Las Vegas Consumer Electronics Show Report

electronics today

MARCH 1979 INTERNATIONAL

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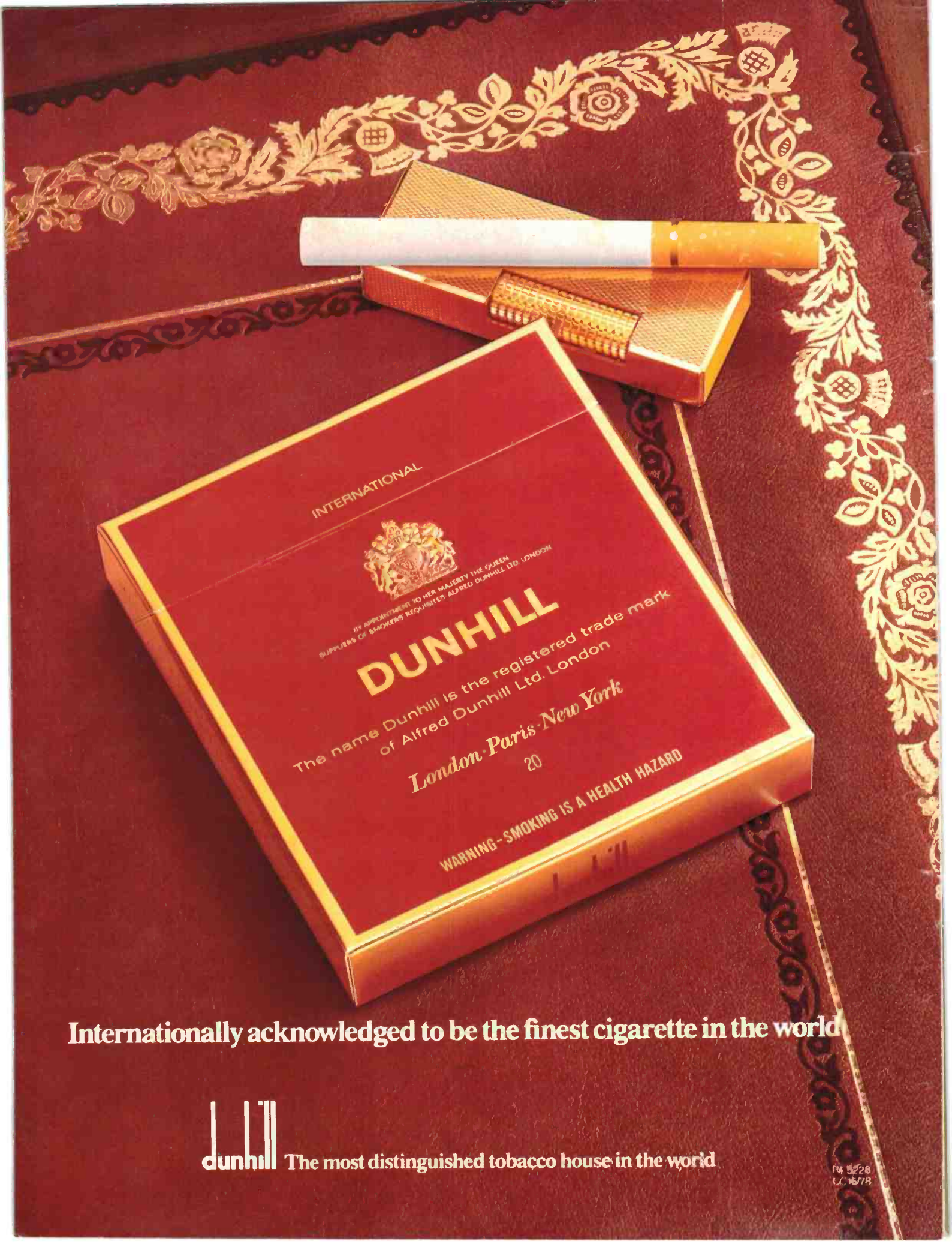
Aircraft Band Radio

Power Supplies

Audio Equaliser

Cable Tester

Electronics In Model Railways



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dunhill **The most distinguished tobacco house in the world**

PA 5228

AUSTRALIAN OWNED AND PRODUCED

March 1979, Vol. 9, No. 3

electronics today INTERNATIONAL

Editorial: Les Bell

Managing Editor: Collyn Rivers

Cover: You can listen in on pilot-ground communications with our Aircraft Band Converter (see page 39). Picture courtesy of Qantas.

