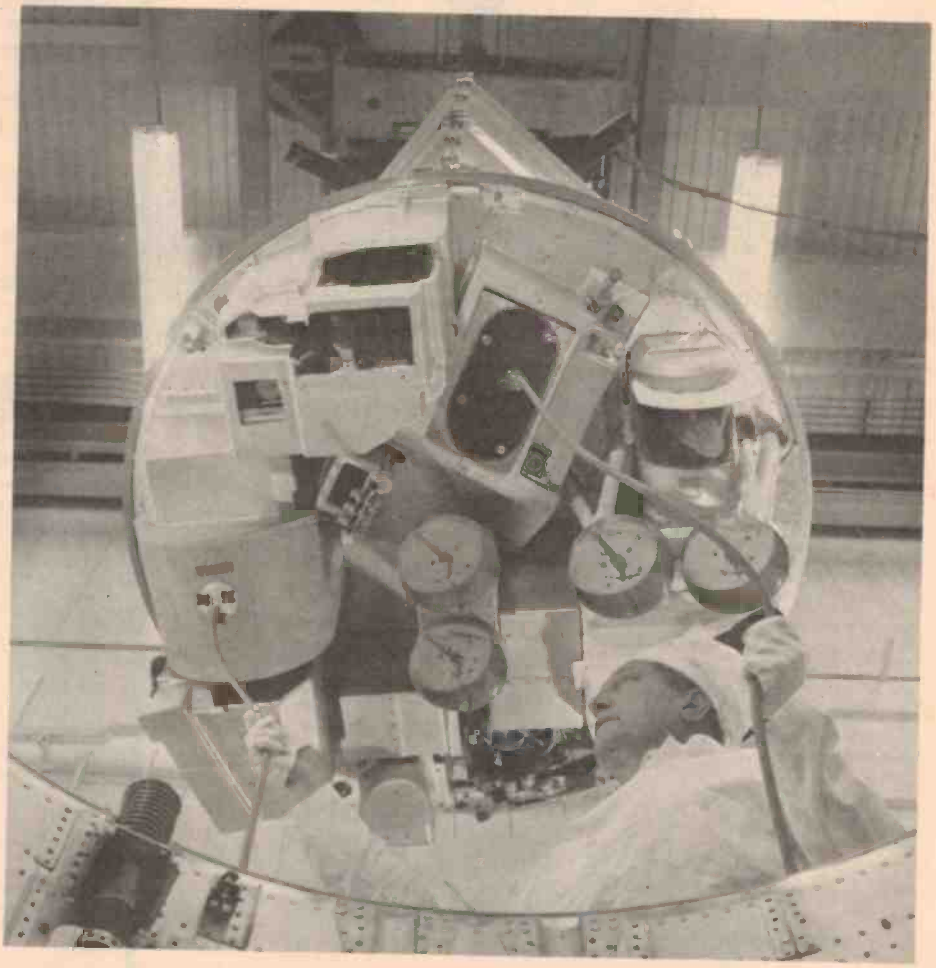
Nimbus Satellites Monitor the Earth

Brian Dance explains how the Nimbus satellites will help us to better understand the ecology of the oceans.



THE NIMBUS-7 SATELLITE launched in September 1978 has joined six earlier Nimbus satellites which relay television pictures, infra-red and ultra-violet data, etc. back to earth. This information is required to enable weather scientists to understand the dynamics of the ocean-atmosphere system and the balance of energy received by and transmitted from the earth. Other applications include such diverse fields as tracking oil spills at sea, monitoring air pollution and helping to locate good fishing areas.

The new satellite has been constructed mainly by the General Electric Company's Space Division at Valley Forge, Pennsylvania. It was launched by a McDonnell Douglas Delta 2910 rocket with 9 Castor II strap-on solid fuel motors into a circular orbit 1 110 km above the earth. This 933 kg satellite is 3.05 m high by 3.35 m wide (with solar panels extended) and has a 1.52 m diameter sensory ring for housing experiments and the electronics. It has an orbital period of 107 minutes.

The primary task of Nimbus-7 is to gather data from the atmosphere, oceans and coastal waters on a global scale from selected regions using 8 sensing instruments. Apart from the U.S., participating nations include Belgium, France, West Germany, Italy, United Kingdom, South Africa, The Netherlands, Switzerland and Canada. The data will be received by earth stations in Alaska, Hawaii, Ascension Island, Guam, Goldstone (California), Quito, Santiago, Orroral and Madrid. This data will be processed and analysed by some 60 members of the Nimbus Experiment Team (NET) in nine different countries.

The CZCS

One of the sensors aboard Nimbus-7 is a "Coastal Zone Colour Scanner" or CZCS which will be made available on a top priority basis for the identification and tracking of oil spills over eleven of the major ocean areas traversed by oil tankers. NASA will support the U.S. Environmental Protection Agency in this application during emergencies.

The CZCS on Nimbus-7 will be used to investigate how well it can detect areas with good fishing potential, measure industrial waste dumping and chemical pollution, offshore sewage outfalls and red tides. In addition, this experimental sensor will map chlorophyll concentration, sediment distribution and temperature gradients of coastal waters and the open ocean. This information can be used to compute the extent of pollution and the location of large fish shoals.

Some of the main areas in which the CZCS will be used in investigations include the Mediterranean coastal waters, the North Sea, the English Channel, the Atlantic Ocean, New England and California river estuaries and coastal waters, the Gulf Stream, the Great Lakes and Cape Hatteras.

Another sensor on board the Nimbus-7 craft will track the earth's energy exchange as an indicator of long term climate changes. This Earth Radiation Budget experiment is designed to measure incoming solar, reflected solar and emitted terrestrial energy simultaneously during different seasons of the year. Other sensors will probe the atmosphere at various altitudes and investigate the sea surface. Gas concentrations and temperature profiles will be monitored, aerosols in the stratosphere measured, ozone mapped, water vapour determined and sea ice observed. A 6 channel infra-red scanning radiometer will be used on the satellite, together with a scanning multichannel microwave radiometer, etc.

Earlier work

The Nimbus programme has compiled more data for the study of the earth's weather and climate from space than any other NASA programme. The six earlier Nimbus spacecraft have transmitted more than 400 000 television images of the earth's cloud cover, provided more than 51 000 hours of infra-red data, more than 42 000 hours of ultra-violet data, more than 185 000 hours of 'sounder' data on atmospheric temperature and pressure, more than 16 000 hours of data on the earth's heat balance and relayed more than 60 000 messages from remote ground and data collection platforms to the receiving stations.

The Nimbus programme began nearly 20 years ago at the General Electronic Space Division and NASA's Goddard Space Flight Centre. Nimbus-1 was launched in August 28th, 1964, but had a much shorter life than the other Nimbus satellites, as shown in Table 1.

The success of the Nimbus craft for providing stable remote sensing platforms for viewing the earth from near space has directly led to the adaption of this type of craft for the development of Landsat craft which have been designed for the analysis and inventory of the natural resources of the land of this planet. Three Landsat craft based on the Nimbus design have been successfully orbited and two of these three continue to provide resource data to some 100 different countries.

A contract has been issued to General Electric for the construction of the first Atmospheric Cloud Physics Laboratory (ACPL) to fly on a future Spacelab Shuttle flight. This vehicle will enable scientists to study the microphysical processes of cloud formation in a manned spacecraft with a gravity reduced environment. Work has also commenced on a LIDAR system in which a space borne laser instrument will be used to measure cloud top heights, pollution concentrations, atmospheric aerosols and wind velocities.

One of the major benefits being derived from space research is the more detailed view we are able to obtain of our own planet. Satellites can provide the data we require to predict large floods and hence to save lives.

NIMBUS	Launch date	Active orbital life	Operational orbits	Remarks
1	August 28, 1964	27 days	371	
2	May 15, 1966	2 years 6 months	13 029	Spacecraft retired
3	April 14, 1969	2 years 8 months	13 575	Spacecraft retired
4	April 8, 1970	7 years 4 months	36 923	In reserve
5	December 11, 1972	5 years 8 months	28 100	Still in service
6	June 12, 1975	3 years 2 months	15 746	Still in service

Table 1. List of Nimbus satellites excluding the new Nimbus-7.

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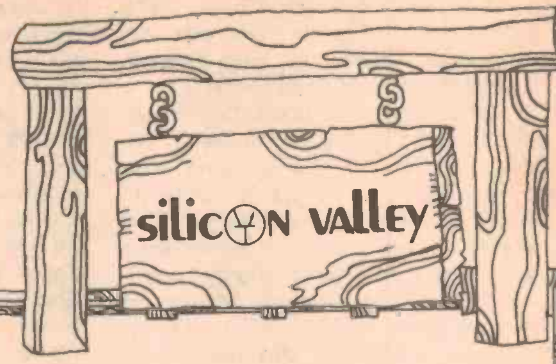
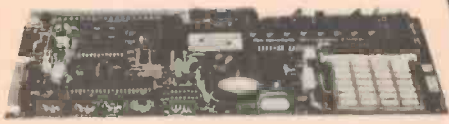
THE STABLE OF THOROUGHBRED MICROS



SYM-1
SIRED BY KIM
(A SURE STARTER)



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Key features include:

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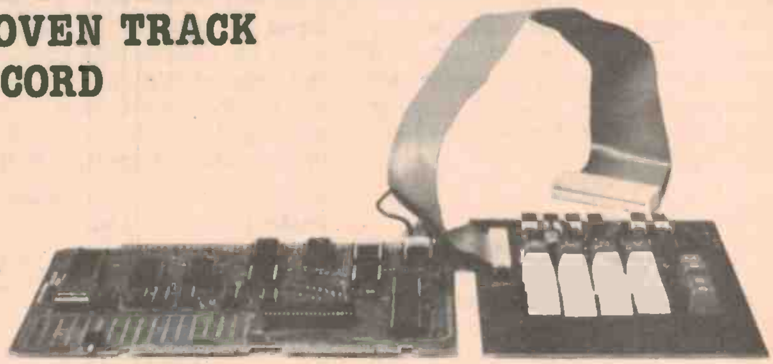

M6800 — FAMILY EVALUATION KIT II

MEK6800D2 provides a useful and expandable tool for those who wish to develop systems with the M6800 Microprocessor without investing in expensive terminals. All parts needed to complete the system and get up and running are provided in the kit with the exception of the power supply. In addition to the expansion available on the basic microcomputer module, additional RAM, ROM and I/O parts can be accommodated at a later date to implement more complex systems. Machine language programmes can be entered through the system keyboard or via a built-in audio cassette interface system. Hexademical LED displays are provided for monitoring data and address information. A crystal-controlled clock generator is used to eliminate timing adjustments.

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  - Trace One Instruction
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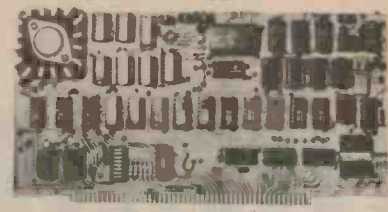
KT9500 THE SHORT PRICED FAVOURITE

Price $95 + Tax = $109.25

The basic kit consists of a plated-through hole board with component overlay and the mighty 2650 8 Bit Microprocessor, 512 bytes of read/write memory (four 2112 static RAM's), 1K bytes of 2608 ROM with PIPBUB*, two 8T31 1/0 ports and buffering on data, address and control lines. A single + 5 volt supply will be required to power the card and communicate with a serial 20mA current loop terminal.

Modifications to the basic system can be easily made to allow for various memory configurations and operating modes. Unused plated through holes are provided for the PROM memory chips (82S115's). Other options are jumper selectable.

SV640 A SURE WINNER — NO PLACE BETS



Designed by David Griffiths this superb software controlled V.D.U. kit composes of all components including crystal, IC sockets and top quality plated through hole PCB. Our exclusive 54 page assembly/trouble shooting and software manual is also included. The display format is 16 lines by 64 characters to give upper and lower case letters, reversed video characters (black on white), flashing characters and a graphics resolution of 64 x 128 dot matrix. The unit conforms to the ever increasing popular hobby computer standard S100 bus. **Price $140 + Tax = $149.50**

TM990 /100M-1 A CLEAR WINNER AT 16 FURLONGS

The TM990/100M is an assembled, tested microcomputer module utilizing the powerful NMOS 16 bit TMS 9900 microprocessor as its CPU. With RAM and ROM/EPROM included on board as well as programmable serial and parallel I/O, the TM990/100M is a powerful single board microcomputer. As all address, data and control lines are brought to the board connectors, the board can be expanded to use the entire capabilities of the TMS 9900 in larger systems.

Features

- TMS 9900 16 bit CPU.
- 256 words of 4042-2 (2111-1) Static RAM expandable to 512 words.
- 1K words of 2708 EPROM expandable to 4K words.
- TMS 9901 programmable system interface.
- TMS 9902 asynchronous communications controller.
- EIA or TTY terminal interface option.
- Prototyping area for custom applications.
- Fully expandable bus structure.
- TIBUG operating monitor.

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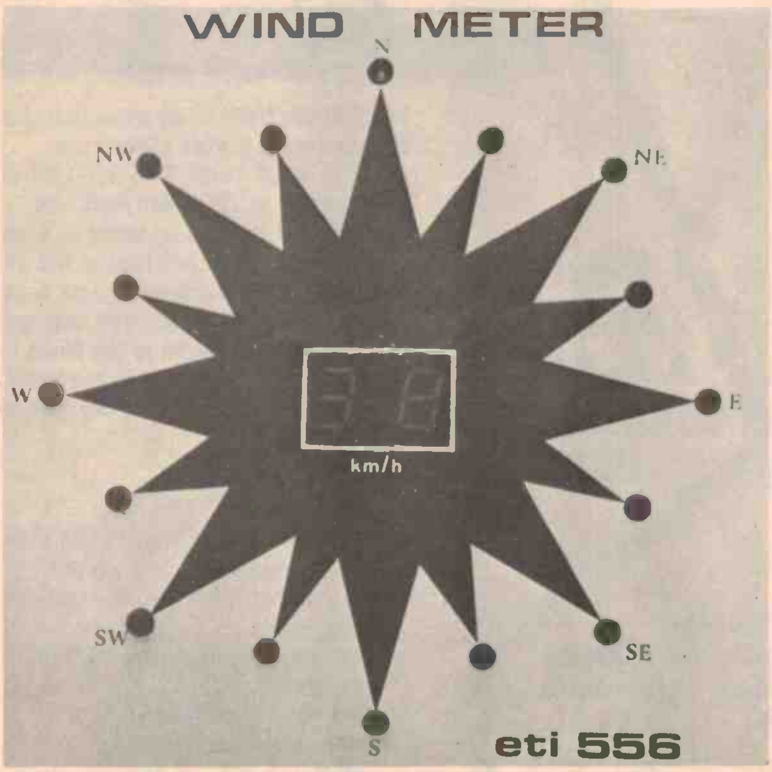
Wind Meter



TRADITIONALLY, THE FOUR primary elements are fire, earth, water and air. At ETI, we've designed projects concerned with the first three (temperature meters, soil moisture indicators, rain alarms), but not much for the last. The major property of the air, apart from the fact that it is necessary to support life, is the movement of the air — wind. Light winds generally aren't of terribly much significance except to meteorologists, but stronger winds can be useful as a source of power; for traditional milling, for electricity generation or as a means of propulsion for sailing yachts. Stronger winds such as hurricanes, can be destructive, causing damage to life or property.

So for all the private pilots, yachtsmen, amateur meteorologists and general weather watchers who read ETI, here is a device which will tell you the wind's speed and direction, with a remote indication of both quantities. Our design is, we'd like to think, both stylish and unusual, but there are simpler methods of mechanical construction which you can follow if you wish.

HOW IT WORKS - ETI 556

Wind Direction

Wind direction is indicated by a series of 16 equally spaced LEDs around a circle. These represent the main points on the compass. These are controlled by IC2 and IC4 which are in turn controlled by the direction sensor head.

The sensor head, which is described in fig. 3, consists of a disc which has four optical tracks and four globes and phototransistors. The phototransistors sense either a clear disc (logical "1") or a black disc (logical "0") and thus control IC2 and IC4. The code used is a special one called a "grey" code and is special in that only one bit is changed at each location eliminating gross errors which occur with the binary code if the heads are not perfectly aligned. An example of this is going from location 7 (0111) to location 8 (1000). If this is not done simultaneously almost any location can be specified. With the grey code the same change is from 0100 to 1100. Here there can be no ambiguity as only one bit is changed. Remember these bits are *not* weighted similarly to binary and a lookup table must be used to decide what number(decimal)a particular code is.

The decoder, IC2, is an eight output analogue demultiplexer with the common line joined to the +5v line. When a particular 3 bit code is presented to its control inputs one of the eight outputs will be joined to the +6v line. The fourth output from the sensor head controls IC4 which gives two, inverted, outputs to drive either bank of LEDs. The complete four bit code therefore specifies a particular LED to be lit. By placing the LEDs correctly around the circle the grey code is decoded.

Wind Speed

This is a simple frequency counter measuring pulses from the sensor head. The head consists of a disc with eight holes which breaks a light beam to its associated phototransistor. The output of this phototransistor is squared up by a schmitt trigger formed by IC5 c, d.

The counting is done by IC8a and IC8b (a dual decade counter) with IC6 and IC7 providing the store and LED drivers necessary to drive the seven segment display. Time base is provided by IC3 which gives a 7 ms wide negative pulse about every one second. We say about as it is adjustable by RV1 as individual heads will have different responses and calibration will be necessary.

This negative pulse opens the store to allow the number reached by the counters to be displayed while simultaneously stopping any further counting by disabling the schmitt trigger. On the completion of the 7 ms pulse IC5 a, b generate a 50μs wide pulse which resets the counter ICs to recommence the sequence.

Power Supply

This is simply a full wave rectified supply with IC1 giving a regulated +6v output. This regulation is needed to ensure that the time base (IC3) remains accurate).

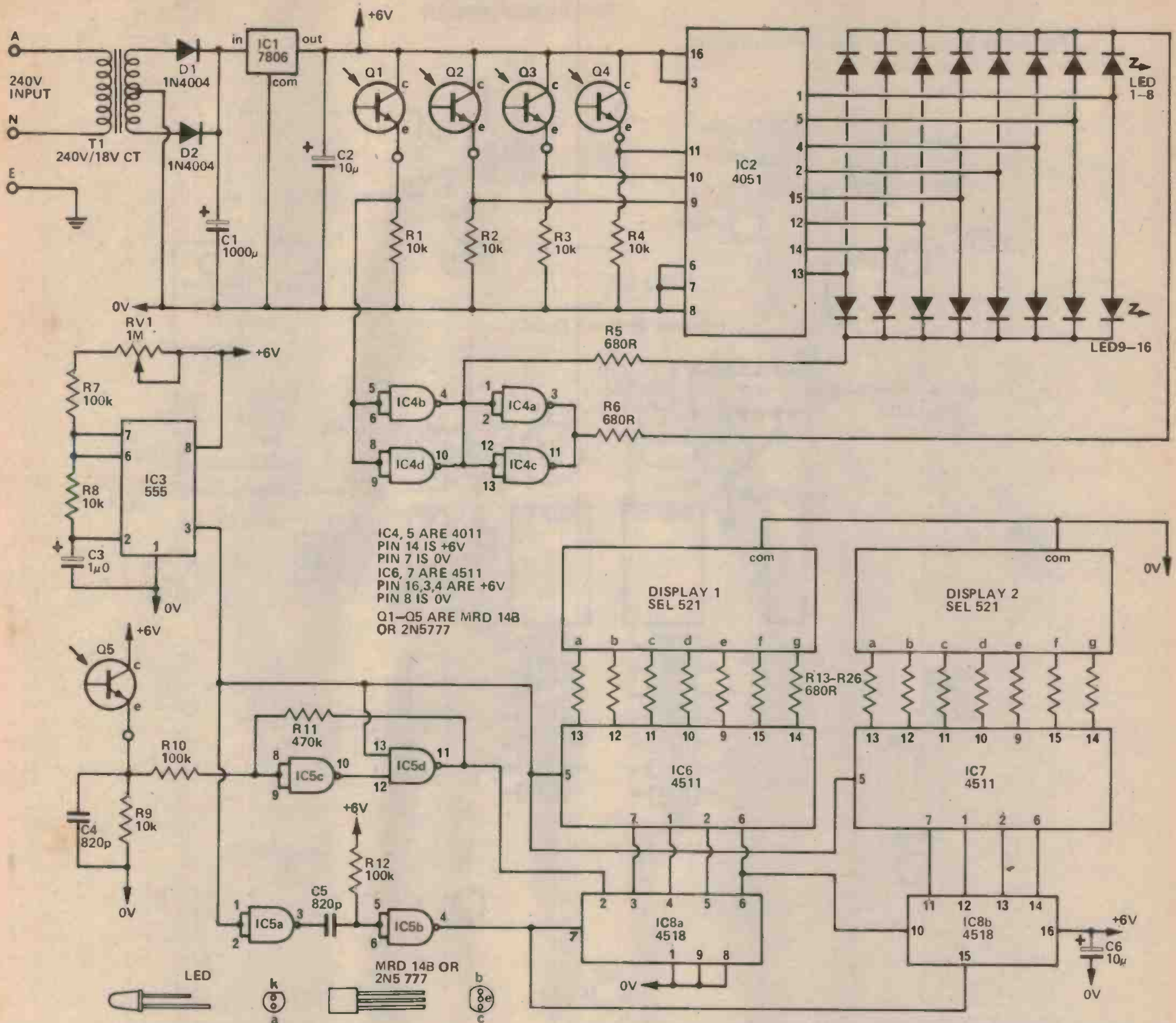
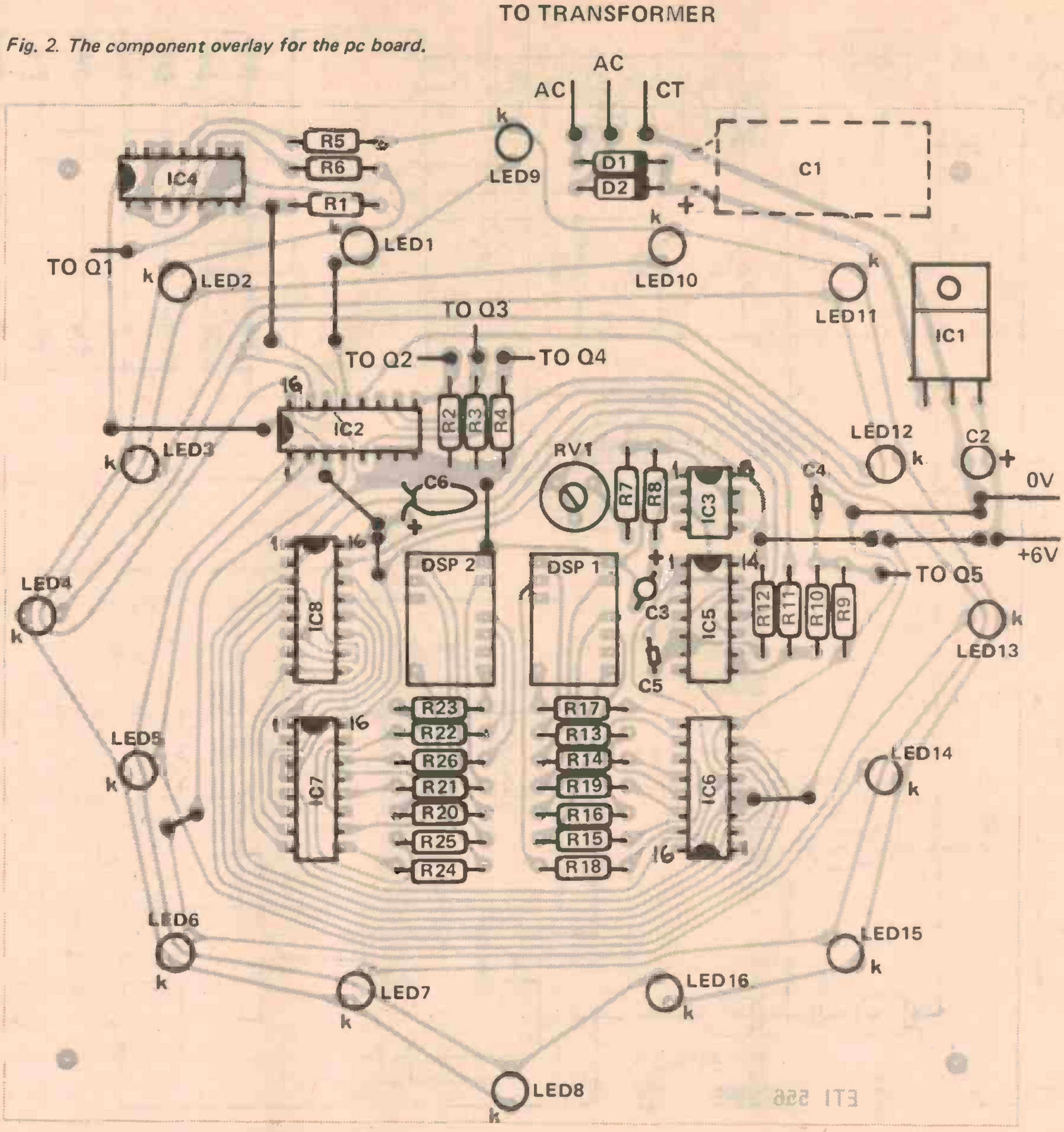


Fig. 1. The circuit diagram of the wind meter.

SPECIFICATION – ETI 556

Wind speed	
Speed range	0 – 99 km/h, knots or mph
Resolution	1 km/h, knot or mph
Display	2 digit LED
Direction	
Resolution	22½ °
Display	16 LEDs
Power supply	240 V ac or 8 to 14 V dc at 350 mA

Fig. 2. *The component overlay for the pc board.*



PARTS LIST – ETI 556

Resistors all ½W, 5%

R1–R4	10k
R5,6	680R
R7	100k
R8,9	10k
R10	100k
R11	470k
R12	100k
R13–R26	680R

Potentiometer

RV1	1M trim, type VTP

Capacitors

C1	1000μ 16V electro
C2	10μ 25V "
C3	1μ0 25V "
C4,5	820p ceramic
C6	10μ 25V electro

Semiconductors

IC1	7806 regulator
IC2	4051 multiplexer
IC3	555 timer
IC4,5	4011 NAND gates
IC6,7	4511 decoder-driver
IC8	4518 dual counter
Q1–Q5	2N5777
D1,2	1N4004
LED1–LED16	Red LEDs
Disp. 1,2	SEL521

Miscellaneous

PC board ETI 556
four minature 12V globes
240V/18V CT Transformer
head assembly
front panel and box

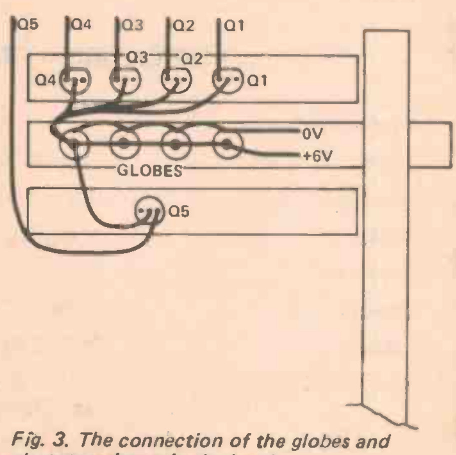


Fig. 3. The connection of the globes and phototransistors in the head.

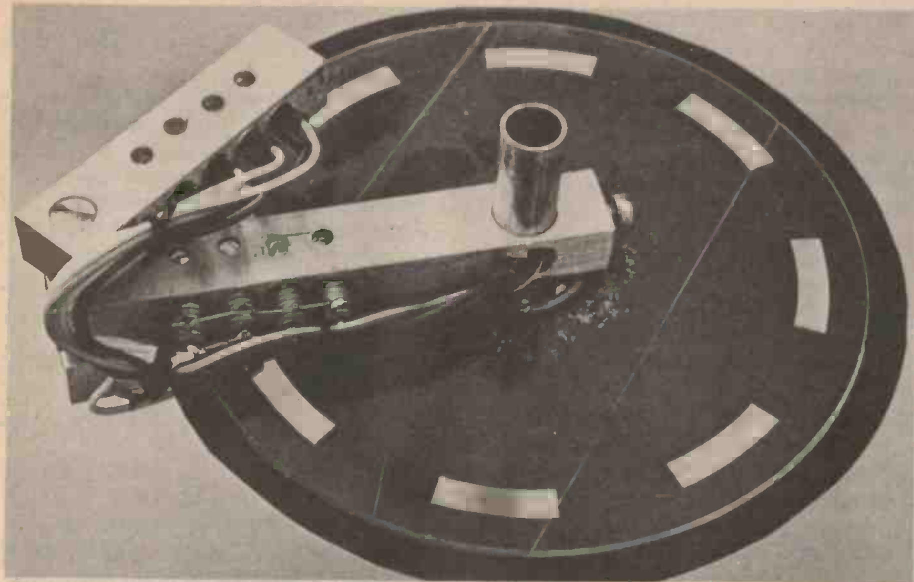
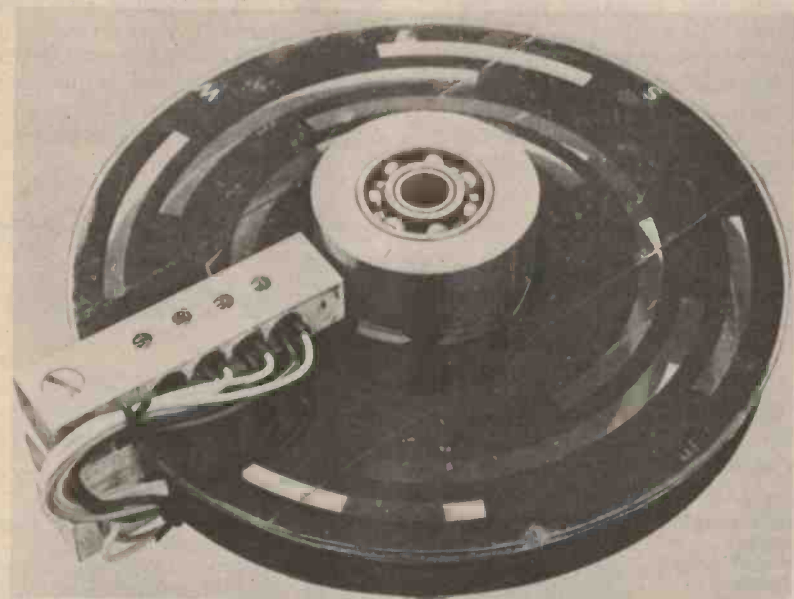


Photo showing the top disc (direction) removed showing the globes and the holes to pass light to the transistor.



The head complete except for the covers.

The Head

The drawings along with the photos will give the general design that we used. The actual dimensions have to be left to the individual constructor as components such as the ball races and light globes may vary in size.

While we used a single head for both speed and direction, it may be simpler to use separate heads.

The discs we used were 1.5mm thick clear plastic with a piece of photographic film glued onto it. It may be easier to make it out of thin aluminum and cut out the slots. For the speed disc simply drilling holes will suffice.

The most important part of the design, apart from ensuring that the discs rotate with a minimum of friction, is the shielding of the light and preventing light scatter striking a transistor which should be dark. As can be seen from the photos and diagram the globes and transistors are imbedded in aluminum blocks with small holes providing a passage for the light beam.

The wiring of the head is shown in fig. 3. Note that the base lead is not used and can be cut off close to the body. Insulate the joints onto the transistors to ensure that they do not short on the aluminum blocks. The globes may touch the block with their outer connection but this is the 0 volt line and does no harm. In fact it provides some electrical shielding for the leads. The globes we used were 12V but they were bright enough on 6V giving a much longer life.

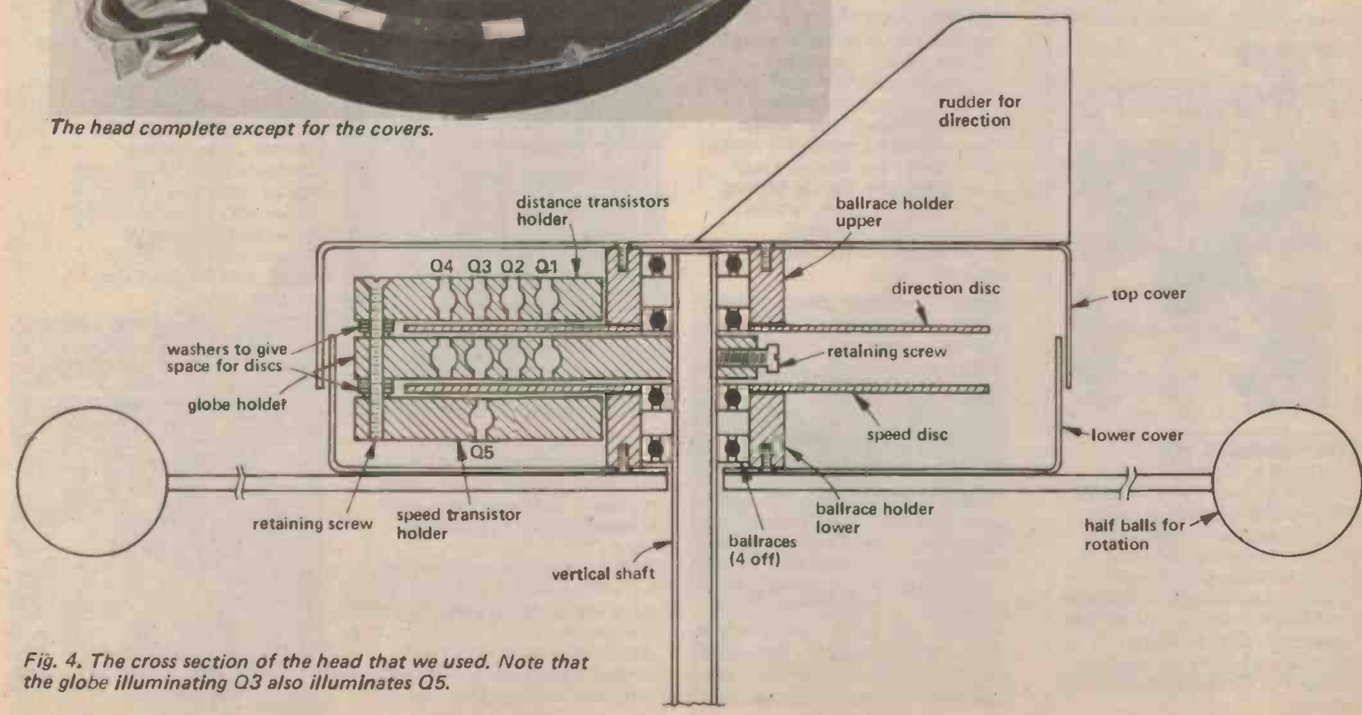


Fig. 4. The cross section of the head that we used. Note that the globe illuminating Q3 also illuminates Q5.

Design Features

When we started design on this project it was to have a digital readout of wind direction with a resolution of either one or two degrees. This would also make it useful in a sailing boat to tell the wind direction relative to the heading.

Difficulties however soon became apparent. The first of these was the sensor head. The only accurate method is a digital head, probably optical. Two methods could have been used, one using a disc with a single optical track of 360 slots and an updown counter and the second using eight or nine tracks in a grey code. The first is simpler in head design but the second is less prone to error. The problem, and the reason for rejecting both, is that with such resolution, the reading would move around so much when the wind is gusty to be unreadable. What is needed is an averaging circuit which unfortunately becomes difficult when the wind is changing from just west of north to just east of north, i.e. 355 to 005. How do you average these (use a microprocessor?).

As this was intended to be a simple project we relaxed our original specification, deleting the use in a boat (we may get back to this problem. A four track 'Grey' scale allows the wind to be given to within 11° of its true heading, without the complexity of a nine track one, and the use of LEDs to give direction solves the problem of averaging as the variations can be seen and averaged by the brain.

Construction

The electronics is relatively simple provided the pc board described is used. Due to a height limitation C1 should be mounted on the rear of the board. The LEDs should be mounted about 7 mm from the board with care being taken not to damage them as the leads have to be bent out slightly. The regulator also has to lie down to give clearance.

We mounted the unit behind an aluminium front panel with the LEDs protruding through holes. If this is to be done it is preferable not to solder the LEDs until after alignment with the front panel.

The head is more difficult as some mechanical ability is necessary to ensure good results. The requirements are basically simple. A disc is to be allowed to rotate, either continuously with the wind or aligning it to the wind, with a globe(s) on one side and phototransistors on the other.

The method used by us is shown in fig 4 with the aluminium blocks providing the shielding necessary to give accurate results. As the unit will be exposed to the weather it must be made waterproof otherwise the ball races will corrode. The races used will normally have to be washed out to give low enough friction with a light spray of WD40 or similar to give some protection.

While our housing is a little ornate, it did work but the more usual half ping pong balls may be more suitable.

Calibration

Wind Speed.

The easiest method for wind speed calibration is to provide the unit with a dc supply (via the common and one of the ac inputs) and to take a drive in the car with the unit supported above the vehicle. Providing there is no wind the potentiometer should be adjusted until the reading corresponds to the speedo.

Direction alignment is simply a matter of aligning the vertical rod so that it gives the correct results.

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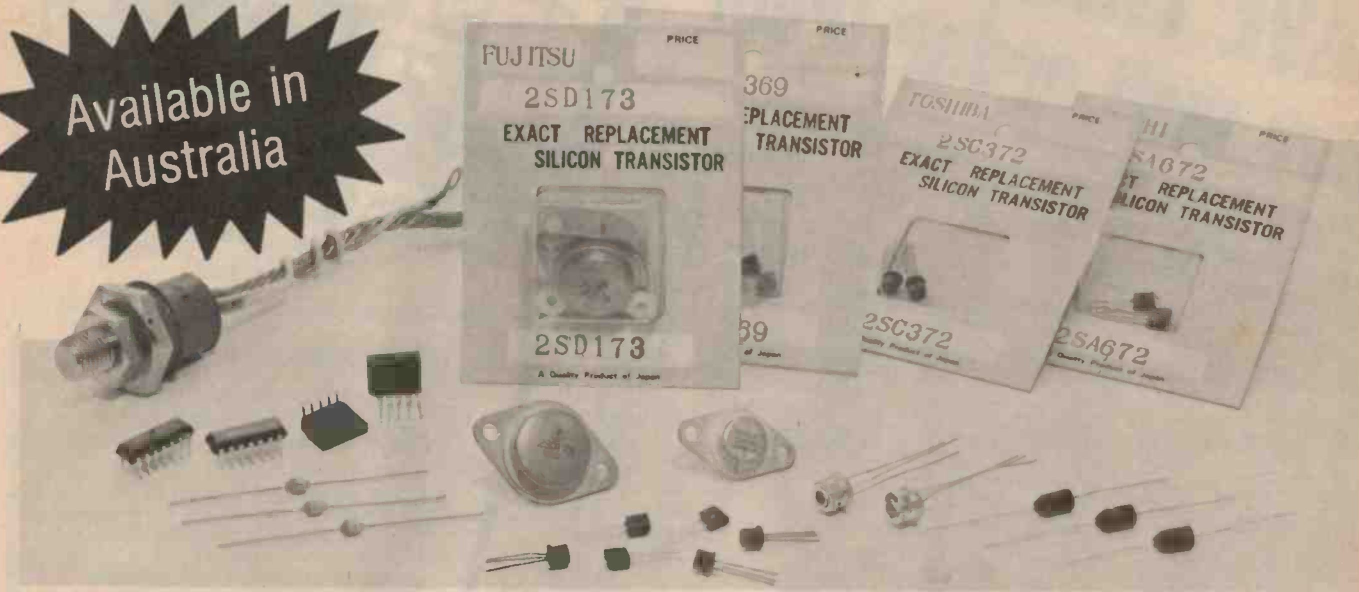

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2SA 715	1.37	2SC 730	6.44	2SC 1114	11.04	2SC 1550	1.65	2SD 389	1.68	M5152L	2.08	LA4050P	3.91
2SA 719	0.56	2SC 732	0.46	2SC 1116	1.17	2SC 1624	1.89	2SD 525	2.36	M5153P	8.40	LA4051P	4.32
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Project 812

WHEEL OF FORTUNE

Take a gamble on this project.

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The answer to that last question as far as we at ETI are concerned is not a lot. We've taken the liberty of implementing that traditional fairground attraction, the Wheel Of Fortune, in our own electronic fashion. The game usually features a large wooden wheel and ratchet arrangement, the stall either accepting bets on which of the ten numbers will be used the pointer when the wheel stops, or perhaps, suggesting that a message under the pointer will give an indication of what the future holds in store for you – you will meet a tall dark stranger, you will marry young and 2.4 mortages, etc.

Cross My Palm

Our game accurately mimics the real thing, the circle of LEDs similating the spin of the Wheel getting under way as a pair of touch contacts are crossed with your palm (or more likely finger). The movement of the LEDs will then slow down to what seems an excrutiatingly slow speed until it finally stops. All this visual activity is at the same time accompanied by a clicking sound that simulates the ratchet sound of the real game.

It's easy to become a trifle blase about electrical games, particularly in the face of the never ending stream of things that we see in the shops at present, but even the most hardened people, and we've got some fairly hardened people here at ETI, found the Wheel of Fortune to be fun. If you start thinking about building it now it might just get finished for Christmas.

WHEEL OF FORTUNE

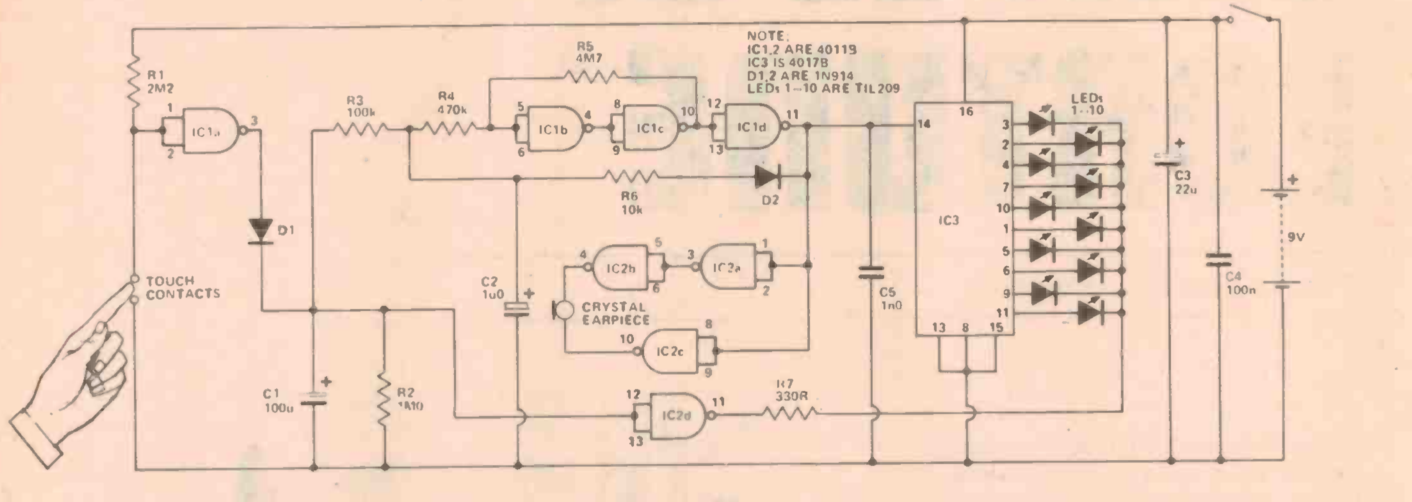


Fig. 1. Circuit diagram of the Wheel of Fortune.

HOW IT WORKS – ETI 812

THE Wheel of Fortune circuit can be broken down into a number of distinct sections; the display circuitry, an audio stage, a VCO, and a touch senstiive/ monostable configuration.

In the "off" state R1 holds the input of IC1a high and hence the output of this gate, wired as an inverter, is low and C1 is discharged. Bridging the touch contacts causes the gate's output to go high and C1 to be charged up via D1, When the finger is removed from the touch contacts and the output of IC1a returns low, C1 is prevented from discharging into this gate as D1 is now reverse biased, instead C1 discharges slowly via R2.

The VCO is formed by the components associated with IC1b, c and d. The circuit in fact generates a series of constant duration negative going pulses separated by "spaces" whose duration can be varied by the control voltage.

When the control voltage (the voltage on C1) is below a threshold level that is equal to half supply voltage the circuit will not oscillate. If we now assume that the voltage on C1 rises to supply, as would be the case when the touch contacts are bridged, C2 will start to charge up. The voltage across C2 is applied, via R4, to the schmitt trigger formed by IC1a and b. As the voltage applied to the schmitt crosses its upper switching threshold the output of IC1d, which inverts and buffers the schmitt's output, will go low. This will cause C2 to be rapidly discharged via the relatively low impedance path offered by R6 and D2. As the voltage on C2 crosses the lower threshold of the schmitt the output of IC1d returns high and C2 once more begins to charge. The time taken for the voltage on C2 to reach the schmitt's trigger point is dependent on the voltage across C1. Thus when the voltage on C1 is large, C2 quickly reaches the trigger point and the VCO produces a high frequency, this frequency reducing as the voltage of C1 falls.

The output from the VCO is fed both to IC3 to drive the ring of LEDs and to IC2a, b and c to produce the audio output.

The crystal earpiece that provides the "clicking" is driven from a bridge circuit. This effectively doubles the voltage applied to the transducer and hence, from $P = V^2/R$, quadrouples the audio output.

The LEDs driven by IC3 have their cathodes connected via R7, to the output of IC2d. The output of this gate will normally be high, going low when the voltage on C1 is above half supply. As IC3 outputs are active high the display is thus enabled for a period of time that is slightly longer than the duration of the VCO's oscillation.

C3 and C4 are included to decouple the supply while C5 is needed to prevent any RF interference affecting the circuit's operation.

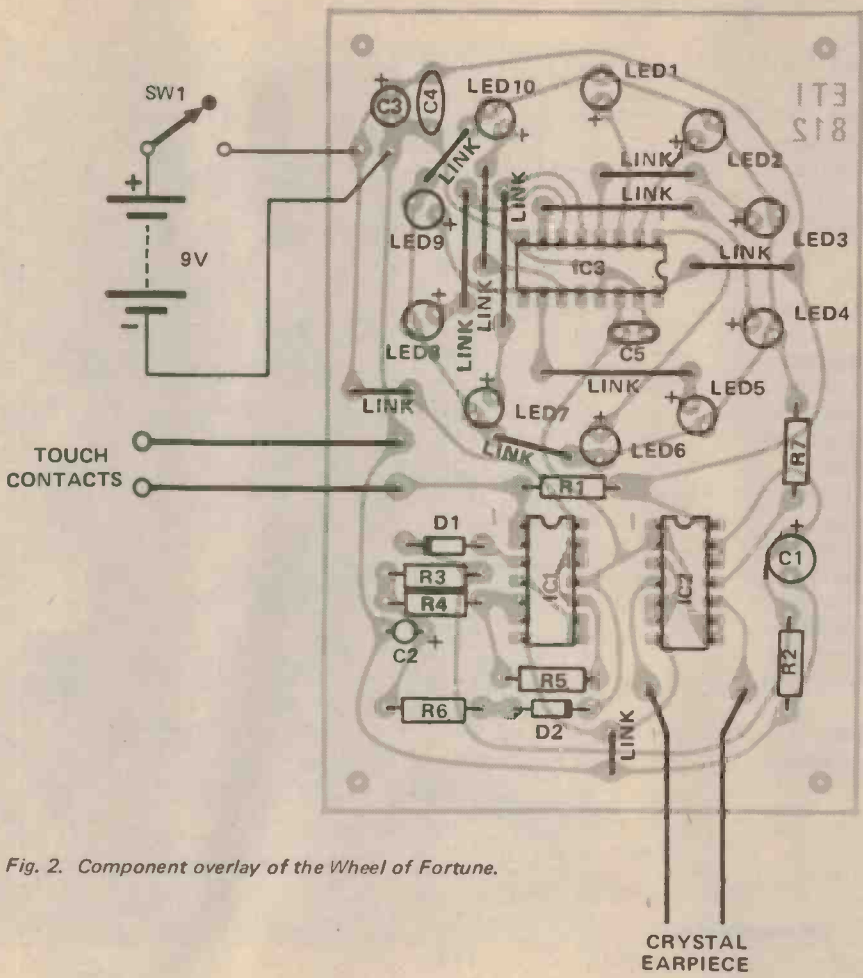


Fig. 2. Component overlay of the Wheel of Fortune.