A Modern Magazines Publication

* Recommended retail price only.

Registered for posting as a publication — Category B

PROJECTS

FEATURES

NEWS & INFORMATION

News Digest

VDU Problems

As if the UK didn't have enough industrial relations problems, already, the Amalgamated Union of Engineering Workers has issued a report on the health hazards of using VDUs (video display units).

The fourteen guidelines set out in the report include regular eye tests (paid for by the employer), adjustable seating, darkened work areas and a maximum of four hours use per day, with 20 minutes rest every two hours. The report also recommends covering the unit with a glass/metal case to reduce 'radiation' hazards.

The union suggests that these points be negotiated with employers *before* VDUs are installed.

Plutonium Cache

Probably unknown to many Australians, for the last several years, a 500 g lump of plutonium metal has been buried at Maralinga, South Australia.

The UK Ministry of Defence and the Australian government state that the UK will recover the metal, which the Australian government says has potential dangers, not from leakage but from misuse by terrorists. Plutonium is highly poisonous and the threat of misuse should send most governments into a flat spin.

Maralinga was used by the British for nuclear weapons testing during the '50s and '60s.

Throw Away That Dictionary!

Has it happened at last – a computer that can translate human languages? A system developed by Weidner Communications Systems Inc. of California, has been demonstrated on Spanish-English translations at the 1979 convention of the American Translators Association. The system, it is claimed, can also handle Arabic, Dutch, French, German, Hebrew, Italian, Japanese, Portugese and Russian!

Satellite TV

Government decision to expand the TV transmission network by satellite has been reached after successful tests using a 30 m OTC antenna to send signals to an 'Intelsat' satellite. The signals were picked up using a 5 m antenna with a low noise amplifier.

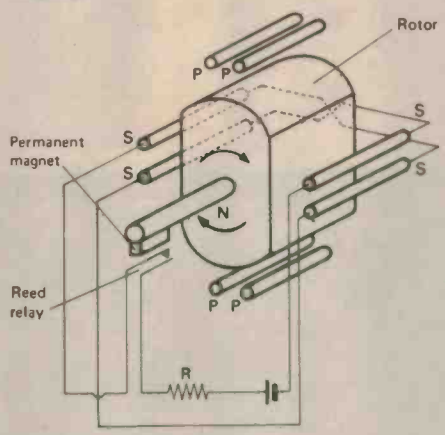
The ground station used will be demonstrated at the DOMSAT 79 conference to be held at the National University in Canberra on 20-23 February.

Squeak Squeak

Could *you* look Mickey Mouse in the face every time you make a phone call?

STC hopes so - they're planning to market a Mickey Mouse phone in Australia. It's a big seller in the United States and a market survey in this country has shown that most people do *not* see it as a "kiddie's item". Well - how many kids make phone calls, anyway?

The device works like a normal phone but perhaps it might be possible to produce one that goes 'Squeak!' instead of ringing?



Principle of brushless alternator

Brushless Alternator

A new magnetically boosted brushless alternator may solve problems of wear in jet aircraft.

A second stator coil around the solid magnetic rotor boosts its field at a particular point in the travel. This increases the mechanical drag and output voltage at that point. A fixed magnet on the shaft closes a reed switch to switch on the boost coil.

TI Do It Again

Texas Instruments are out to increase their lead in dynamic RAM technology with their announcement of the development of what they term the taper-isolated dynamic-gain RAM cell. This design dispenses with the capacitor used to store charge in present dynamic RAM circuits, and instead stores bits by trapping charge in two regions within the transistor. The cell offers several advantages over previous designs: it requires simpler sense amplifiers, is smaller and easier to make since it has only one layer of polysilicon compared to three in older types, and can retain data without refresh for up to one minute compared to two ms. How long before we see the 256 K RAM?

Video Disk Unit

At last a commercial videodisk system has been released in the US, by Magnavox. The Magnavision system uses a laser to replay video information from a disk which resembles an audio record. According to Magnavox, the picture quality is better than that obtainable from current video recorders, and the software for the machine is attractively priced – a range of 200 programmes is priced from $5.95 to $15.95. Pricing of the player itself is perhaps on the high side at $695 but it is said that this is some $300 below the manufacturing cost of the unit. Magnavox are obviously counting heavily on establishing a reputation by being first in the marketplace – if they sell the predicted 20 000 units in the first year, this represents a loss of some $6M, which parent company Philips (who supplied the technology) will not take lightly.