PARTS LIST – ETI 812

Resistors all ¼W 5%

R1	2M2
R2	1M
R3	100k
R4	470k
R5	4M7
R6	10k
R7	330R

Capacitors

C1	100µ 16 VW
C2	1µ 16 VW
C3	22µ 16 VW
C4	100n Ceramic
C5	1n Ceramic

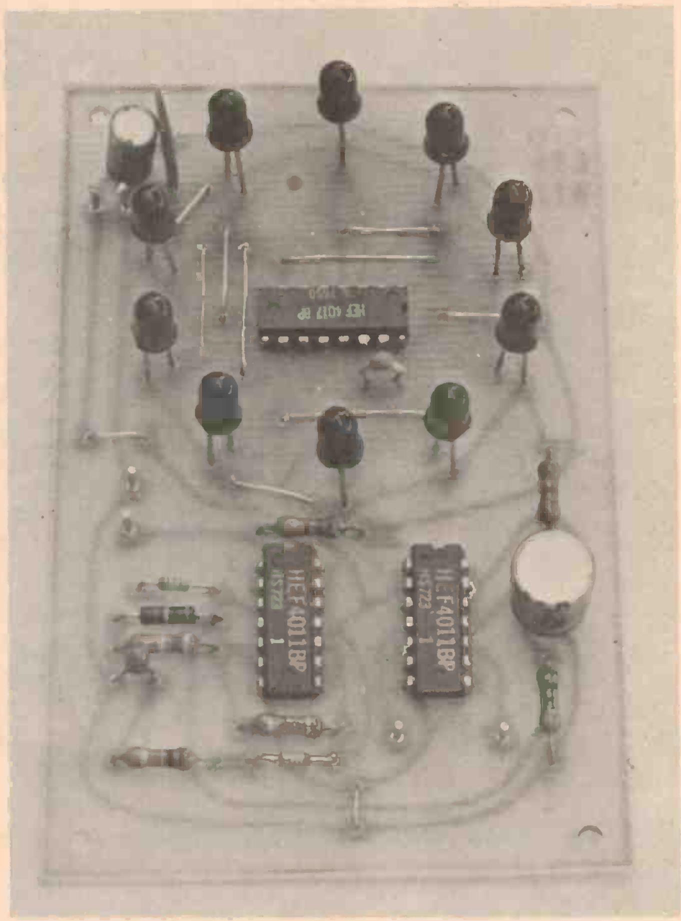
Semiconductors

IC1, 2	4011B
IC3	4017B
D1, 2	IN914 or similar
LED1-LED 10	TIL 209 or similar

Miscellaneous

9V battery and clip, crystal earpiece, miniature jack socket, box to suit, pcb.

None of the components used in the Wheel of Fortune game should prove hard to find as most will be stock items in many component shops. Make sure that the tantalum capacitors specified for C1, 2 and 3 are used as the circuit makes use of the low leakage characteristics of these components.



The assembled PCB.

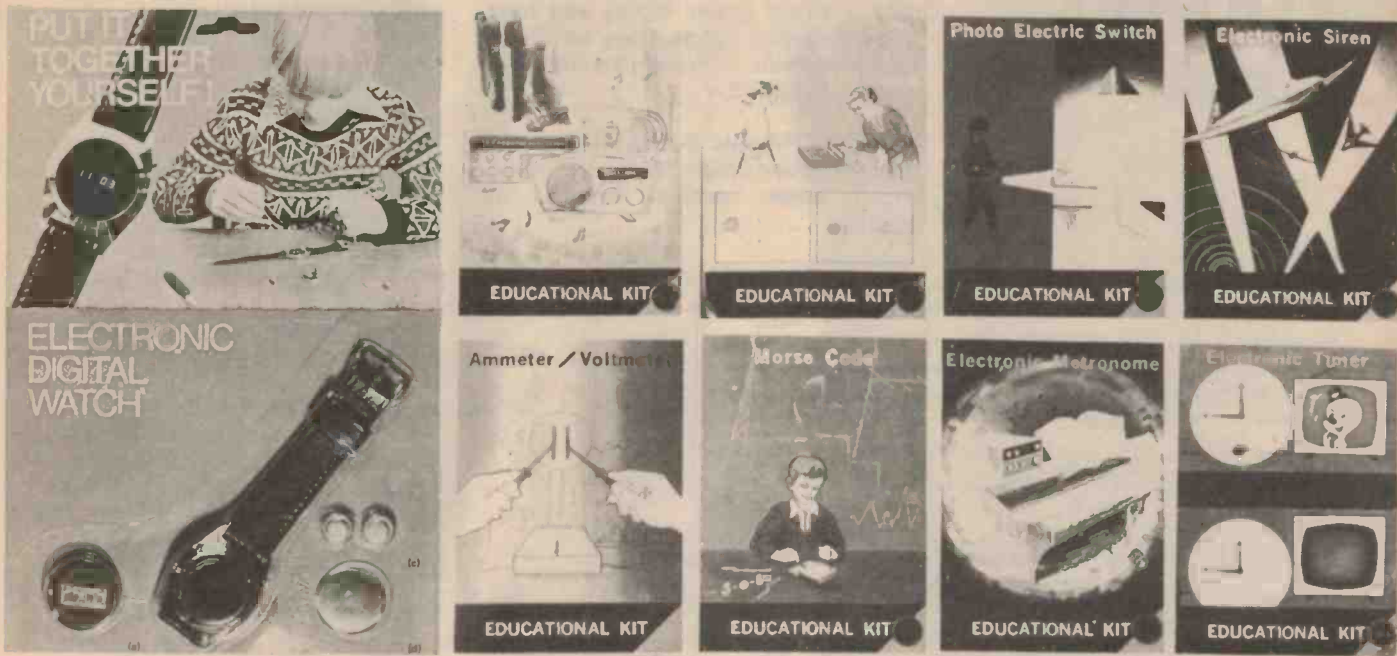
Construction

Start by mounting all the components on the PCB with the exception of the LEDs. Pay attention to the orientation of the polarity sensitive devices and, for choice, mount the ICs in sockets.

The touch contacts formed by two drawing pins are glued to the front panel. When the case has been prepared, place, but do not solder, the LEDs into the PCB and offer them up to the case. Solder one lead of each LED. At this stage make sure that all the devices are properly seated, then solder the second lead.

That about completes the construction, just connect up to a battery and place your bets.

KITS for KIDS!



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See July or August '78 ETI for full details. ****Batteries not included in kits A to T.***

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ETI data sheet

NATIONAL LM324

The LM124 series op amps operate with only a single power supply and have true-differential inputs. They remain in the linear mode with an input common-mode voltage of 0 V_{DC}.

Precautions should be taken to insure that the power supply for the integrated circuit never becomes reversed in polarity.

Large differential inputs voltages can be easily accomodated and, as input differential voltage protection diodes are not needed, no large input currents result from large differential input voltages. The differential input voltage may be larger than V^+ without damaging the device. Protection should be provided to prevent the input voltages from going negative more than −0.3 V_{DC} (at 25°C). An input clamp diode with a resistor to the IC input terminal can be used.

To reduce the power supply current drain, the amplifiers have a class A output stage for small signal levels which converts to class B in a large signal mode. This allows the amplifiers to both source and sink large output currents. Therefore both NPN and PNP external current boost transistors can be used to extend the power capability of the basic amplifiers.

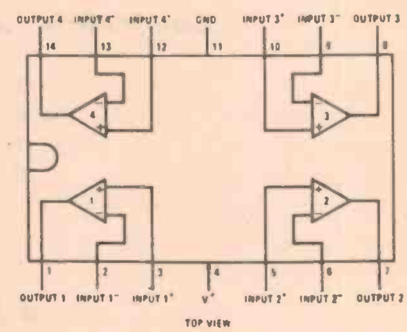
For ac applications, where the load is

electrical characteristics (V^+ = +5.0 V_{DC}

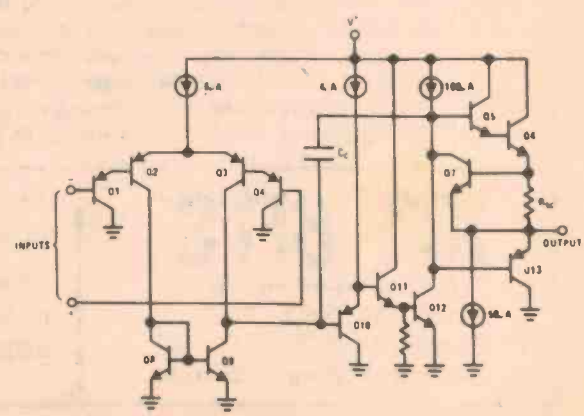
PARAMETER	CONDITIONS	LM324 MIN	LM324 TYP	LM324 MAX	UNITS
Input Offset Voltage	T_A = 25°C		±2	±7	mV_{DC}
Input Bias Current	$I_{IN(+)}$ or $I_{IN(-)}$, T_A = 25°C		45	250	nA_{DC}
Input Offset Current	$I_{IN(+)} - I_{IN(-)}$, T_A = 25°C		±5	±50	nA_{DC}
Input Common-Mode Voltage Range	V^+ = 30 V_{DC}, T_A = 25°C	0		V^+−1.5	V_{DC}
Supply Current	R_L = ∞, V_{CC} = 30V, (LM2902 V_{CC} = 26V) R_L = ∞ On All Op Amps Over Full Temperature Range T_A = 25°C		1.5 0.7	3 1.2	mA_{DC} mA_{DC} mA_{DC}
Large Signal Voltage Gain	V^+ = 15 V_{DC} (For Large V_O Swing) $R_L \geq$ 2 kΩ, T_A = 25°C	25	100		V/mV
Output Voltage Swing	R_L = 2 kΩ, T_A = 25°C (LM2902 $R_L \geq$ 10 kΩ)	0		V^+−1.5	V_{DC}
Common-Mode Rejection Ratio	DC, T_A = 25°C	65	70		dB
Power Supply Rejection Ratio	DC, T_A = 25°C	65	100		dB
Amplifier-to-Amplifier Coupling	f = 1 kHz to 20 kHz, T_A = 25°C (Input Referred)		−120		dB
Output Current Source	V_{IN}^+ = 1 V_{DC}, V_{IN}^- = 0 V_{DC}, V^+ = 15 V_{DC}, T_A = 25°C	20	40		mA_{DC}
Sink	V_{IN}^- = 1 V_{DC}, V_{IN} = 0 V_{DC}, V^+ = 15 V_{DC}, T_A = 25°C	10	20		mA_{DC}
	V_{IN}^- = 1 V_{DC}, V_{IN}^+ = 0 V_{DC}, T_A = 25°C, V_O = 200 mV_{DC}	12	50		μA_{DC}
Short Circuit to Ground	T_A = 25°C		40	60	mA_{DC}
Input Offset Voltage				±9	mV_{DC}
Input Offset Voltage Drift	R_S = 0Ω		7		μV/°C
Input Offset Current	$I_{IN(+)} - I_{IN(-)}$			±150	nA_{DC}
Input Offset Current Drift			10		pA_{DC}/°C
Input Bias Current	$I_{IN(+)}$ or $I_{IN(-)}$		40	500	nA_{DC}
Input Common-Mode Voltage Range	V^+ = 30 V_{DC}	0		V^+−2	V_{DC}
Large Signal Voltage Gain	V^+ = +15 V_{DC} (For Large V_O Swing) $R_L \geq$ 2 kΩ	15			V/mV
Output Voltage Swing V_{OH}	V^+ = +30 V_{DC}, R_L = 2 kΩ $R_L \geq$ 10 kΩ	26 27	 28		V_{DC} V_{DC}
V_{OL}	V^+ = 5 V_{DC}, $R_L \leq$ 10 kΩ		5	20	mV_{DC}
Output Current Source	V_{IN}^+ = +1 V_{DC}, V_{IN}^- = 0 V_{DC}, V^+ = 15 V_{DC}	10	20		mA
Sink	V_{IN}^- = +1 V_{DC}, V_{IN}^+ = 0 V_{DC}, V^+ = 15 V_{DC}	5	8		mA
Differential Input Voltage				V^+	V_{DC}

connection diagram

Dual-In-Line and Flat Package



schematic diagram (Each Amplifier)



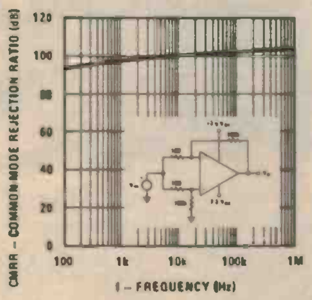
capacitively coupled to the output of the amplifier, a resistor should be used, from the output of the amplifier to ground to increase the class A bias current and prevent crossover distortion. Where the load is directly coupled, as in dc applications, there is no crossover distortion.

Large closed loop gains or resistive isolation should be used if load capacitances over 50 pF must be driven by the amplifier.

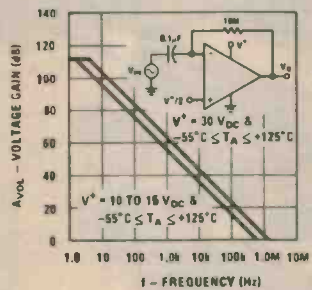
Output short circuits either to ground or to the positive power supply should be of short time duration. Putting direct short-circuits on more than one amplifier at a time will increase the total IC power dissipation to destructive levels, if not properly protected with external dissipation limiting resistors in series with the output leads of the amplifiers.

Introducing a pseudo-ground (a bias voltage reference of $V^+/2$) will allow operation above and below this value in single power supply systems.

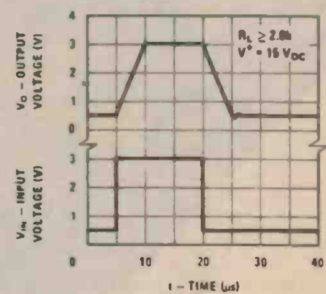
Common Mode Rejection Ratio



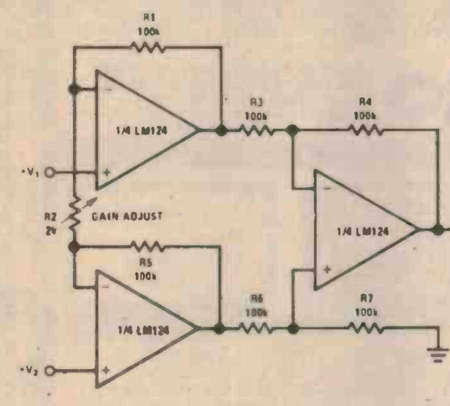
Open Loop Frequency Response



Voltage Follower Pulse Response



High Input Z Adjustable-Gain DC Instrumentation Amplifier

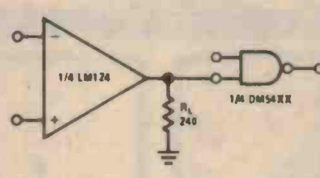


If R1 = R5 & R3 = R4 = R6 = R7 (CMRR depends on match)

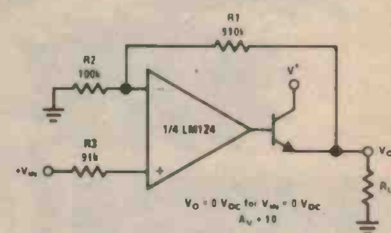
$$V_O = 1 + \frac{2R1}{R2}(V_2 - V_1)$$

As shown $V_O = 101 (V_2 - V_1)$

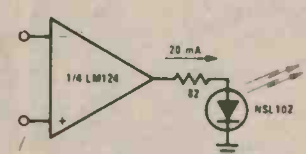
Driving TTL



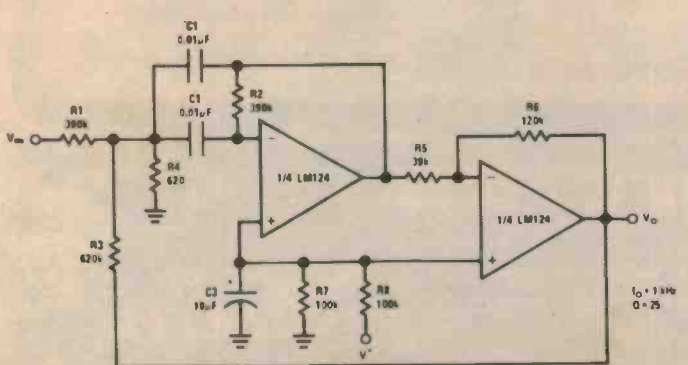
Power Amplifier



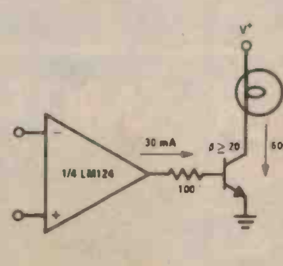
LED Driver



Bandpass Active Filter



Lamp Driver



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See review in December '78 E.A.

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MAZE Cat. X-1204
Four great games - Maze, Jailbreak, Blind-man's-bluff, and Trailblazer - games that will test your skill.

BASEBALL Cat. X-1205
All the skills and thrills of the league - for two players.

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Two games - for one player the Red Baron is after you, in the other, two players shoot it out in the sky.

SPACE WAR Cat. X-1207
Laser beams streak towards you - can you outrace and outgun the aliens from outer space.

MATH QUIZ I Cat. X-1208
Addition and subtraction by using your TV screen

MATH QUIZ II Cat. X-1209
Multiplication and division - teach yourself and the kids.

PINBALL CHALLENGE Cat. X-1217
Remove different coloured walls of bricks to become a pinball wizard.

BACKGAMMON Cat. X-1213
All the rules programmed into the cartridge - so no cheating - also has Acey Duecy a variation on Backgammon.

TORPEDO ALLEY Cat. X-1211
Sink as many ships as possible - plus Robot War, try and escape the robots by destroying them in a force field.

SONAR SEARCH Cat. X-1214
Use your ears to try and sink a hidden fleet.

DODGE IT Cat. X-1216
Dodge a varying number of balls to win this game.

MEMORY MATCH Cat. X-1215
Numbers are exposed then disappear try and remember where they are to win this game.

MAGIC NUMBERS Cat. X-1210
Guess the right digits in the right place - race the clock or play for points.

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425EA1278

Project 490

Audio compressor

Increase your talk power with this circuit.

THE HUMAN VOICE, being expressive at its best, varies considerably in level, even when one is speaking in a normal conversational voice. The peaks are considerably higher than the lower levels, which can give rise to problems when the speech waveform is being modulated onto a carrier by a transmitter. For example, if the mic gain control is set so that the peaks are just giving 100% modulation, then soft sounds can barely be heard whereas if the gain is turned up to give a higher level on vowel sounds, etc., then plosives (p-sounds) will give overmodulation and consequent splattering and poor speech quality.

A higher ratio of average power to peak voltage can be achieved by several methods, including compression or clipping of the audio signal and compression or clipping of the radio frequency signal. Radio frequency compression or ALC (automatic level control) is often used in the final stages of SSB transmitters.

Radio frequency clipping is the most effective method of increasing the average power; however it requires complex circuitry, since it is necessary to generate an SSB signal, clip, and then insert this signal into the transmitter IF chain.

Almost as effective as RF clipping is a combination of audio compression, clipping and filtering, which is relatively simple and can realise an improvement in signal to noise ratio of up to 5 dB on weak signals.

Compression

When speaking into a microphone it is desirable to keep the voice level as constant as possible. This can be quite difficult as any change in the distance to the microphone will cause a drastic change in its output. To overcome this a variable gain amplifier can be used which senses the average speech level and adjusts its gain accordingly for a constant output voltage. The compressor operates with a fast attack (gain reduction) and a slow decay (gain increase), to quickly respond to the voice while remaining at this level to prevent amplification of background noise during speech pauses.

Clipping

The average power contained in a speech waveform is quite low compared to the peak voltage, and much less than the average power of a sine wave of the same amplitude. If the low energy high voltage peaks are cut off at a preset level the remaining signal can be increased without overdriving the transmitter. The average power is therefore increased. Clipping will slightly change the sound of the voice but will increase the intelligibility of a weak signal, as well as preventing the transmitter from being overdriven by limiting the maximum signal voltage.

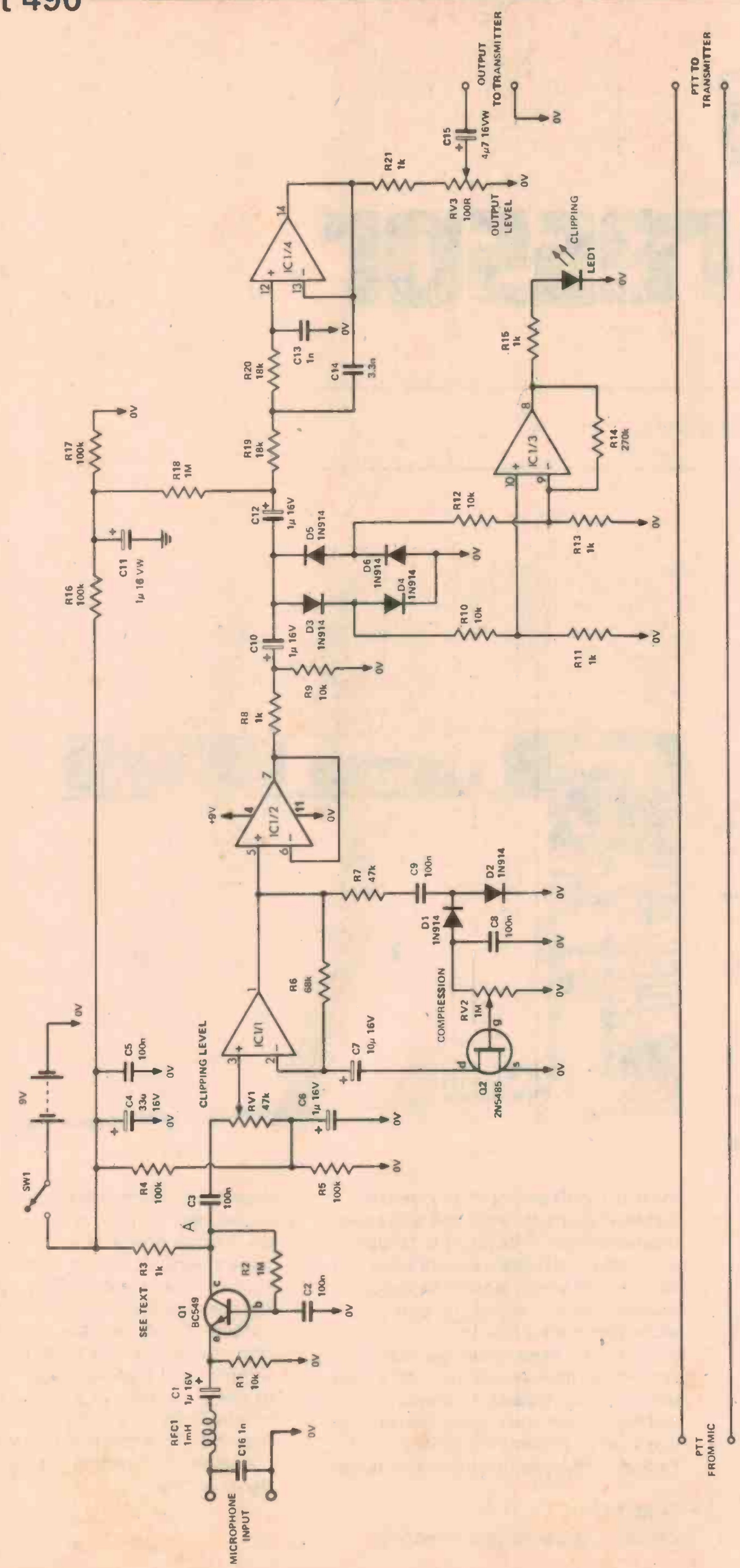


Fig. 1. Circuit of the Audio Processor.

HOW IT WORKS – ETI 490

The input is fed to a common base amplifier (Q1) and then to the gain control, RV1. The signal is then further amplified by IC1/1. Some of the output from IC1/1 is rectified and negatively charges C8. This voltage is then fed to Q2, a depletion mode N – channel FET. As the output of IC1/1 increases the voltage on the gate increases negatively and the impedance of Q2 increases. This increases the ratio of the feed back signal applied to the negative input of IC1/1 and the overall gain is reduced. The attack time is set by the time constant of R7 and C8, while the decay time is set by RV2 and C8.

IC1/1 is a buffer to isolate the peak limiter from the compressor input. R8 limits the output current of IC1/2 on peaks while R9 provides output bias current to prevent crossover distortion in the LM324 when driving capacitive loads. The diodes D3-D6 form the peak limiter by shorting any signal over about 1.5 V. When clipping occurs the voltage across D4 and D6 rises to 0.7 V. This voltage is used to turn on IC1/3 to give an indication of clipping by lighting LED 1.

The active low pass filter, IC1/4, removes the unwanted harmonics produced by clipping. RV3 sets the output level. The low frequency response is limited by the value of the coupling capacitors and C2.

Filtering

When a waveform is clipped high order harmonics are produced which, if allowed to reach the transmitter, would cause splatter and interference to neighbouring stations. A filter must be used after the clipper to rapidly attenuate all frequencies above 3 kHz, which are unnecessary for intelligibility. This is achieved by using an active filter with 12 dB/octave attenuation above 2.5 kHz.

Construction

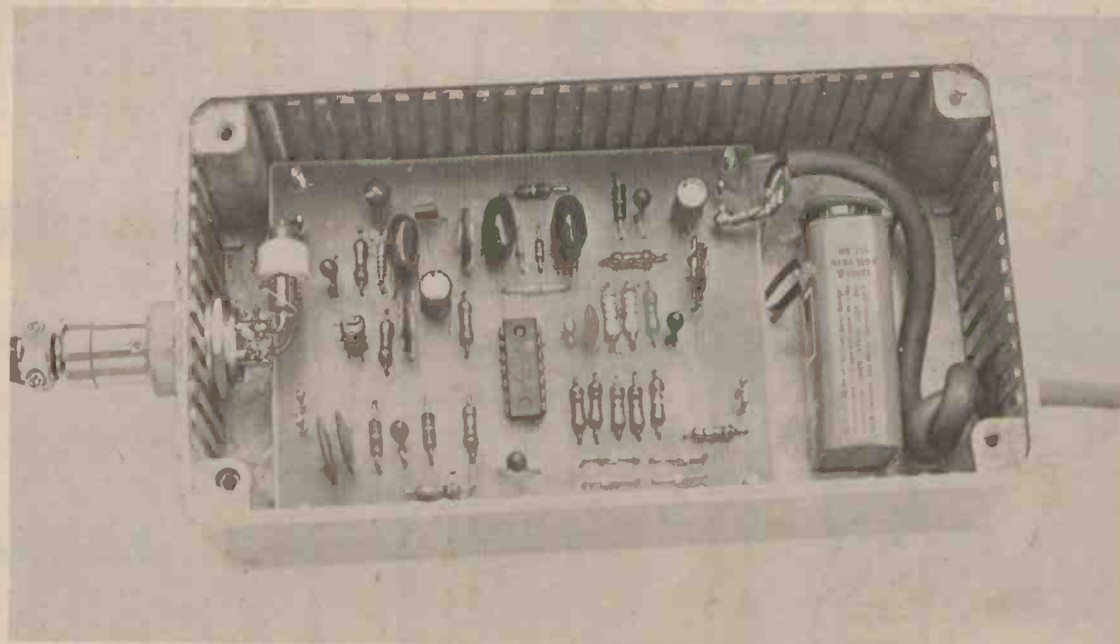
The speech processor is mounted in a diecast aluminium box to guard against feedback which can be caused by strong RF fields. Our box measured 150 mm x 80 mm x 50 mm deep. Either an internal 9V battery or the 12V transceiver supply can be used. The processor is designed to be used in the line from the microphone to the transmitter without any modification to either. A matching socket to the mic plug is used for the input and the output taken via a lead with a matching plug. The connections for the plug and socket vary between makes of transceivers and will have to be taken from the circuit diagram of the transceiver. The clipping indicator (LED 2) and the power switch are mounted on the front panel.

Setting Up

Turn the compressor control to maximum and speak into the microphone at the greatest distance you are likely to use, (say 30 cm). Increase the gain control until the clipping LED flashes. If this point cannot be reached decrease the compression control and try again. The setting of these two controls is best determined by on-air tests. The output level control should be set so the RF indicator on the transmitter reaches the same peak as with only the microphone plugged in.

For high output, high impedance microphones, such as crystal types, Q1 can be omitted, RV1 replaced with a 1M trimpot and the input fed to point A on the circuit.

The gain of Q1 is proportional to the value of R3. Increasing its value increases the gain. To guard against feedback the lowest value possible should be used.



Inside view of the Processor. The RF chock should be mounted as close as possible to the input socket.

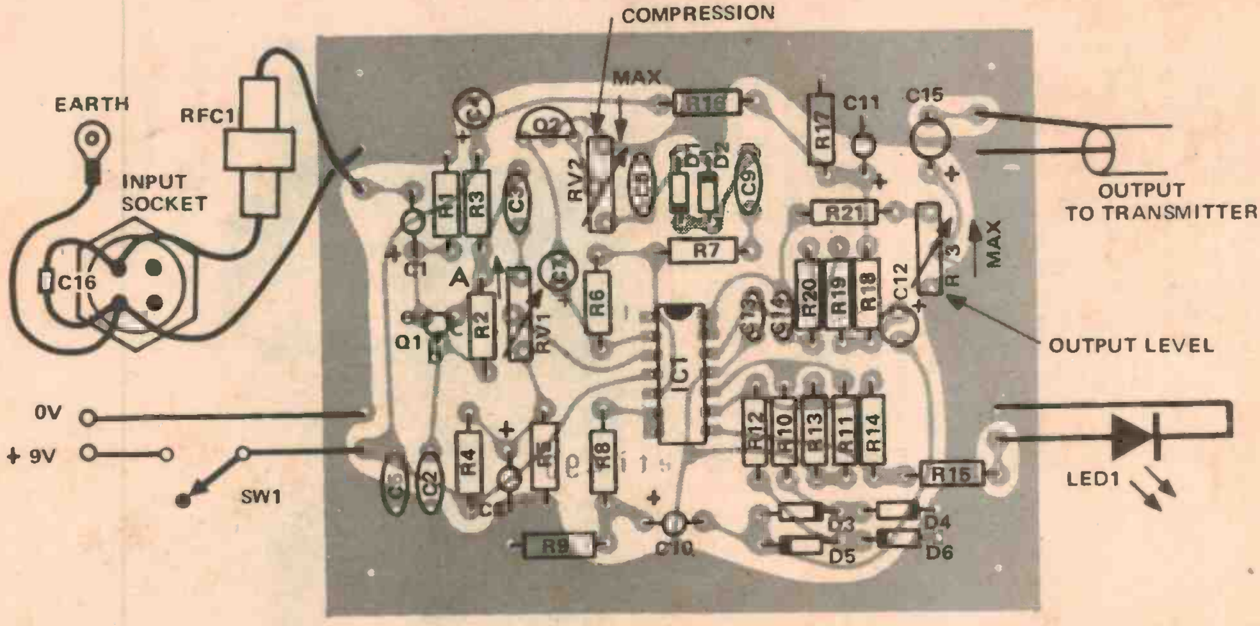


Fig. 2. Component overlay of the Audio Processor. Note the RF chock and capacitor mounted between the PCB and input socket.

PARTS LIST – ETI 490

Resistors all ¼W, 5%
R1 . . . . . 10k
R2 . . . . . 1M
R3 . . . . . 1k
R4, 5 . . . . 100k
R6 . . . . . 68k
R7 . . . . . 47k
R8 . . . . . 1k
R9, 10 . . . 10k
R11. . . . . 1k
R12. . . . . 10k
R13. . . . . 1k
R14. . . . . 270k
R15. . . . . 1k
R16, 17 . . 100k
R18. . . . . 1M
R19, 20 . . 18k
R21. . . . . 1k

Potentiometers
RV1 . . . . 47k lin mini trimpot
RV2 . . . . 1M lin mini trimpot
RV3 . . . . 100Ω lin mini trimpot

Capacitors
C1. . . . . . 1µ 16 VW electro
C2, 3 . . . . 100n greencap
C4. . . . . . 33µ 16 VW electro
C5. . . . . . 100n Ceramic
C6. . . . . . 1µ 16 VW electro
C7. . . . . . 10µ 16 VW electro
C8, 9 . . . .100n greencap
C10–C12 . 1µ 16 VW electro
C13 . . . . . 1n greencap
C14 . . . . . 3.3n greencap
C15 . . . . . 4µ7 16 VW electro
C16 . . . . . 1n ceramic

Semiconductors
Q1 . . . . . BC549 or sim
Q2 . . . . . 2N5485 FET
IC1 . . . . . LM324N

D1–D6. . . 1N914 or sim
LED1. . . . Red LED

Miscellaneous
RFC1. . . .1mH or higher Radio Frequency Chock
SW1. . . . . SPST miniature toggle
Metal box to suit, 9V battery and holder, microphone plug and socket to suit, length multi wire shielded cable.

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PM-351 3½ digits

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- No zero adjustment.
- Input voltage protection.
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- Overload indication.
- Automatic polarity.
- 0.2V, 2V, 20V, 200V or 1000V range.

Features:
- MOS/LSI construction.
- Less than 1" high.
- Large LCD or LED display.
- Programmable decimal.
- No zero adjustment.
- Overload indication.
- Low power requirement.
- Display blanking.
- Automatic polarity.
- Input voltage protection.
- 0.2V, 2V, 20V, 200V or 1000V range.

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Project 593

Colour Sequencer

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

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

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

Design Features

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

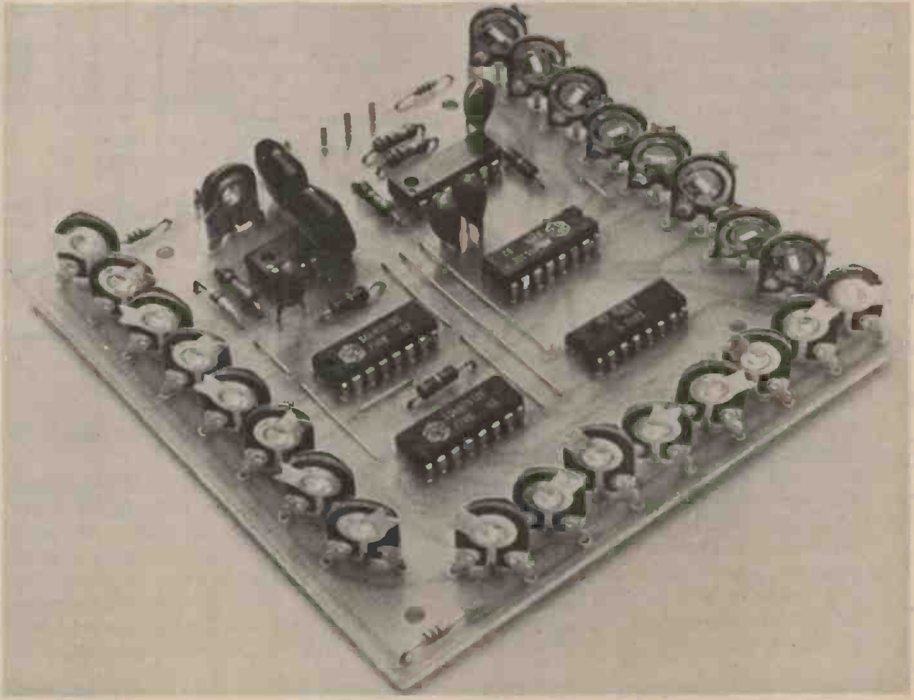
Construction

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

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

SPECIFICATION – ETI 593

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



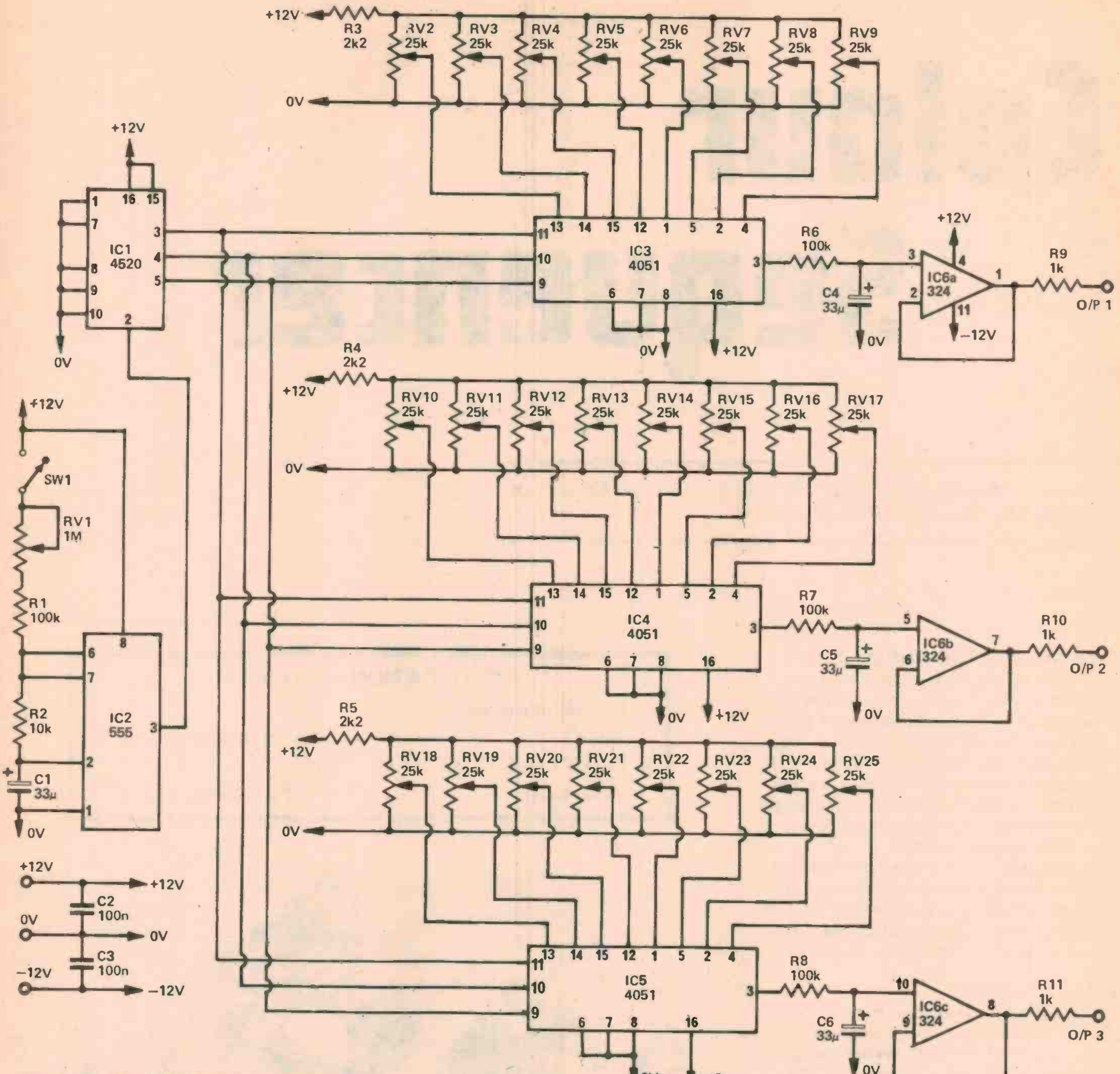


Fig. 1. The circuit diagram of the sequencer.

How It Works - ETI 593

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

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

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

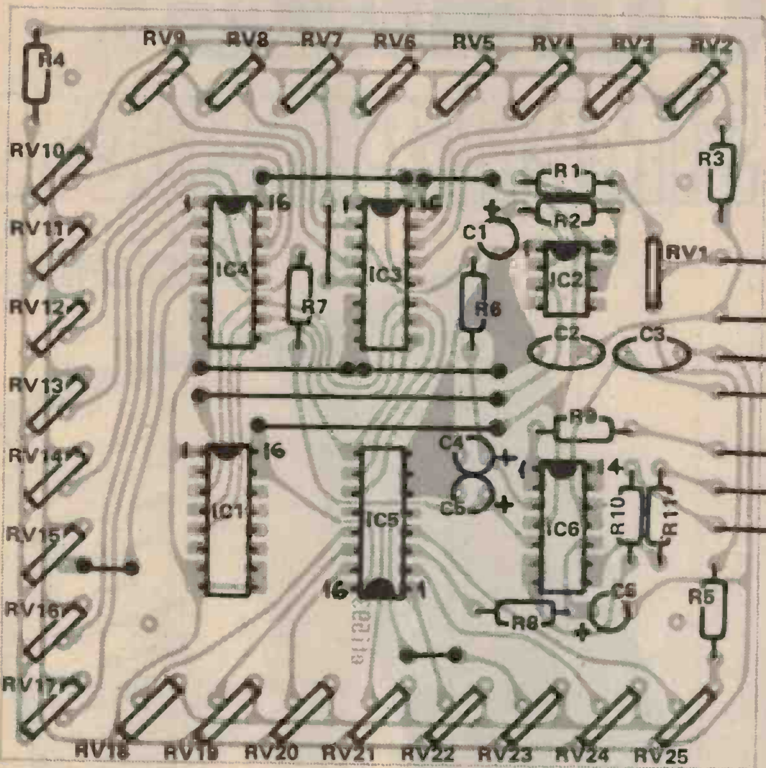


Fig. 2. The component overlay.

PARTS LIST – ETI 593

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

Potentiometers
RV1 . . . . . . 1M trim
RV2–RV25 . . 25k trim

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

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

Miscellaneous
PC board ETI 593
single pole switch

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

Setting Up

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

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

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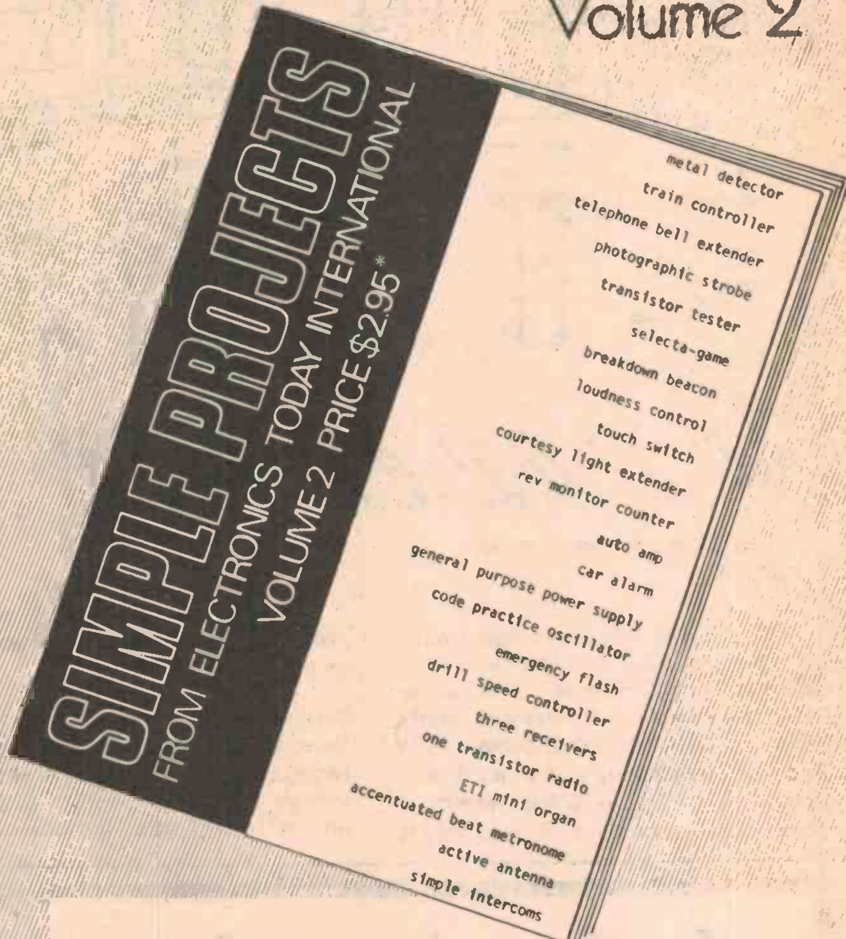

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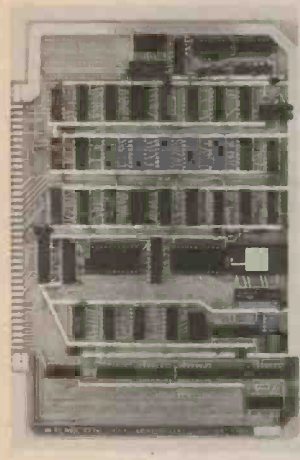

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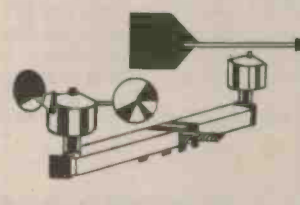

ID-1590E SPECIFICATIONS: Wind Speed: 0-99 in miles per hour, knots or kilometres per hour (choice of two). Response Threshold: 3 mph Accuracy ± 1 digit or ± 10%, whichever is greater. Direction Response Threshold: approx 2 mph. Power Requirement: 240V AC, 50 Hz.

Outstanding accuracy and easy-to-read digital display make this kit a "must" for pilots, boaters—anyone whose activities are affected by the wind. Pick the two readout modes you want from the three available: miles or kilometres per hour, or knots. Switches select mode and front-panel lights show which is in use. Incandescent bulbs mark the 8 principal compass points, providing 16-point resolution. The transmitter boom clamps on to any 1" to 1½" TV aerial mast and connects to the receiver with optional cable.

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KIT ID-1390AE—$97.00

You'll never have to "gauge-guess" again! This fun-to-build kit monitors indoor/outdoor (or any two temperatures) with a big, bright, ½" high digital readout. The readout includes plus and minus signs as well as indoor and outdoor indicator lights, so you know at a glance which temperature is being monitored. Switches select Fahrenheit or Celsius and let you choose continuous readings of one temperature or alternate readings of both. The 85' of cable included lets you place the temperature sensors just about anywhere for a variety of custom applications—home freezer, hot house, garage, basement, pump house, swimming pool, aquarium, almost any temperature.

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ICM7216C Frequency Counter, Drives Common Anode LED's
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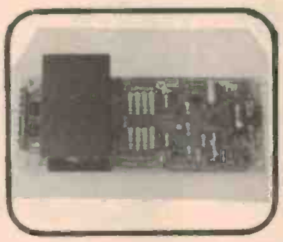

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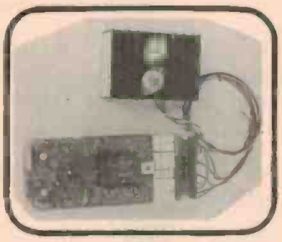

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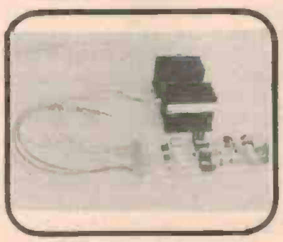

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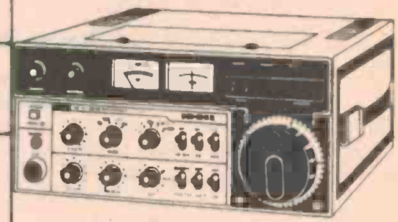

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Amateur News

Auroral Scatter

The first reported auroral scatter contacts in about 20 years for this part of the world occurred on the night of 28th August last. Contacts between Victoria (VK3), South Australia (VK5) and Tasmania (VK7) were reported with about a dozen stations involved. Both the six metre and two metre bands were used during the period of the opening.

An auroral formation was visible to the south of Tasmania at about 1900 hrs. First contacts via auroral scatter were on CW at around 2000 hrs between VK7JG and VK7AH who maintained contact for about an hour. The aurora flared up at 2230 hrs, the formations moving north. It was subsequently visible from as far north as Birchip in Victoria and Albury in southern NSW. The predominant aurora was a light-coloured arc visible in the south-western sky.

VK3OT and VK3ATN in north-western Victoria made contact at 2300 hrs and were successful on SSB apart from CW, despite the heavy 'buzz' on the signal – the most noticeable characteristic of auroral scatter signals.

The visible aurora faded around 2330 hrs, signals dropping at the same time. The opening faded at around 2345 hrs.

From reports it seems that high erp greatly assists propagation and the successful stations were running between 100 and 400 watts PEP on six metres to beams ranging from four elements to 11 elements (VK3ATN). On two metres, stations running high power into large arrays were reportedly the most successful.

Auroras peak during the winter months and could provide some welcome excitement and a boost to wintertime activity which is traditionally very low in Australia in contrast to the summer 'DX' season.

Stations reported to be involved in the 28th August opening were: VK3ATN, VK3OT, VK5KK, VK5ZMO, VK7AH, VK7AK, VK7BC, VK7JC, VK7LZ, VK7MC and VK7ZAH.

There should be many more opportunities to explore this mode of propagation over the coming solar cycle peak, so gentlemen of the amateur fraternity, dig out your reference books, sharpen up your wits and keep a sharp lookout for all the indications (solar flares, magnetic storms, watery HF signals etc).

The Channel 5A/0 Battle

Now that there's a 'leg in the door' towards the introduction of UHF television, as reported last issue, now is the time to press your local politician and the Minister for P & T (the Right Honourable A.A. Staley) for the removal of Australia's non-standard TV channels – 0 and 5A.

There's a wealth of material to support the amateurs' case for the removal of 0 and 5A in local amateur publications and from the WIA. See your local Member of Parliament, discuss the *basics* of the issue in a *clear, concise* manner and let him know that radio amateurs exist, what we are and what we do – stress the aspects of the radio amateur as a community resource. If you can organise, get other amateurs who live in the same electorate to go along, either singly or maybe en masse, if you can arrange it!

The fight has just begun!

The "Gosford Field Day"

This most-famous of annual amateur radio events will recur next year (that's 1979!) on Sunday 18 February. Commencing at 0800 (Daylight Saving Time) and ending at 1615 on the appointed day, the Gosford Field Day (as it is colloquially known) will include the 'usual' range of events: scrambles, foxhunts, demonstrations and *new* this time – *a workshop.* This will be run by Des Clift, VK2AHC, and the workshop facilities will include:

- Sweep gen. with VSWR attachments, 10 MHz – 2 GHz
- Deviation meter, 5.5 MHz – 1 GHz
- Power meters, 10 MHz – 12.4 GHz
- Frequency measurement up to 12.4 GHz.

The registration fee is a mere $4 for men, $2 for women (that's sexist discrimination!), $1 for children 16 years and under with a pensioner concession of 50%.

The event will be staged at the familiar venue: the Gosford Showground, Showground Road, Gosford (amazing address!).

To the uninitiated the Gosford Field Day is organised by the Central Coast Amateur Radio Club and is probably the biggest amateur event of its type in this country attracting some 700 registrants each year.

For full details and program, write to (including SAE): *The Secretary, CCARC, P.O. Box 238, GOSFORD 2250.*

Dick Smith Covers Yaesu

Dick Smith Electronics advise that they have available a heavy duty PVC cover to suit Yaesu amateur equipment – the popular FT101E transceiver, FL2100B linear, FRG-7 and FRG-7000 general coverage receivers and the FT901D transceiver.

Recommended for keeping out dust, creepy-crawlies (except those tenacious ones that crawl up from underneath) and to prevent scratching of the equipment, the cover should help to maintain the appearance and resale value.

The covers are supplied free with the purchase of any major piece of Yaesu equipment or they may be purchased separately for $3.95 each (catalogue number D-9050).

More Auroral Scatter – stop press!

The excitement of August 28th returned on the evening of 29 September when stations in VK3, VK5 and VK7 were treated to a seven hour opening.

The fun started a little before 0730 z when VK7DA, Dan, worked VK3OT on CW on 52.050 MHz promptly followed by VK5PB who worked Steve VK3OT but could not hear the VK7. During the following hour the following stations cashed in on the opportunity: VK3AAK, VK3AQR, VK3ATN and VK3OT with VK5KK, VK5PB, VK5ZMH, VK5ZMO and VK7DA, VK7JG, VK7KJ and VK7LZ.

The aurora flared up around 1030 z when the following stations mixed it on six metres with signals at very good strength – VK1RK and VK1VP; the VK3's mentioned previously were this time joined by VK3AXV, VK3AZY, VK3BKF and VK3BMV. The VK7's were joined by VK7AZ, VK7FA, VK7JG, VK7KJ, VK7MC, VK7ZAH, VK7ZIE and VK7ZIF.

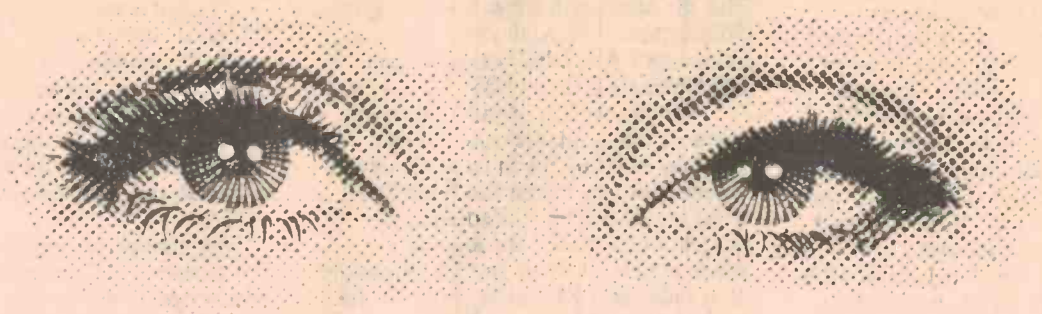
Most everybody gave it away around 1430 z (well after midnight local).

Long distance TEP

In between the first and second bouts of auroral scatter on 29 September reported above, the KH6EQI beacon, from Hawaii, was heard for a considerable period and over a wide area in Australia from around 0900 z. Stations in VK4, VK5 and VK3 reported hearing the beacon, running at strengths over S9 on occasions. No contacts were made despite frantic phone calls to Hawaii and attempts to drum up 50 MHz operators on the 21 MHz band.

However, on October 16, at 0915 z, VK2YDY and VK2BXT, later joined by VK5KK and VK5LP worked KY6EQY, Hawaii. This is the first Hawaii-Australia contact for around 20 years.

WOW! Feast your



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CB News

K40 Magnamount

President Electronics (Aust.) markets the popular American Antenna Company's K40 base-loaded mobile whip here in Australia. The parent company recently released a magnetic mount to suit their K40.

Called the "K40 Magnamount", it features a toroidal magnet 116 mm in diameter – considerably larger than the magnets in the biggest magnetic mounts currently available in Australia. These latter usually measure around 90 mm in diameter.

The manufacturers indicate that the magnet used consists of eight magnets set around the circumference of the ring to produce a powerful magnetic seal. They claim this construction assists the radiation pattern of the K40.

The K40 Magnamount will retail here for $21.95 and is distributed by *President Electronics Australia, 506 Miller Street, Cammeray, NSW, 2062;* phone (02) 922-3827.

CB Australia 21 and Glossy!

Sister publication, CB Australia's 21st issue was the November one with which it commences printing on quality gloss paper throughout the magazine.

The change is an effort to further boost its standing in the market place (already held in high regard for its technical accuracy and news content) and to effect a change in the 'image' of CB – now being referred to increasingly as 'personal communications' and similar phrases by the trade. It is felt that an improved quality publication will reflect and/or lead an emerging trend towards more sane on-air activities, particularly on the UHF band, and marketing attitudes.

Catering to wider reader interests, and expanding the existing interests of readers, is a new feature of CB Australia. It has provided articles of interest to novices (many of whom 'step up' from the CB ranks) since the July issue, and in recent issues has highlighted shortwave listening. Simple electronic construction projects of interest to CBers have become a regular part of CB Australia as many CBers have had an interest in electronics sparked from their hobby.

CB Australia continues to grow. It's come a long way since the first issue, published as a supplement to the February 1977 edition of ETI, running to 32 pages – Australia's first national CB publication.

NZ CBers Get Boost

New Zealand CBers received a welcome increase in channels and power output in recent months and are now allowed to use an *extra four channels* and transmitter output power has been increased from 0.5 watt to 2 watts. The four extra channels are:–

26,600 MHz
26,625 MHz
26,650 MHz
26,675 MHz.

In addition, NZ Government Departments, public bodies and 'approved' (?) operators are allowed to use a further three channels on 26.700, 26.725 and 26.750 MHz.

New Zealand's first CB magazine has appeared also – CB World.

CB Invention Now 'Secret'

The four inventors of a new CB voice scrambler have had a secrecy order slapped on them by a US Intelligence agency responsible for eavesdropping on communications of foreign governments and decoding such messages.

The four inventors, Carl Nicolai, Carl Quale and David Miller – all from Washington, and William Raike of Monterey, California, can't sell their device because it's considered a threat to national security!

When they applied for a patent for their device the Patent Office, part of the US Commerce Department, issued a secrecy order instead of a patent! This forbids the inventors from discussing or manufacturing their device under threat of prosecution.

The invention uses an unrevealed (naturally!) technique that scrambles the voice at the transmitter, reversing the procedure in the receiver, it was reported (that's the way most scramblers work!).

Dick Smith Enters UHF Market

Dick Smith has announced that he will be marketing a UHF CB rig under Midland label in Australia, due for release this month.

Although designed as only a 'basic rig' – no LED display or preselected channel options – Dick Smith claims the rig features better adjacent channel rejection than 'current' UHF equipment (i.e.: the Philips FM320).

It is believed that the rig will retail for less than $300.

SWL News

Compiled by Peter Bunn, on behalf of the Australian Radio DX Club (ARDXC).

All times are given in GMT (Greenwich Mean Time); all frequencies are in kiloHertz (kHz).

Summertime Signals On 60 Metres

With summer now upon us, you will discover that the 60 metre band – that part of the frequency spectrum from 4750 to 5060 kHz – such a rich source of exotic reception from Latin America during our winter months, trends towards better reception of Asian broadcasters. By systematically scanning this band during our evenings, many countries can be heard, so let's present a brief rundown of some of them:

Indonesia has a great array of shortwave broadcasters serving the different areas of this vast archipelago, often broadcasting with humble facilities in small towns for their local audiences. Programs are therefore almost invariably in the Indonesian language. Most evenings you should be able to hear some of the stations of the closest province, Iran Jaya, but about 0930. The best of these should be Radio Republik Indonesia at Sorong operating on 4875. The station gives station identification fairly regularly, and will start like this: "Inilah Radio Republik Indonesia Sorong", with "Inilah" meaning "this is". Shortly after 0930 you should also be able to hear the station in the provincial capital of Irian Jaya, Jayapura, on 4980 but the Jayapura outlet will suffer bad interference from a Venezuelan station which opens transmission on the same frequency at 1000, but don't be deterred, as Jayapura will still be there when the Latin station fades out soon after 1130, and will be audible through to evening closedown at 1400. Yet another Irian Jaya station is located at the small town of Fak Fak on the western side of the province, operating on 4790 and this station should also be audible by 1000.

Soon after 1000, you will be able to hear some of the stations in the central area of Indonesia. Two of the strongest signals are usually those emanating from Radio Republik Indonesia at Surakarta on 4932, and Radio Republik Indonesia at Yogyakarta on 5047, both cities located in Central Java. Yogyakarta is quite unusual, in that it is one of the few regional stations in Indonesia to broadcast an English program, which is currently heard each night at 1130-1145. By around 1030, some of the stations in the island of Sumatra will become audible, and the best of these is usually Radio Republik Indonesia at Palembang, operating on 4855. For night-owls, this one is audible right through to 1600 closedown.

A special note regarding those regional Indonesian stations. Do not be surprised if you hear a station identification on any of the above stations for "Radio Republik Indonesia dari Jakarta". All stations carry the news on relay from Jakarta each night at 1200.

Moving further west a little, we reach Malaysia. Malaysian stations come in three varieties: penninsula Malaysia or West Malaysia, and the provinces of Sarawak and Sabah, located on the island of Borneo. Penninsular Malaysia has shortwave outlets carrying Home Service programs from Kuala Lumpur operating on 4845, which is audible most nights by 1100. You can also hear the transmitter located at the northern centre of Penang, on 4985 which becomes audible by about 1030 nightly, and carries some English programs as well as programs in Malay. Moving to the other Malaysian states, the small state of Sabah has a transmitter at Kota Kinabalu which operates on 4970, and generally is heard from about 1100 when the Venezuelan station also operating on the frequency fades. In Sarawak, there are shortwave transmitters at three centres, at Kuching, Sibu and Miri. Best signals are provided by the Kuching outlets operating on 4835, 4950 and 5030, and the Sibu transmitter on 5005, most of these outlets carrying programs in Malay and local languages, though 4950 carries English programs. Malay has a very similar sound to that of the Indonesian language, and again the key word in station identification announcements is "Inilah" followed by "Radio Malaysia" and the name of the town where the studio is located. Regional stations often relay the news from Kuala Lumpur, and these take place most nights at 1130 and 1530, so at these times you are likely to hear the station identification from Kuala Lumpur, regardless of which station you are tuned to.

Finland

Radio Finland has a daily English program for Australia and the Far East between 0930 and 1000, using 21495. On Sundays, there is the special weekly magazine program for Australia between 0800 and 0930, also on 21495, which is known as "Radio Finland in its Sunday Best". A new program this summer is DX Editor Davis Mawby's "World of Radio" which will be heard on the Sunday Best program every fortnight. The program will include reviews of different sections of the radio spectrum, telling about its particular characteristics, who broadcasts there, and how you may best tune in.

Tropical Band Survey Now Available

This survey, published annually by the Danish Shortwave Clubs International, provides a comprehensive listing of stations broadcasting in the "tropical bands" between 2000 and 5900 kHz. It is highly recommended and perfect in aiding you in your reception of the many exotic Asian signals over these summer months, not to mention its value for next March or April when signals from Africa and Latin America begin to reach their peak on this part of the spectrum. If you would like a copy, just write to the ARDXC asking for the "DSWCI Tropical Bands Survey" and enclosing 8 International Reply Coupons.

Turkey

Voice of Turkey has been observed on two new channels for the Foreign Service with the French program noted on 11955 and 6185, followed by the English service between 2130 and 2300 daily. Other frequencies announced as carrying this service are 9515 and 7170.

Spain

Radio Exterior de Espana at Madrid has added the new outlet of 9790 for programs in Spanish every day between 0800 and 1130, this outlet being in parallel with both 9520 and 11730. This constitutes a new out-of-band channel for Madrid, as the normal 31 metre shortwave broadcast band ends at 9750. This is yet another example of an international broadcaster resorting to the technically illegal practice of going outside the designated bands in order to find a vacant frequency.

Portugal

Voice of Hope (Adventist World Radio) had introduced a the new channel of 9665 for the special Sunday services via the facilities at Sines in Portugal. Good signals are noted at present, with German programs at 0730; English programs are scheduled for broadcast between 0900 and 1000.

Ethiopia

An interesting station providing excellent reception at present is the Voice of Revolutionary Ethiopia in Addis Ababa. The station has a daily English service between 1500 and 1600, which is carried on both 9615 and 7165. Much local and western music is presented, along with current affairs talks.

Singapore has two transmitters operating in the 60 metre band, on 5010 and on 5052. Both these channels carry the English language service, and usually provide good reception during summer from around 1030 until sign-off at 1630.

Vietnam is a country with a host of shortwave transmitters in various regional centres throughout the country, but possibly the best reception on 60 metres will be of the Home Service programs carried on 4943 with the first program, and on 4995 with the second network, all in Vietnamese. Incidentally, in our mornings, the 4943 channel carries an English segment daily at 2130-2145, taken up largely with language lessons.

Cambodia has a powerful transmitter located at Phnom Penh, which may be heard every night from sign-on at 1100 on 4908. The music from this station is something quite distinctive.

By about 1130, you should also be able to hear the home service program of **Radio Thailand** in Bangkok, operating on 4830 with a 10 kilowatt transmitter. The key word to listen for, which precedes all station identifications, is "Thiini" and the station name is given.

Probably the ultimate in exotic listening is Radio Ulan Bator, in **Mongolia,** which has a transmitter which operates on approximately 5053, varying to 5055 on occasions. During summer, Ulan Bator may be heard from about 1100, but you may have to be a little persistent to hear this one!

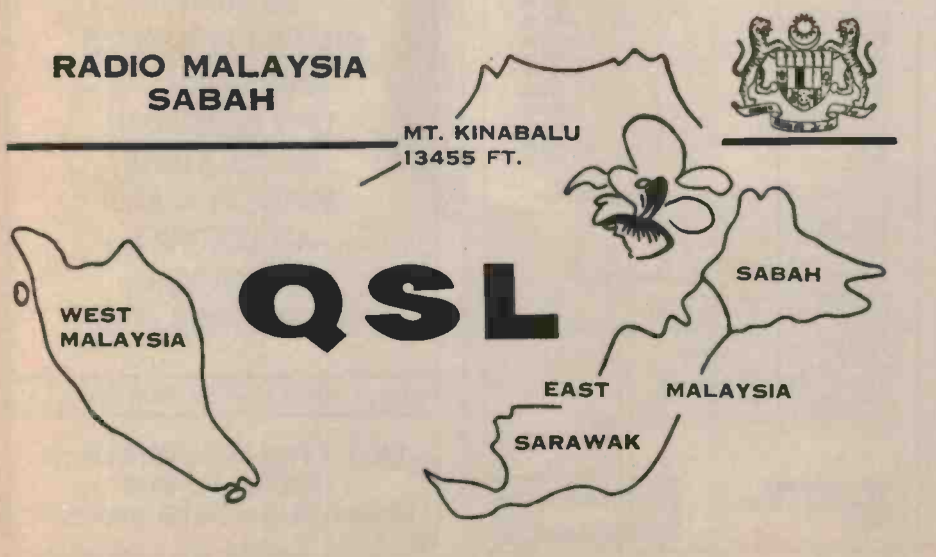
There are many more obscure and exotic stations to hear on the 60 metre band during summer, such as the small Laotian and Vietnamese regional stations which seldom seem to operate on exactly the same frequency every night, and utilise transmitters which could perhaps be best described as "home made"! All these stations, with the exception of Cambodia and some of the smaller Vietnamese stations, will verify listeners' reception reports. Many of the smaller stations will require reports to be written in their local language, especially those in Indonesia. To aid listeners in forwarding reports to such stations, the Australian Radio DX Club has a publication called the "Indonesian Reporting Guide" which sets out in detail all information you will need for writing reports to Indonesian stations, including complete translations with glossaries of words, phrases and sentences used. Write to the ARDXC if you are interested in obtaining a copy.

Norway

Radio Norway in Oslo has supplied details of its schedule for the period November to March (that is, period "D" -78) and this shows programs to Australia, New Zealand and the Far East broadcast daily from 0700-0830 on 9590, 11850 and 21730. A further service to Australia, Indonesia and the Far East is listed between 1100 and 1230 on 21730, and 17840. Both these services include an English segment for the last half-hour of the Sunday program. All other programs are in Norwegian.

Greece

The Voice of Greece at Athens provides its schedule for "D"-78, effective until March 1979, showing programs in Greek and English beamed to Australia 0900-0950 daily on 15160 and 9655. The morning service for Australia is on the air 2100-2150 on 9760, 9655, and 6140 with programs continuing in Greek on 9655 until sign-off at 2250. The morning service carries English news at 2115, while in the evenings a bulletin of news in English may be heard at 0915.



The Australian Radio DX Club is a non-profit body with headquarters in Melbourne and members Australia-wide. For further information regarding shortwave radio and the ARDXC, please write to the General Secretary, PO Box 67, Highett, Vic. 3190, enclosing a 30c stamp.

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predictions

The Ionospheric Prediction Service have kindly developed propagation predictions for us, in the form of a computer printout, which we can reproduce directly. These predictions are known as GRAFEX and contain a lot more information than those we published previously.

The left hand vertical column of each printout lists the frequency, in MHz, for each horizontal row of characters. Each vertical column of characters represents one hour, commencing at 00 UT on the left-most column going to 23 UT on the extreme right column.

Each printout is for a particular path, named at the bottom. The month to which the predictions apply, the mean path distance and the great circle bearing are also listed beneath each printout.

A variety of up to ten characters may appear on the printout and their meanings are listed in the table reproduced here.

The form of the GRAFEX predictions allows the indication of several 'modes' of propagation. The *first* mode is that requiring the least number of 'hops'. This will mean *two* hops on paths of length 4000 to 6000 km or so, *three* hops on paths around 7000 to 10,000 km in length, and so on. The *second* mode for a path will be the next integral number of hops that may be required to propagate a signal over the path.

Thus, the second mode for paths around 4000 to 6000 km in length will involve *three* hops and for paths 7000 to 10,000 km long will involve *four* hops, and so forth.

Mixed modes may also be indicated (symbols M, S and X). That is, a combination of hops involving both first and second modes perhaps (this indicates that considerable fading may be experienced on signals); a mixture of hops involving both the E and F layers of the ionosphere, etc. (See "Propagation, a Closer Look", the July 1978 issue of ETI, pages 112 to 114.).

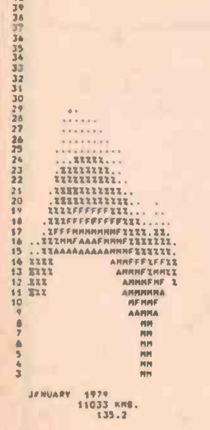
For ultra-reliable predictions follow the times and frequencies indicated by the F characters on the printouts. For a bit of adrenalin in your operating, use the % symbols area of the printouts. But, for a real 'buzz' look to the dot symbols area and hang around during the month of the predictions for those magic days when the higher frequency DX starts pouring through!

Six metre band amateur enthusiasts should scan the printouts for those that have characters extending into the 40 MHz region and operate accordingly.

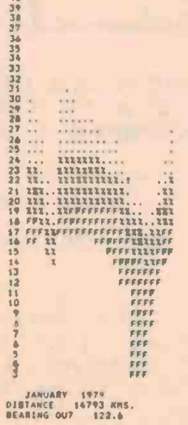
Co-ordinated Universal Time (UT) is used on all predictions. For most people's purposes that's equivalent to the well-known GMT. Thus, times for Eastern Australia will be 10 hours ahead (Eastern Australian Standard Time or E.A.S.T.); for central Australia, 9½ hours ahead and for Western Australia, 8 hours ahead. Don't forget to take into account Daylight Saving Time where and when it applies. Oh, heck, save yourself all the hassle and run a clock in the shack set to Universal Time!

For information on the areas served by the prediction charts, see ETI July 1978, page 113.

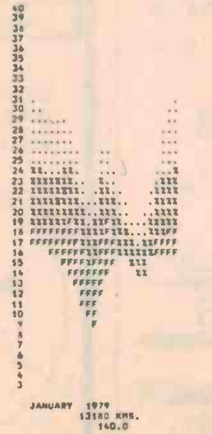
' '	A blank means no propagation is possible by a normal first or second mode.
'.'	A dot indicates that propagation is possible but probably on less than 50% of the days of the month. This normally applies for the first F mode but under some circumstances the first mode may not be propagated because the layer is too low (usually for hops greater than 3000 kilometres) in which case the symbol applies to the second mode.
'%'	Propagation is possible between 50% and 90% of the days of the month. It should be noted that the median F MUF for each hour lies between the lowest '.' and the highest '%' for that hour.
'F'	Propagation is possible by the first F mode on at least 90% of the days of the month unless there is a severe ionospheric disturbance. For frequencies on the highest 'F' for the hour the probability is 90% but this will increase slightly on lower frequencies.
'E'	Propagation is possible by the first E mode and on less than 50% of days by the first F mode. This symbol overrides '.' if present.
'P'	Propagation is possible by the first E mode and between 50% and 90% of days by the first F modes. This symbol overrides '%'.
'B'	Propagation is possible by the first E mode and by the first F mode on more than 90% of the days. This symbol overrides 'F'.
'M'	Propagation is possible by both the first and second F modes. The strongest mode is normally the first mode but the vertical aerial pattern may influence the mode received. It should be noted that the second F mode MUF is just about the highest frequency showing 'M'.
'S'	Propagation is not possible by the first mode but it is possible by the second mode. It should be remembered that propagation may be possible by other modes, e.g.: the third F or mixed E and F modes at these frequencies. This symbol does not occur very often.
'A'	High absorption i.e.: above the ALF but probably too close to it for good communication.
'X'	Complex mixture of modes including the second E mode (the vertical angles of the first F and the second E modes are often very close).



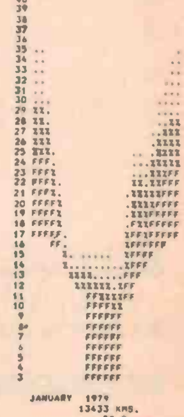
East Coast — South Africa (also serves South Central)



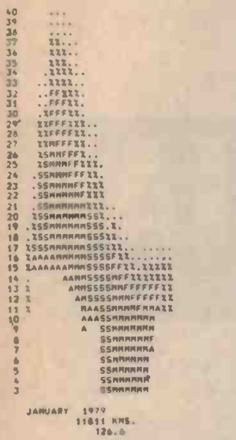
East Coast — North Africa (also serves South Central)



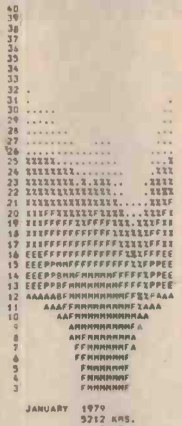
East Coast — South America (also serves South Central)



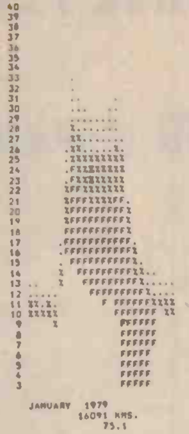
East Coast — North America (also NE and South Central)



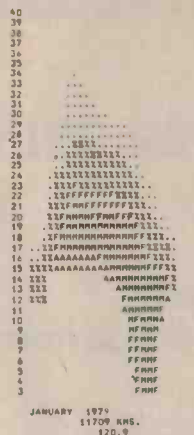
East Coast — Japan (also serves NE and South Central)



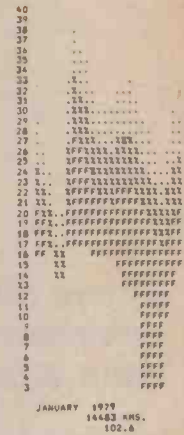
East Coast — South Pacific



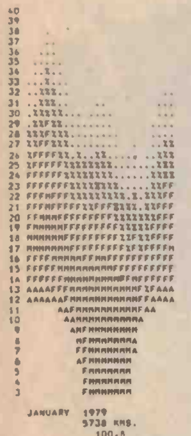
East Coast — Europe (Short Path)



North East — South Africa

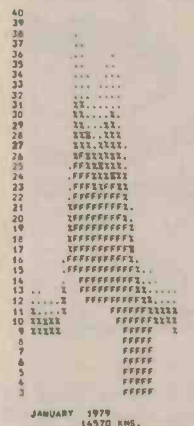


North East — North Africa

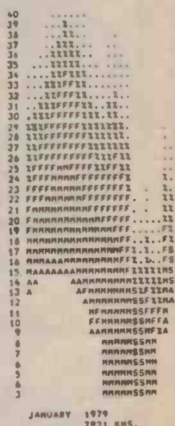


North East — South Pacific (also serves South Central)

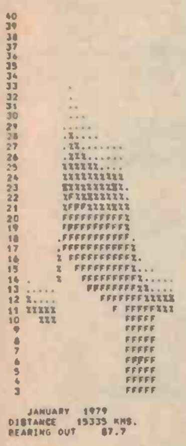
SWL and AMATEUR COMMUNICATIONS



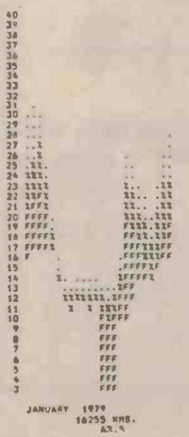
North East — Europe (Short Path)



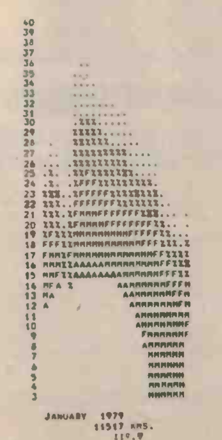
West Coast — Japan



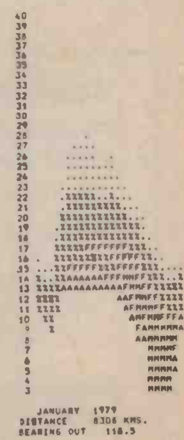
South Central — Europe (Short Path)(also West Coast)



West Coast — North America



West Coast — North Africa



West Coast — South Africa

(Advertisement)

OUR XMAS SPECIAL OFFER FOR ETI READERS

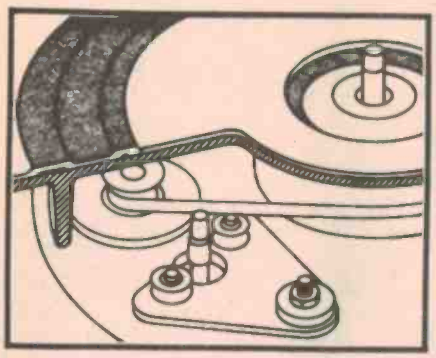
ELAC BELT DRIVE-PLUS TURNTABLE

FOR ONLY $199 (RRP $389)

ELAC
high fidelity

If you missed our previous offer this is now your chance!

It's hardly necessary to state that the PC 830 exceeds DIN 45 500. It leaves it way behind!
The 830 is a unique unit which combines the vibration decoupling advantages of belt drive units with the trouble free running of the classic idler wheel design.



In essence the 830 may be seen as a belt-drive unit but with an idler wheel drive which automatically aids the drive belt whilst running up to speed and also during the inward and outward movement of the pick-up arm. In addition the mechanism ensures that the drive belt is slackened off whenever the turntable is switched off thus preventing belt stretching unevenly.
The result of all this is extraordinary smoothness reflected in a wow and flutter figure of 0.08 percent. Rumble is down to 44 dB and signal noise 64 dB.
Naturally the unit operates in both manual and fully automatic modes and has a record repeater plus auto changer mechanism.
It is supplied with ELAC's STS 355-17 magnetic cartridge and has all the features you'd expect to find on a near-$400 unit.

ELAC TURNTABLE XMAS SPECIAL OFFER

Please forward .... ELAC PC. 830 Turntable complete with deluxe base and hinged lid including ELAC STS 355/17 magnetic cartridge for $199.00 each. (plus $5 post/packing in NSW, plus $7 post/packing interstate.)

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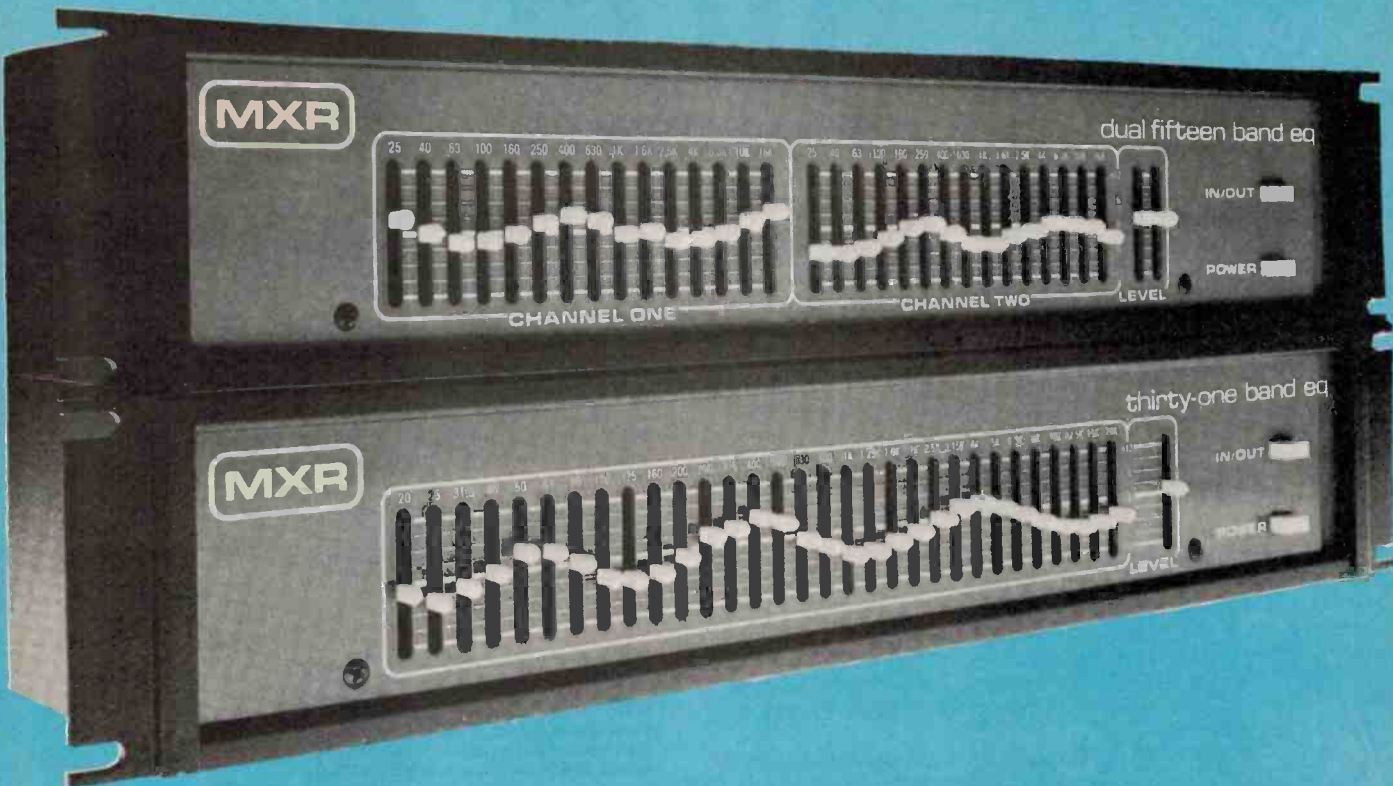
Please allow a minimum of 2 weeks for delivery. Please make cheques etc. payable to "ATRAM OFFER" and post together with order form to:

"ATRAM OFFER" c/o P.O. Box 465 North Sydney N.S.W. 2060 Tel. 92-4177

MXR Dual Fifteen Band Equalizer
Thirty-One Band Equalizer



MXR is proud to present two additions to our Professional Products Group—the Dual Fifteen Band Equalizer and the Thirty-One Band Equalizer.

The Dual Fifteen Band Equalizer is a professional, two-channel frequency equalizer offering 15 bands of discreet adjustment per channel. Each of the bands, spaced at 2/3 octave intervals, has a range of -12 to +12 decibels and can be independently adjusted using the slide controls. In addition, each channel has its own level control slider.

The Thirty-One Band Equalizer is a professional, single channel graphic equalizer providing precise control over thirty one discreet frequency bands spaced at 1/3 octave intervals. Like the Dual Fifteen Band Equalizer, each band has a range of -12 to +12 decibels. In addition, there is a broadband level control to provide optimum dynamic range and ease of operation.

Due to their advanced design and high quality construction, both units are reliable, versatile instruments, that can be utilized in a wide variety of situations. Adjustments can be made in the basic tonal characteristics of any instrument to suit one's taste or needs. Specific portions of program material may be accented or diminished. A room can be "tuned" by adjusting for tonal discrepancies caused by room acoustics. Compensation for inadequacies in microphones, speakers, or even hearing is easily accomplished.

The Dual Fifteen Band and Thirty-One Band Equalizers are graphic units in that their response is illustrated on the front control panel. The outline of the frequency response curve is reflected in the positions of the slide controls. This visual representation facilitates duplication of the desired effects.

Both units can be easily mounted in any standard EIA 19" rack for studio installation, or in the optional road case for portable use.

As with every MXR product, the Dual Fifteen Band Equalizer and the Thirty-One Band Equalizer are designed and manufactured with all of the care and attention given to our products used around the world in recording studios and musical performances.

Distributed by:
The Music Distillery,
503 Pittwater Road,
Brookvale. NSW.
938-4095 938-2372

MXR Professional Products Group

The last time you saw a really new bench/portable DMM was

1972

THAT'S the year our 8000A was introduced. Its custom LSI and solid owner benefits quickly established it as the world's leading DMM. Now, look at the new 8010A and 8012A: single-chip CMOS designs for problem solving in the eighties!

RAZOR-SHARP LCD for large, no-strain answers at first glance — in any light.

TOUCH AND HOLD probe option, so you can thread your way through a component jungle and capture the readings you need.

FUNCTION POWER: 22 ranges of AC and DC volts and current, six ranges of resistance, and three ranges of conductance — the missing function on other bench multimeters.

CONDUCTANCE RANGES for noise-free leakage measurements to 10,000 M ohms. A valuable function for bench-testing boards and components, conductance also measures transistor beta (using a bias resistor) and light intensity (by using a photocell).

OVERLOAD PROTECTED — like no other DMM, including rejection of 6000V transients and up to 600V applied to the current terminals.

HONEST AC ANSWERS derived from a Fluke hybrid true rms converter. You'll even see the difference on your AC line between the correct value and what your average-responding meter reads. And 50 kHz bandwidth won't let any significant distortion products go unmeasured. Plus, 10 times the basic response you may be limited to now!

SPECS YOU EXPECT from Fluke — like 0.1 percent on DC for one year. Both models available with rechargeable batteries, and backed by the same solid warranty and worldwide service that helped make the 8000A the industry standard.

LEADERSHIP HAS TO BE EARNED. And we're committed to keeping the price of your confidence as realistic as possible. Like $255* for the 8010A with a 10A current range, and $315* for the 8012A with two extra-low ohms ranges that allow measurements from 0.001 ohms to 10,000M ohms — making it the widest range ohmmeter available!

Excluding sales tax (add 15 percent).
Rechargeable Battery Model – add $45.
Quantity discounts available.

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Instruments Pty. Ltd.

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ADELAIDE: 51-3521, Brisbane: 229-3161, Perth: 325-3144.

KITS FOR ETI PROJECTS

We get many enquiries from readers wanting to know where they can get kits for the projects we publish. The list below indicates the suppliers we know about and the kits they do.

Any companies who want to be included in this list should phone LES BELL on 33-4282.

Key to companies:

- **A** Applied Technology Pty. Ltd. 109 - 111 Hunter St, Hornsby. 2077. NSW.
- **D** Dick Smith Pty. Ltd. of Crows Nest, NSW. (see Ads. for address).
- **E** All Electronic Components (formerly ED & E Sales), 118 Lonsdale Street, Melbourne, Victoria 3000.
- **J** Jaycar Pty. Ltd. 405 Sussex St., Sydney 2000.
- **L** Delsound Pty. 1 Wickham Terrace. Queensland.
- **M** Mode Electronics. PO Box 365, Mascot 2020.
- **N** Nebula Electronics Pty. Ltd. 15 — 19 Boundary St., Rushcutters Bay 2011. NSW.
- **P** Pre-Pac Electronics. 718 Parramatta Rd., Croydon NSW 2132.
- **T** Townsville Electronics Centre. 281E Charters Towers Rd, Rising Sun Arcade, Hermit Park. 4812

PROJECT ELECTRONICS

ETI 041	Continuity Tester	DS
ETI 043	Heads or Tails	DATSE
ETI 044	Two-Tone Doorbell	DATSE
ETI 045	500 Second Timer	DS
ETI 047	Morse Practice Set	DS
ETI 048	Buzz Board	DS
ETI 061	Simple Amplifier	DATS
ETI 062	Simple Amplifier Tuner	DSE
ETI 063	Electronic Bongo's	DS
ETI 064	Intercom	ATS
ETI 065	Electronic Siren	DS
ETI 066	Temperature Alarm	ADTSE
ETI 067	Singing Moisture Meter	DS
ETI 068	Led Dice	ADSE
ETI 072	2-Octave Organ	DS
ETI 081	Tachometer	E

TEST EQUIPMENT

ETI 102	Audio Signal Generator	E,DS
ETI 105	Lab Power Supply	E
ETI 107	Widerange Voltmeter	E
ETI 108	Decade Resistance Box	ES
ETI 109	Digital Frequency Meter	E
ETI 111	IC Power Supply	ES
ETI 112	Audio Attenuator	ES
ETI 113	7-Input Thermocouple Meter	P,E
ETI 116	Impedance Meter	ES
ETI 117	Digital Voltmeter	E,AS
ETI 118	Simple Frequency Counter	E,AS
ETI 119	5V Switching Regulator supply	ETS
ETI 120	Logic Probe	L,ES
ETI 121	Logic Pulser	L,ES
ETI 122	Logic Tester	ES
ETI 123	CMOS Tester	ES
ETI 124	Tone Burst Generator	ES
ETI 128	Audio Millivoltmeter	L,ES
ETI 129	RF Signal Generator	L,ES
ETI 130	Temperature Meter	E
ETI 131	General Purpose power supply	E,N
ETI 132	Power Supply	NSE
ETI 133	Phase Meter	E
ETI 134	True RMS Voltmeter	E

SIMPLE PROJECTS

ETI 206	Metronome	T
ETI 218	Monophonic Organ	ET
ETI 219	Siren	ET
ETI 220	Siren	ET
ETI 222	Transistor Tester	ETS
ETI 234	Simple Intercom	T
ETI 236	Code Practice Oscillator	E
ETI 239	Breakdown Beacon	E
ETI 240	High Powered Emergency Flasher	E

MOTORISTS' PROJECTS

ETI 301	Vari-Wiper	ET
ETI 302	Tacho Dwell	ET
ETI 303	Brake-light Warning	E
ETI 305	Car Alarm	E
ETI 309	Battery Charger	P,E
ETI 312	CDI Electronic Ignition	P,ET
ETI 313	Car Alarm	E,DT
ETI 316	Transistor Assisted Ignition	E
ETI 317	Rev. Monitor	E

AUDIO PROJECTS

ETI 401	Audio Mixer FET Four Input	E
ETI 406	One Transistor Receiver	T
ETI 408	Spring Reverb. Unit	E
ETI 410	Super Stereo	E
ETI 413	100 Watt Guitar Amp	P,L,J,DT
ETI 413	x 200 Watt Bridge Amp	SE
ETI 414	Master Mixer	E,J
ETI 416	25 Watt Amplifier	E
ETI 417	Amp Overload Indicator	E
ETI 419	Guitar Amp Pre-Amp	P,E,DT
ETI 420	Four-channel Amplifier	L,E
ETI 420E	SQ Decoder	E
ETI 422	International Stereo Amp	SL,D
ETI 422B	Booster Amp	E
ETI 422	50 Watt Power Module	E
ETI 423	Add-on Decoder Amp	E
ETI 424	Spring Reverberation Unit	SL,E
ETI 425	Integrated Audio System	E
ETI 426	Rumble Filter	E
ETI 427	Graphic Equaliser	SL,E,J
ETI 429	Simple Stereo Amplifier	E
ETI 433	Active Crossover	J
ETI 435	Crossover Amp	J
ETI 438	Audio Level Meter	L,ES
ETI 440	Simple 25 Watt Amp	L,E
ETI 441	Audio Noise Generator	L,ES
ETI 443	Compressor-Expander	E,J
ETI 444	Five Watt Stereo	ES
ETI 445	Preamp	J,E,D
ETI 446	Audio Limiter	J
ETI 447	Phaser	E,J
ETI 449	Balanced Mic Preamp	JE
ETI 480	50 W, 100 W Power Amp	A
ETI 480P	Power Supply	DAT
ETI 481	12V to 40V DC Inverter	E
ETI 482A	Preamp Module	AE
ETI 482B	Tone Controller	AE
ETI 484	Compressor Expander	E
ETI 485	Graphic Equalizer	JSE
ETI 480	50W, 100W Power Amp	ADBE

MISCELLANEOUS

ETI 502	Emergency Flasher	E
ETI 503	Burglar Alarm	ET
ETI 505	Strobe	L,E,D
ETI 506	Infra-Red Alarm	E
ETI 509	50-Day Timer	E
ETI 512	Photographic Timer	E
ETI 513	Tape Slide/Synchroniser	E
ETI 514	Flash Unit — Sound Operated	E
ETI 515	Flash Unit — Light operated	E
ETI 518	Light Beam Alarm	ET
ETI 525	Drill Speed Controller	E
ETI 528	Home Burglar Alarm	P,ET MS
ETI 529	Electronic Poker Machine	E
ETI 532	Photimer	E
ETI 533	Digital Display	L,E,AS
ETI 534	Calculator Stopwatch	A,D
ETI 539	Touch Switch	E
ETI 540	Universal Timer	ES
ETI 541	Train Controller	ET
ETI 543	Double Dice	A
ETI 544	Heartrate Monitor	AE
ETI 546	GSR Meter	E
ETI 547	Telephone Bell Extender	E
ETI 548	Photographic Strobe	E
ETI 549	Induction Balance Metal Locator	E
ETI 581	Dual Power Supply	E
ETI 582	House Alarm	E
ETI 583	Gas Alarm	ME
ETI 586	Shutter Speed Timer	E

ELECTRONIC MUSIC

ETI 601 4600	Synthesiser	J
3600	Synthesiser	J
ETI 602	Mini Organ	E,A,D
ETI 604	Accentuated Beat Metronome	E

COMPUTER PROJECTS

ETI 630	Hex Display	AE
ETI 631	VDU Keyboard Encoder	AE
ETI 632	VDU 1 k x 8 Memory Card	AE
ETI 633	VDU Sync Generator	AE

RADIO PROJECTS

ETI 701	TV Masthead Amplifier	E,D
ETI 702	Radar Intruder Alarm	DE
ETI 703	Antenna Matching Unit	E
ETI 704	Crosshatch/Dot Generator	L,A,D,ES
ETI 706	Marker Generator	ES
ETI 707	Modern Solid State Converters	E
ETI 708	Active Antenna	E
ETI 709	RF Attenuator	E
ETI 710	2 metre Booster	E
ETI 711B	Single Relay Remote Control	AE
ETI 711C	Double Relay Remote Control	AE
ETI 711R	Receiver	AE
ETI 711AR	Remote Control Transmitter	AE
ETI 711DR	Remote Control Decoder	AE
ETI 712	CB Power Supply	E
ETI 740	FM Tuner	AE
ETI 780	Novice Transmitter	E

ELECTRONIC GAMES

ETI 804	Selecta-Game	O,A,DS

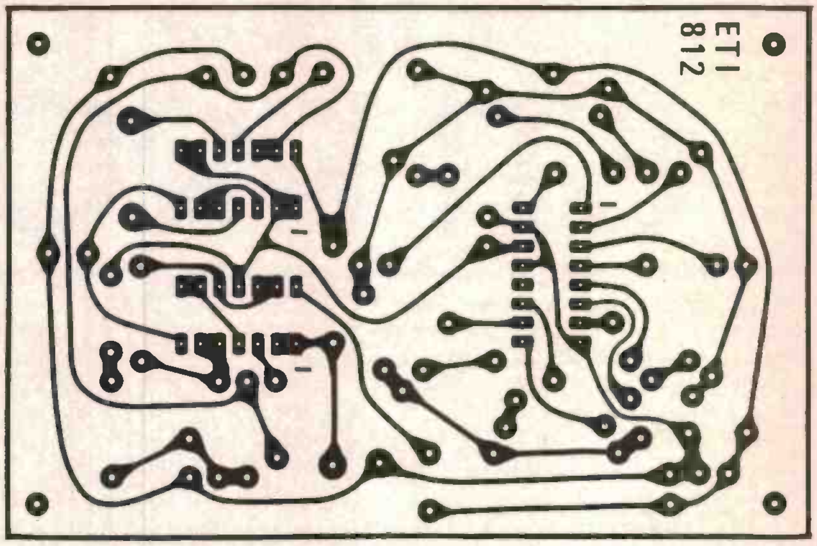
Using ETI PCB Artwork

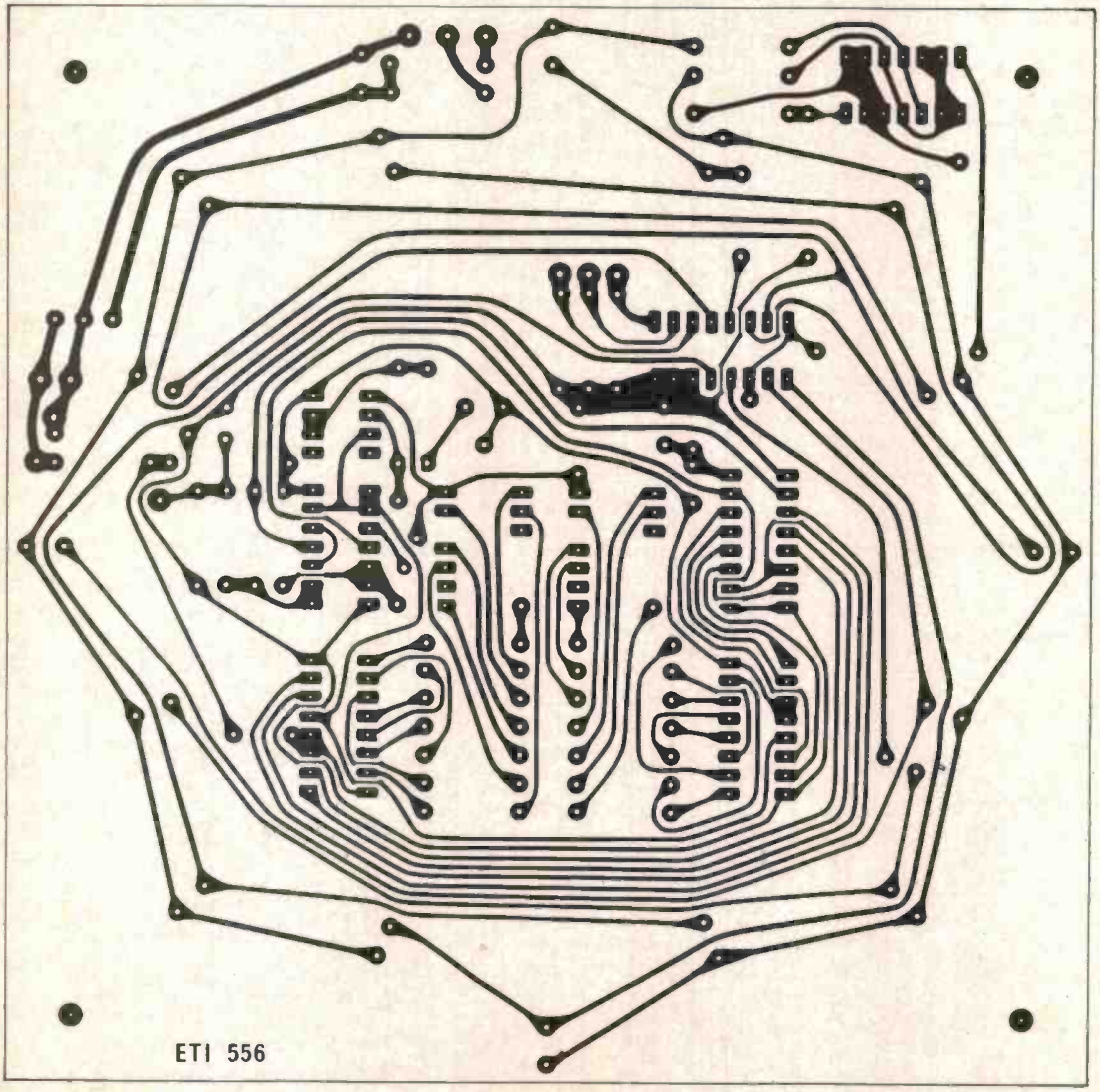
This method can be used to make negatives of ETI artwork from October 1977 on, provided the reverse of the page is printed in blue. The film used is Scotchcal 8007 which is UV sensitive and can be used under normal subdued light.

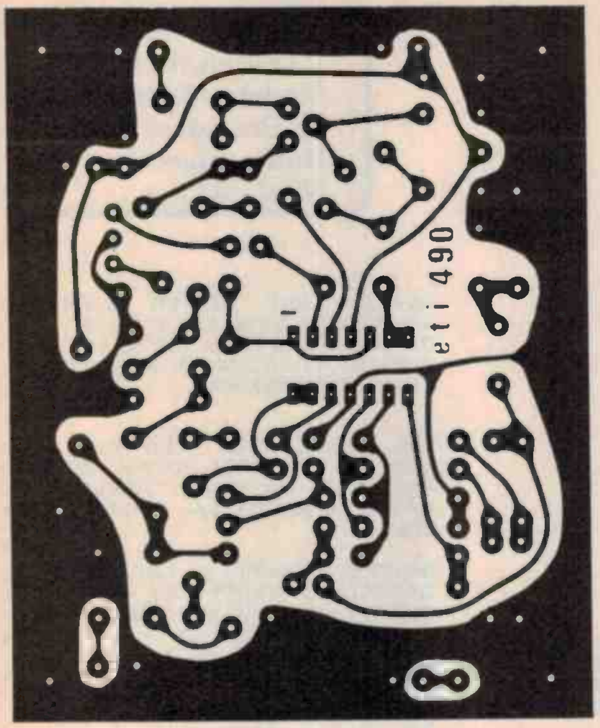
Cut a piece of film a little larger than the PC board and expose it to UV light through the magazine page. The non emulsion side should be in contact with the page. This surface can be detected by picking the film up by one corner - it will curl towards the emulsion side. Exposures of about 20 minutes are normally necessary.

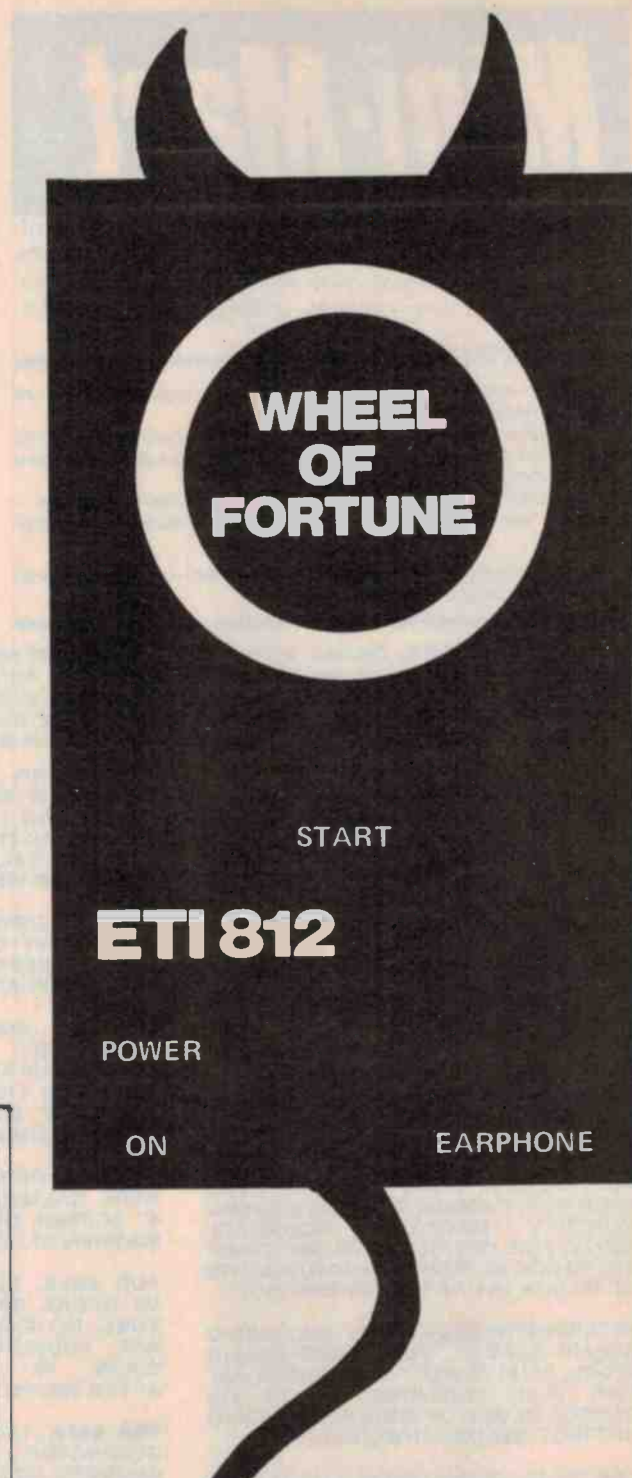
The film can now be developed by placing it emulsion side up on a table, pouring some Scotchcal 8500 developer on the surface and rubbing it with a clean tissue.

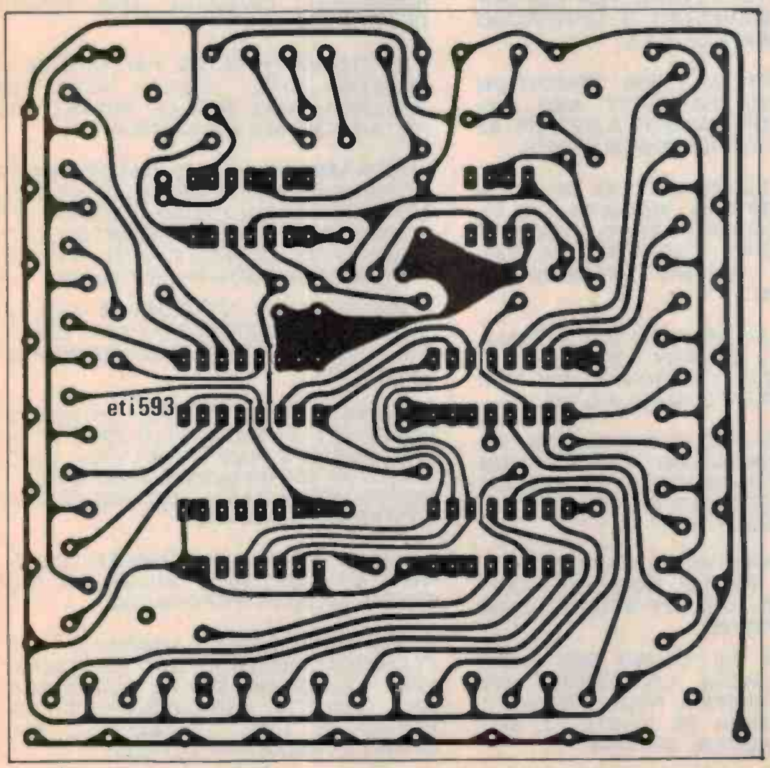
Further information on Scotchcal and PCB manufacture can be found in the September and December 1977 issues of ETI. Please note also, that occasionally pressure on space may unfortunately prohibit the printing of blue type behind all PCB's, in which case the reader must resort to more conventional photographic techniques for PCB manufacture.






eti 490


WHEEL
OF
FORTUNE
START
ETI 812
POWER
ON
EARPHONE


eti593

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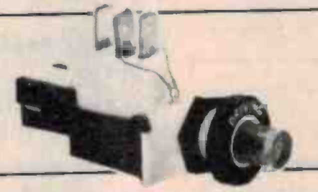

***PUSH-BUTTON GLOW SIWTCH.** Update with attractive illuminated push-buttons. Red, amber, blue, green.

***PUSH-BUTTON SWITCHES.** Illuminated or non-illuminated. Red, amber, blue, green.

CIRCUIT BREAKER. Does away with need for a separate switch or fuse.

**** All switches extra-heavy-duty and have been tested in excess of 28 amps at 12 volts.***

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SH-1

- KEYBOARD (32 keys, 2-½ octaves)
- VCO (voltage controlled oscillator)
- Modulator
- Autobend Depth
- Autobend Time (8-360 msec)
- VCO Range (32', 16', 8', 4', 2')
- Waveform (⩘ , ⎍ , ∿)
- Pulsewidth Modulation (Min-50%)
- PWM Mode Switch (Env-1/Manual/LFO)
- Sub-oscillator
- 1 oct Down /2 oct Down /2 oct Down
- AUDIO MIXER
- VCO
- Sub-oscillator
- Noise Generator
- Ext Sig
- Overload Indicator
- NOISE GENERATOR
- White/Pink Selector
- HIGH PASS FILTER
- Cutoff Frequency Control (25Hz-5KHz)
- VCF (Voltage Controlled Filter)
- Cutoff Frequency Control (5 Hz-20KHz)
- Resonance (Min-Self Oscillation)
- ENV-1 Control Depth
- Modulator
- KYBD Control
- Envelope Follower Control
- VCA (Voltage Controlled Amplifier)
- Hold Control
- Envelope Switch (ENV-1/ENV-2)
- ENVELOPE GENERATOR 1
- Attack Time Control (1.5 msec-2.5 sec)
- Decay Time Control (1.5 msec-8 sec)
- Sustain Level (0-100%)
- Release Time (1.5 msec-8 sec)
- Gate Trigger Selector Switch (Gate + Trig/Gate/LFO)
- ENVELOPE GENERATOR 2
- Attack Time Control (1.5 msec-3 sec)
- Release Time (1.5 msec-8 sec)
- Gate Selector Switch (Gate/LFO)
- Modulator
- Mode Switch (Random / ⎍ / ∿)
- Rate Control (0.2 Hz-25Hz)
- Delay Time Control (0-3 sec)
- Rate Indicator
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- KYBD/Ext CV GATE Selector Switch
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- Output Jack
- Output Level Switch (L/M/H)
- Phones Jack (8 ohm stereo)
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- External Input Jack
- External Signal Input Level Switch (L/M/H)
- External Control Voltage Input Jack (1 V/1 Oct)
- External Gate Voltage Input Jack (ON with +7.5 V or over)
- Keyboard Control Voltage Output Jack (1 V/1 Oct)
- Keyboard Gate Output Jack (OFF-0 V, ON-14 V)
- POWER CONSUMPTION: 10W
- DIMENSIONS: 610(W) x 370(D) x 135(H)mm 24.0(W) x 14.6(D) x 5.3(H) in
- WEIGHT: 6.4 kg, 14 lbs
- ACCESSORY: 2.5m Connection Cord

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*Specifications are subject to change without notice.

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Shure N70EJ	$11
Shure N55E	$21
Shure N44E	$18
Shure N24H	$52
Shure N70B	$7
Shure N75C	$15
Shure N44-7	$16
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ANSWER: Because users of 8-bit equipment are becoming aware of its limitations and of the advantages offered by the 16-bit microcomputer: greatly increased calculating capacity, increased addressing efficiency in programming, and so on. More and more of the experts in the field are becoming convinced that for the serious users of microcomputers, the future lies with the 16-bit processors.

PONDER: While the others are working hard to catch up, Texas Instruments remains the world leader in microprocessors with its 64-pin, 16-bit TMS9900. Anything 8 bits can do, this can do better. And it can do many things that are completely beyond the capability of any 8-bit microprocessor. It has separate data and address lines (no multiplexing), hardware multiply and divide, and a host of other features. May we tell you more about them?

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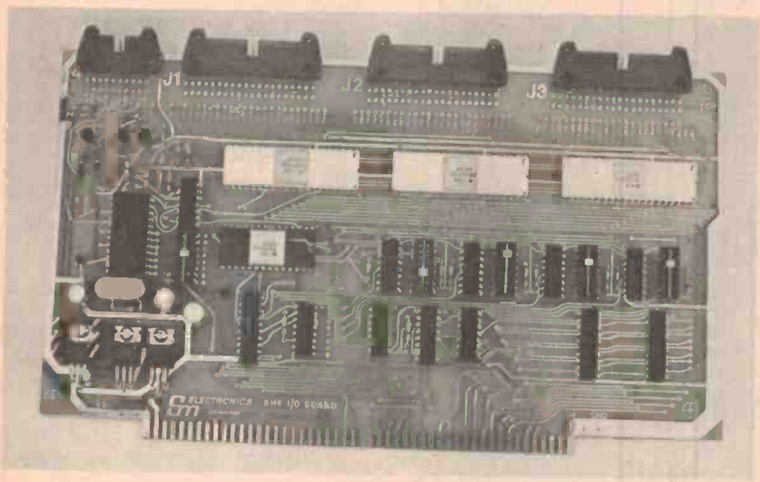

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- Australian made.

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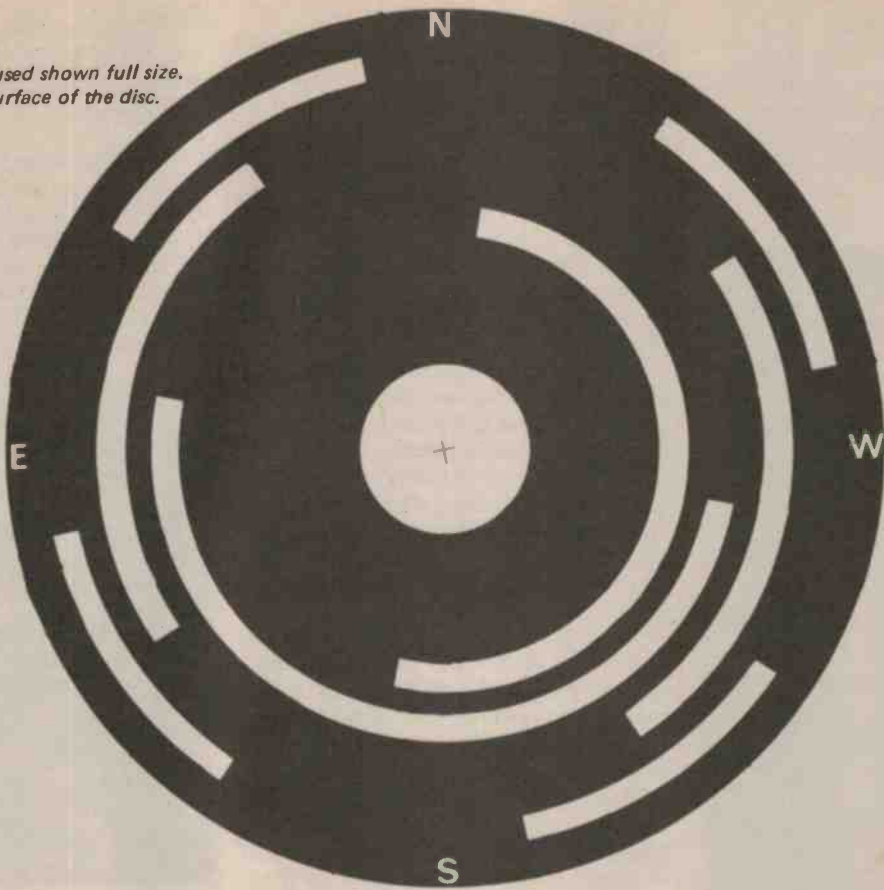

Fig. 5. The direction disc used shown full size. Note that this is the top surface of the disc.

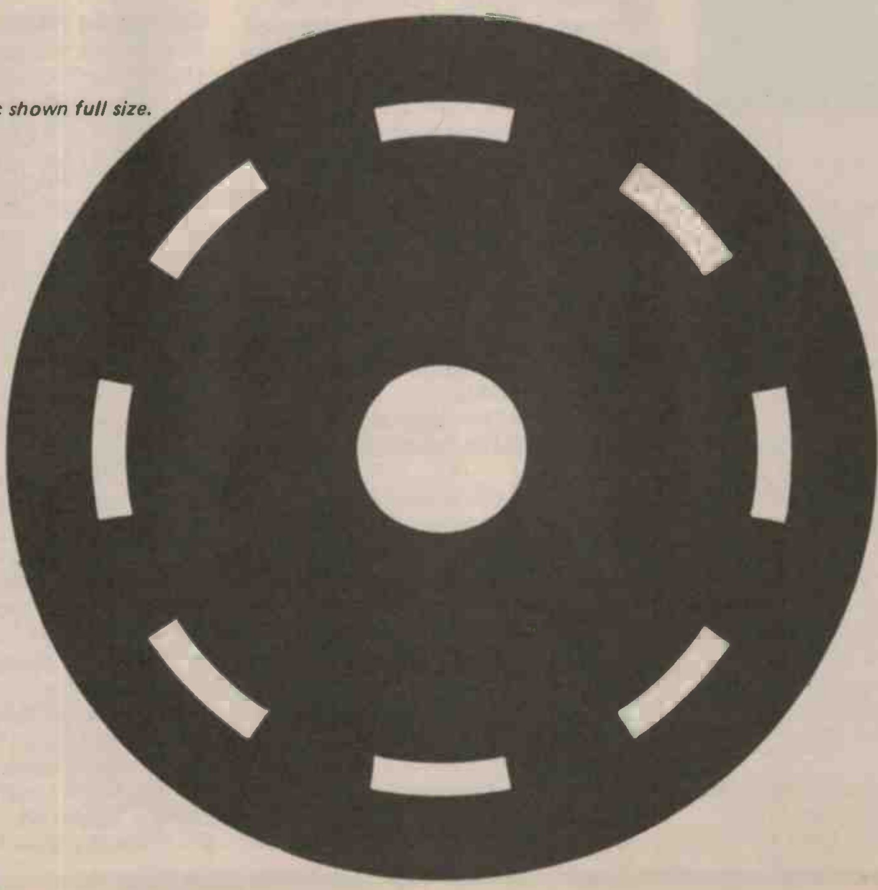

Fig. 6. The wind speed disc shown full size.

Attention, Mr. S. Campbell

Would Mr. S. Campbell of Mill Park, Victoria, who won the September ETI/ Unitrex Calculator Contest, please contact us, as we have mislaid his address and we are unable to send him his Unitrex calculator?

374 kW Triode

The new Philips YD1432 metal-ceramic triode, intended for use as an industrial oscillator in rf heating equipment, supplies high power of typically 374 kW at a low anode voltage of only 12 kV. This means that conventional components can be used in the power supply and the rf circuitry with consequent cost savings.

Featuring a high anode efficiency of 80%, the YD1432 bridges the gap between the other well-known Philips tubes, the YD1212 (240 kW) and the YD1342.

The YD1432 incorporates similar component parts to the other Philips rf heating tubes with proven reliability and is fitted with an integral helix for water cooling. The new tube follows the current market requirements in the trend to the use of lower voltage anode supplies.

Further information available from Philips Electronic Components & Materials, 67 Mars Road, Lane Cove.

C E Show Diversifies

The organisers of the Consumer Electronics Show this week announced details of a substantially diversified C E Show in 1979. The 4th Australian CES will be staged at the Sydney Showgrounds from Wednesday, 18 July to Sunday, 22 July.

Whilst previous C E Shows have drawn wide support from the hi fi industry, organisers next year are looking to a greater range of products fully justifying the "consumer electronics" title.

Amongst the projected list of displays are: digital watches and clocks, computer games, personal computing equipment, dictating machines, lighting equipment, records, amusement machines, antennas, PA systems, security systems, electronic calculators, microwave ovens, batteries, photo systems, professional sound recording equipment and electronic radios.

The organisers weren't quite ready to release full details, but whispers of space age equipment and a CE Wiz Kid promotion were heard at the Showgrounds.

World Eye on Australian Exhibition

In October 1980 the world computer spotlight will turn to Melbourne for the biggest single computing activity ever to be staged south of the equator. IFIP – The International Federation of Information Processing – has selected the Exhibition Building, Melbourne for the 8th World Computer Congress, incorporating an Exhibition of the likes never before seen in Australia.

World Computer Congress' are held once every three years, Congress 80 being shared between Tokyo, Japan and Melbourne, Australia.

Going on the 1977 Congress in Toronto, Australian exhibitors can expect between 2000-3000 registered delegates representing every technologically advanced country in the world to visit the Exhibition.

The exhibition is certain to attract virtually the entire computing profession in Australia.

A Personal Computing Fair will be a major drawcard within the Exhibition, particularly for the thousands of Australians to visit the Exhibition Building on a day set aside for the public.

The organisers of the Congress 80 Exhibition, Riddell Exhibition Promotions Pty Ltd have allocated over 5,500 square metres (60,000 square feet) for exhibition purposes only.

According to Riddell's general manager, Mr Bryan Humphris, the Congress 80 Exhibition will dwarf all previous computer exhibitions held in Australia.

"If there is any doubt about Australia's role in the world computer stakes, Congress 80 will cement our foothold until the turn of the century," Mr Humphris said.

Riddell's have been contracted to organise and promote the Exhibition by Congress 80 organisers, The Australian Computer Society.

For further information please contact Riddell Exhibition Promotions Pty Ltd, 166 Albert Road, South Melbourne, Vic, 3205.

16K Bipolar PROM

What is believed to be the world's first 16K bipolar PROM to go into production has been announced by Signetics. Designated 82S190 (open collector output) and 82S191 (three-state output), the new 16K PROM is the latest addition to a range of PROMs which has already set new industry standards. Samples are now available through Philips Electronic Components and Materials, and production build-up is planned to meet a full-scale demand next year.

The 82S190/191 offers a great deal more than just extra storage. Despite having double the capacity of its 8K counterpart, it has the same power dissipation as the smaller PROM and is almost as fast. Its access time is guaranteed at 80 ns, with 50 ns as the typical value, while the power dissipation is 650 mW typical and 875 mW maximum.

The manufacturing process is the reliable diffused isolation, michrome fuse system utilizing dual-layer aluminium interconnect. The programming circuitry is unchanged from Signetics PROMs currently in production, so new programming equipment is not needed.

For further information, contact Philips Electronic Components and Materials, 67 Mars Road, Lane Cove.

SUPER SPECIALS

BD 139 — 50c ea.
BD 140 — 50c ea.
BC 547/8/9 — 15c ea.
20 555 Timers for $5
MJ2955 — 80c
2N3055 — 75c
T03 Mounting Kits — 5c ea.

CANNON CONNECTORS

XLP-3-11	$2.30
XLP-3-12c	$3.25
XLP-3-31	$3.25
XLP-3-32	$3.00
XLR-LNE-11c	$3.05
XLR-LNE-32	$4.30

Weller cordless soldering iron kit, model WC100DKW — includes batteries, solder, 4 interchangeable tips, battery charger and instructions for only **$29.50.**

TTL

7400	.20
7401	.25
7402	.28
7403	.28
7404	.37
7405	.37
7406	.50
7407	.50
7408	.34
7409	.34
7410	.20
7411	.37
7413	.54
7414	90
7416	.60
7417	.60
7420	.30
7422	.30
7426	.45
7427	.45
7430	.30
7432	.43
7437	.50
7438	.50
7440	.30
7441	1.50
7442	.70
7447	60
7448	60
7450	.35
7451	.35
7453	.35
7454	.30
7460	.35
7470	.65
7472	.45
7473	.60
7474	.65
7475	.65
7476	.45
7480	1.25
7483	1.25
7485	1.45
7486	.65
7490	.35
7491	1.00
7492	.75
7493	.35
7494	1.10
7495	.95
74100	2.45
74107	.65
74121	.60
74123	60
74132	1.25
74150	1.80
74151	1.10
74153	1.10
74154	1.70
74157	1.10
74160	1.55
74164	1.55
74165	1.55
74173	2.75
74175	1.65
74180	1.35
74192	1.40
74193	1.40
74221	1.50
74367	1.40

74LS

74LS00	.30
74LS01	.30
74LS02	.30
74LS03	.30
74LS04	.35
74LS05	.35
74LS08	.30
74LS09	.30
74LS10	.30
74LS11	.30
74LS12	.30
74LS14	1.20
74LS20	.30
74LS21	.30
74LS27	.30
74LS28	.40
74LS30	.30
74LS32	.33
74LS37	.45
74LS38	.45
74LS40	.30
74LS42	1.20
74LS73	1.20
74LS74	.50
74LS75	.70
74LS78	.50
74LS85	1.50
74LS86	.50
74LS90	1.20
74LS92	1.20
74LS93	1.20
74LS95	1.50
74LS109	.50
74LS113	.55
74LS114	.55
74LS138	1.20
74LS151	1.20
74LS154	1.60
74LS157	.90
74LS163	1.20
74LS164	1.30
74LS174	1.00
74LS175	1.00
74LS191	1.20
74LS192	1.20
74LS193	1.20
74LS194	1.20
74LS195	1.20
74LS196	1.20
74LS221	1.20
74LS253	1.85
74LS279	.65
74LS365	.80
74LS367	.80
74LS368	.80

CMOS

4000	20
4001	.25
4002	.25
4006	1.40
4007	.25
4008	1.25
4011	.25
4012	.25
4013	.55
4014	1.35
4015	1.20
4016	.50
4017	1.40
4018	1.40
4019	.75
4020	1.60
4021	1.40
4022	1.60
4023	.25
4024	.90
4025	.40
4027	.80
4028	1.25
4029	1.90
4030	.40
4040	1.30
4041	1.25
4042	1.25
4043	1.50
4044	1.50
4046	1.95
4049	.60
4050	.60
4051	1.20
4052	1.20
4053	1.20
4060	2.65
4066	1.00
4068	.40
4069	.35
4070	.40
4071	.40
4072	.40
4073	.40
4074	.40
4076	1.85
4077	.40
4078	.40
4081	.40
4082	.40
4510	1.30
4511	1.30
4518	1.30
4520	1.30
4528	1.20
4555	1.20
14553	7.50
14584	1.25
74C00	.40
74C02	.40
74C04	.40
74C08	.40
74C10	.40
74C14	1.90
74C48	2.55
74C73	1.20
74C75	1.20
74C76	1.35
74C90	2.25
74C93	2.25
74C175	1.85
74C192	2.25
74C193	2.25

LINEAR

301	35
307	.65
308	1.35
311	.85
324	1.35
339	.90
349	2.25
356	1.65
380	1.20
381	2.00
382	2.00
386	1.95
555	.35
556	.85
565	1.95
566	2.50
567	2.65
709	.75
723(VR)	.55
741	.35
747	1.25
3900	.90
3909	1.25
CA3130	1.95

VOLTAGE REGS.

309	1.50
317	2.90
323	8.25
325	2.60
723	.55
7805	90
7806	1.30
7808	1.30
7812	90
7815	1.30
7818	1.30
7824	1.30
7905	1.50
7912	1.50
7915	1.50
78L05	.50
78L12	.50
78L15	.50
79L05	.85
79L12	.85
79L15	.85

OPTO

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PL18/20VA	18 volts at 1.11 amps	9 volts at 2.22 amps
PL24/20VA	24 volts at 0.83 amps	12 volts at 1.67 amps
PL30/20VA	30 volts at 0.67 amps	15 volts at 1.33 amps
PL40/20VA	40 volts at 0.50 amps	20 volts at 1.00 amps

40VA CHASSIS OR FRAME MOUNTING

Type No.	Series Connections	Parallel Connections
PL12/40VA	12 volts at 3.33 amps	6 volts at 6.67 amps
PL15/40VA	15 volts at 2.67 amps	7.5 volts at 5.33 amps
PL18/40VA	18 volts at 2.22 amps	9 volts at 4.44 amps
PL24/40VA	24 volts at 1.67 amps	12 volts at 3.33 amps
PL30/40VA	30 volts at 1.33 amps	15 volts at 2.67 amps
PL40/40VA	40 volts at 1.00 amps	20 volts at 2.00 amps

60VA CHASSIS OR FRAME MOUNTING

Type No.	Series Connections	Parallel Connections
PL12/60VA	12 volts at 5.00 amps	) single secondary
PL15/60VA	15 volts at 4.00 amps	) winding only
PL18/60VA	18 volts at 3.33 amps	9 volts at 6.67 amps
PL24/60VA	24 volts at 2.5 amps	12 volts at 5.00 amps
PL30/60VA	30 volts at 2.0 amps	15 volts at 4.00 amps
PL40/60VA	40 volts at 1.5 amps	20 volts at 3.00 amps

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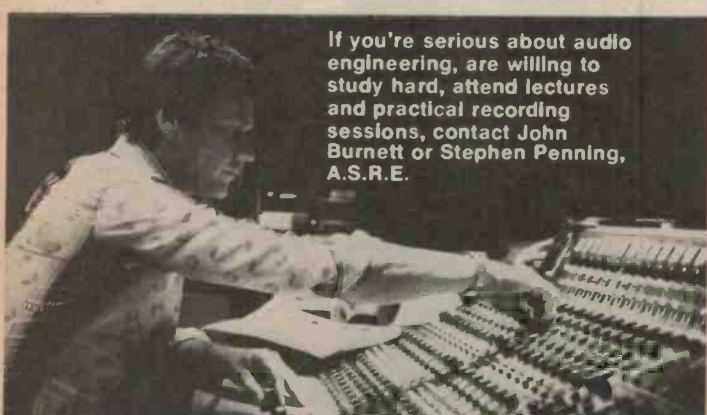

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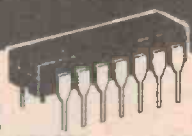

74LS00	30	74LS92	1.20
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74LS05	35	74LS113	55
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74LS09	30	74LS138	1.20
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74LS11	30	74LS154	1.60
74LS12	30	74LS157	90
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74LS20	30	74LS164	1.30
74LS21	30	74LS174	1.00
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74LS28	40	74LS191	1.20
74LS30	30	74LS192	1.20
74LS32	33	74LS193	1.20
74LS37	45	74LS194	1.20
74LS38	45	74LS195	1.20
74LS40	40	74LS196	1.20
74LS42	1.20	74LS221	1.20
74LS73	1.20	74LS253	1.85
74LS74	50	74LS279	65
74LS75	70	74LS365	80
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4007	25	4050	60
4008	1.25	4051	1.20
4011	25	4052	1.20
4012	25	4053	1.20
4013	55	4060	2.65
4014	1.35	4066	1.00
4015	1.20	4068	40
4016	50	4069	35
4017	1.40	4070	40
4018	1.40	4071	40
4019	75	4072	40
4020	1.60	4073	40
4021	1.40	4074	40
4022	1.60	4076	1.85
4023	25	4077	40
4024	90	4078	40
4025	40	4081	40
4027	80	4082	40
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4029	1.90	4511	1.50
4030	40	4518	1.50
4040	1.30	4520	1.45
4041	1.25	4528	1.20
4042	1.25		

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381	2.00	747	1.25
382	2.00	3900	90
		3909	1.25

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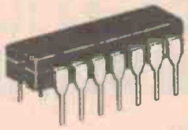

7400	28		
7401	28		
7402	28		
7403	28		
7404	37		
7405	37		
7406	50		
7407	50		
7408	34	7476	45
7409	34	7480	1.25
7410	30	7483	1.25
7411	37	7485	1.45
7413	54	7486	65
7414	1.03	7489	1.20
7416	60	7490	75
7417	60	7491	1.00
7420	30	7492	75
7422	30	7493	75
7426	45	7494	1.10
7427	45	7495	95
7430	30	74100	2.45
7432	43	74107	65
7437	50	74121	60
7438	50	74123	1.10
7440	30	74132	1.25
7441	1.50	74150	1.80
7442	70	74151	1.10
7447	1.25	74153	1.10
7448	1.25	74154	1.70
7450	35	74157	1.10
7451	35	74160	1.55
7453	35	74164	1.55
7454	30	74165	1.55
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220pf 50V	10
330pf 50V	10
470pf 50V	10
.001mfd 50V	10
.0047mfd 50V	10
.01mfd 50V	10
.022mfd 50V	10
.047mfd 50V	10
.1mfd 50V	10

Polyester:

.001 100V	15
.0015mfd 100V	15
.0022mfd 100V	15
.0047mfd 100V	15
.01mfd 100V	15
.022mfd 100V	15
.047mfd 100V	15
.1mfd 100V	20
.15mfd 100V	25
.22mfd 100V	25

Electrolytic:

1mfd 50V	10
4.7mfd 50V	10
10mfd 50V	10
22nfd 25V	15
47mfd 25V	15
100mfd 25V	20
220mfd 25V	30
470mfd 25V	45
1000mfd 25V	55
2200mfd 16V	85

Tantalum:

.1mfd 35V	35
.22mfd 35V	35
.33mfd 35V	35
.47mfd 35V	35
.68mfd 35V	35
1mfd 35V	35
1.5mfd 35V	35
2.2mfd 25V	35
3.3mfd 25V	35
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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.
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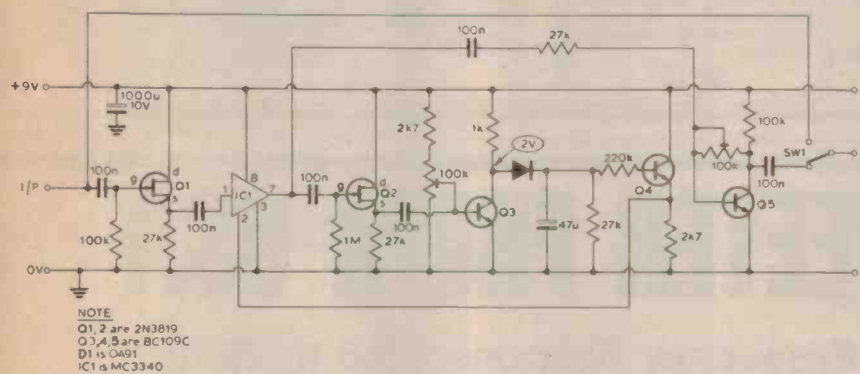
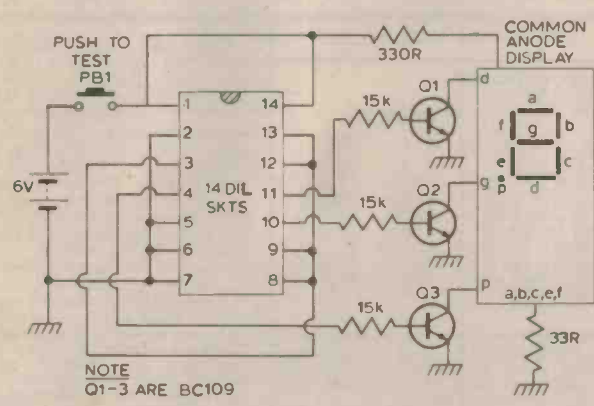


Guitar Sustain Unit

The sustain to be described here holds the output at a constant level over a wide range of input levels. It was designed to use with electric guitars and has a maximum effect with the guitar pick-up full up.

The principle employed is that of an AGC, whereby the circuit output is monitored by a DC voltage follower which controls the gain of the VCA through which the signal passes. The advantages of this circuit are that, unlike many such devices, it does not use opto-coupling which draws too much current for battery powered equipment; it produces no audible distortion; components are easily obtained – and cost is low.

Construction method is not critical.



CMOS Gate Identifier

The circuit can be used to distinguish four types of dual input gates – AND, OR, NAND, NOR – it is also a quick method of checking IC function. If an AND gate is inserted into the socket, an A appears on the LED. An O denotes an OR gate. The decimal point is used to denote inverted function, i.e. A is an NAND gate.

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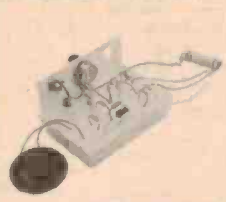

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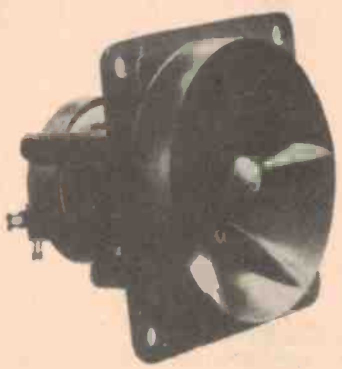

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.015	6c	.15	12c
.018	6c	.18	14c
.022	6c	.22	15c
.027	6c	.27	16c
.033	7c	.33	18c
.039	7c	.39	19c
.047	7c	.47	20c
.056	8c		
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33 uF	8c($4)	9c($5)	10c($6)
47 uF	9c($5)	10c($6)	11c($7)
100 uF	10c($6)	12c($7)	14c($11)
220 uF	12c($8)	16c($10)	35c($17)
470 uF	16c($12)	22c($16)	45c($30)
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4A	30V	C106Y1	40	10A 400V SC146D	$1.50	1N4004	9c (1A 400V)
4A	400V	C106D1	75	25A 400V SC260D	$2.50	1N4007	12c (1A 1000V)
8A	400V	C122D	$1.05	DIAC ST2	35	1N4148	5c, $4/C, $30/K
8A	500V	C122E	$1.20	Chart to identify leads			
25A	400V	C37D	$2.50	Plus trigger info.	10c		

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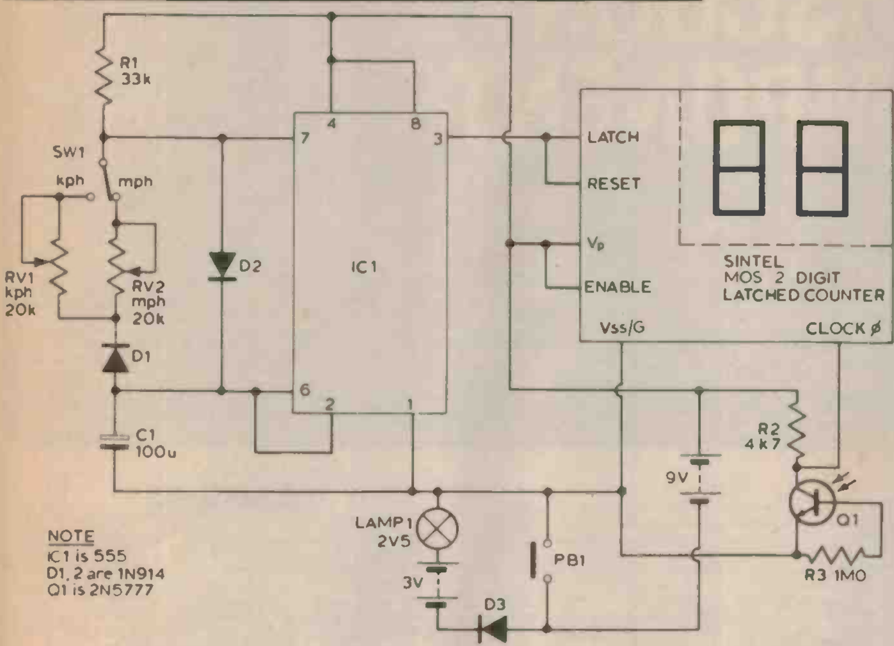
Ideas for experimenters

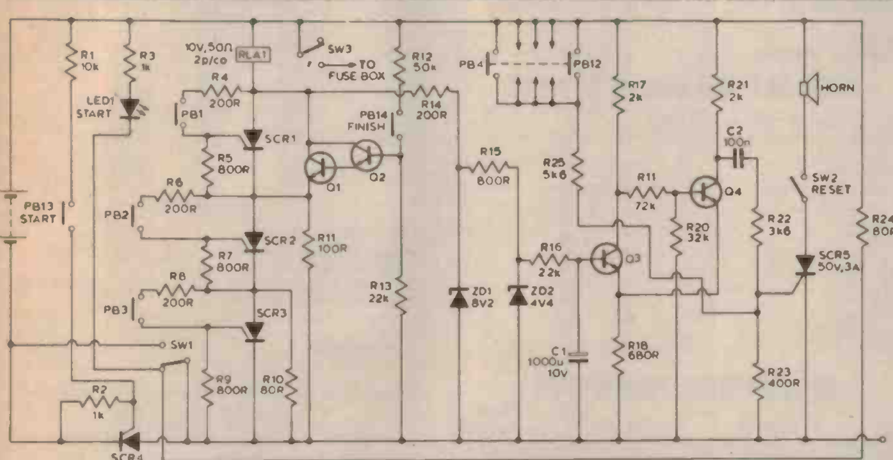


Digital Bike Speed

This unit provides push-bike speed measurement between zero and 100 km hr or 100 mph! The circuit is based on the Sintel MOS counter block, which counts the pulses from the photo transistor Q1.

The pulses are provided by fixing 18 aluminium 'barriers' to the wheels. Q1 was an unmarked type in the prototype, in a TO 18 package. This mounts in an old felt-tip pen case opposite the lamp so that the barriers interrupt the beam in operation. The counter operates whilst PB1 is pressed, but latches after a time determined by RV1 or RV2. IC1 and associated components. IC1 forms a square-wave oscillator with variable mark-space ratio. The time for which pin 3 is taken low is determined by RV1/RV2 — this enables the counter.

The speedo accuracy is determined by the accuracy of setting of controls RV1 and/or RV2.



Electronic Ignition Switch

When used with a calculator type keyboard, this circuit provides a 'combination lock' ignition switch which only activates if the correct sequence of three numbers is keyed in. The keyboard has 14 keys numbered 1 to 12, 'START' and 'FINISH'. To start the car, the 'start' key is pressed and the start LED will light. The correct sequence of 3 numbers is then keyed in. If the sequence is wrong, the cars horn will be sounded. If the right sequence is entered, the 'START' LED will extinguish and the ignition will be energised. The correct sequence will be PB1, PB2, PB3, but these can be arranged amongst the other keys in the keyboard and given any numbers.

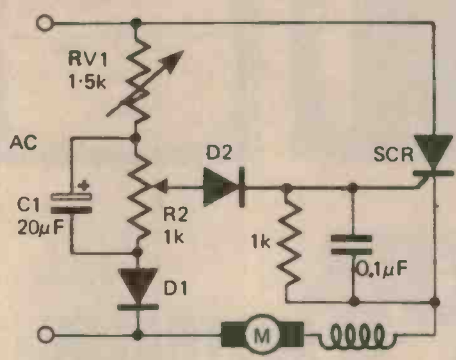
Ideas for experimenters

Half-Wave Control

One of the most common applications for SCR phase control systems is speed control of commutator motors — such as those used for food mixers, sewing machines, pottery wheels etc.

However one of the disadvantages of controlling motor speed by varying input power is that as the effective power input is reduced to slow down the motor — the torque available is reduced as well.

This may be overcome by using a feedback signal to advance the firing angle in proportion to the load on the motor — thus increasing the power input if more torque is required.



The circuit shown (right) achieves this load compensating function by deriving a feedback signal from the armature back-emf (produced by the residual field of the motor). In this circuit, the SCR is triggered when the voltage on the wiper arm of potentiometer R2 rises to a high enough value to forward bias diode D2 — thus allowing gate current to flow. As the back emf tends to reverse bias D2, the firing point of the SCR depends largely upon the back emf and this in turn is a function of speed. If the motor is loaded, the speed reduces, thus also reducing the back emf — hence D2 becomes forward biased earlier in the cycle (triggering the SCR earlier in the cycle), and thereby supplying the motor with more power to offset the effect of the loading.

The component values shown are suitable for most fractional horse-power motors — for optimum results it will be necessary to adjust component values to suit the motor used.

The circuit described above will provide stepless speed control over a wide range of motor speed — but tends to cause jerky operation at low speeds.

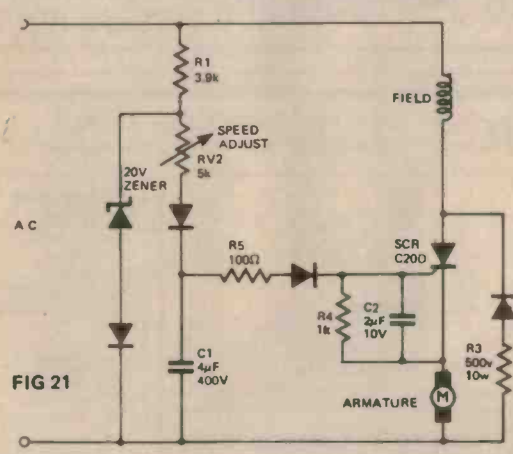
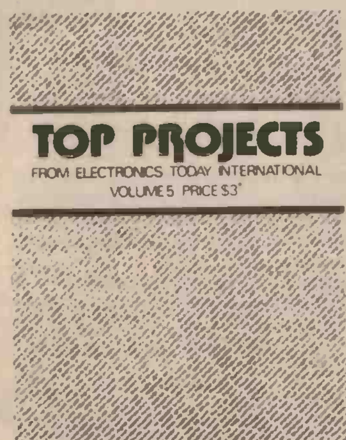


FIG 21

Improved Half-Wave

As may be seen from the circuit diagram it is necessary to bring out separate connections from the armature and field windings. This is generally a simple operation and providing it can be done the circuit will provide stepless speed control down to virtual standstill. In this circuit the 20 V zener diode provides a constant voltage for the discharge of C1. Capacitor C2 and resistor R4 are connected from gate to cathode of the SCR to stabilize the circuit by preventing the SCR from being triggered by extraneous signals.

ETI SPECIALS



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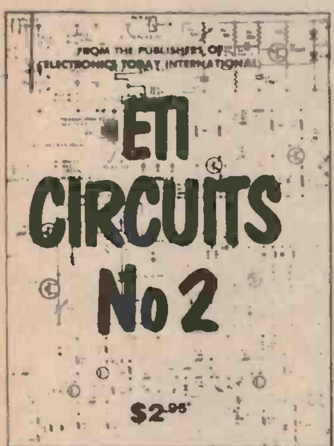

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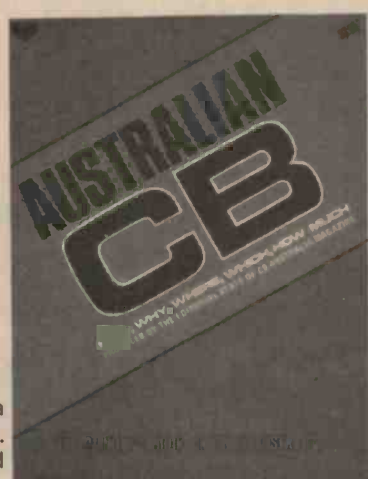

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We regret we cannot answer readers' enquiries by telephone.

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