Two types of disks are used in the system; a 30-minute per side record which revolves at a constant 1800 rpm and a 60-minute per side record which rotates at a variable angular velocity. An analogue representation is burned into pits in the record surface by a laser during manufacture (by MCA Inc) and is read out by a helium-neon laser.

Electronic Phone

In the US, recent policy changes by the FCC have paved the way for aggressive marketing of telephone equipment by rival manufacturers. For example, Bell Canada intends to sell a US$79.95 telephone with no moving parts through telephone stores from April. The electronic mechanism features push-button dialling with an auto-repeat facility.

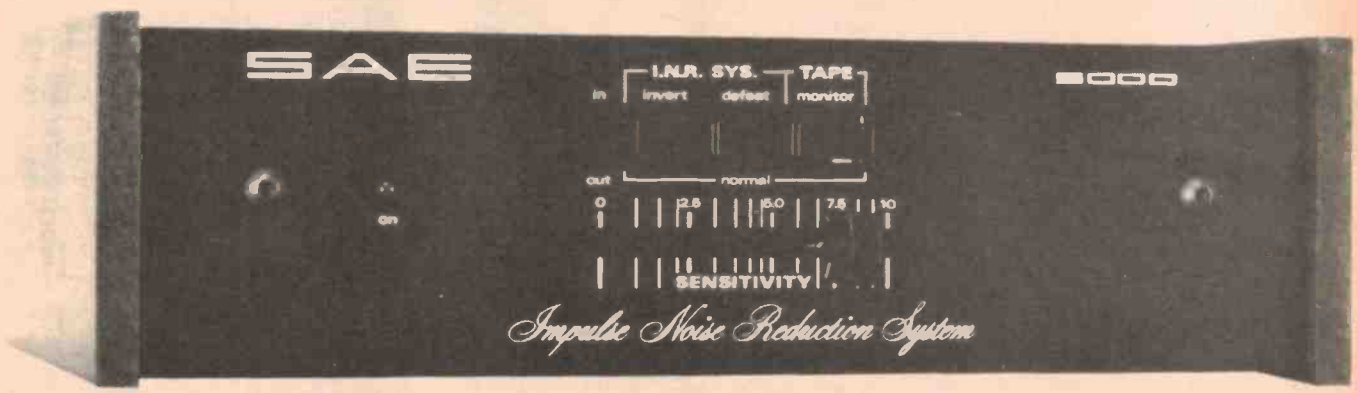
The "Click and Pop" machine

Ever since the invention of the recorded disc annoying "clicks" and "pops" caused by scratches, static and imperfections have consistently disturbed the listening pleasure of music lovers.

Now, SAE introduces the unique model 5000, an Impulse Noise Reduction System which eliminates those unwanted sounds with no adverse effect on the quality of the recorded material. This breakthrough in electronic circuitry is so demonstrably effective that the SAE 5000 is destined to become an essential part of any sound system.

The SAE 5000 is compact and sleek, built to SAE's exacting standards, and ready to enhance the performance of any system, from the standard receiver/turntable combination, to the most sophisticated audiophile components.

SAE is proud to add the 5000 to their broad line of Components for the Connoisseur.



If your Hi-Fi dealer is out of stock contact the distributors.

AUDIO ENGINEERS P/L
342 Kent Street
SYDNEY 2000 N.S.W

AUDIO ENGINEERS (Vic.)
2A Hill Street
THORNBURY 3071 Vic

AUDIO ENGINEERS (Qld.)
51A Castlemaine Street
MILTON 4064 Qld

ATHOL M. HILL P/L
33 Wittenoom Street
EAST PERTH 6000 W.A.

AE136/FP

TI Have Personal Problems

Texas Instruments are having problems getting US government clearance for the design of their new personal computer – they asked the FCC (Federal Communications Commission) if they could have the RF modulator tested separately from the rest of the machine. This delay meant that its release was too late for the US Winter Consumer Electronics Show.

Perhaps TI are being a bit too complacent about the success of their machine – it is rumoured that they consider it so good that they won't have to compete for sales – who knows what might turn up on the market between now and its release?

New Heat Pump Technique

Yet another 'solution looking for a problem', it seems.

NASA have developed a heat pump using a magnetothermal material. The temperature of a block of gadolinium increases or decreases by 10 to 20°C as a magnetic field is either applied or removed.

A suggested use for the effect is in refrigeration – a block of the material is raised and lowered in a tube with a magnetic field at one end.

What about a 'clever' heat sink, though, with an embedded block of gadolinium to iron out power transients? Any more ideas.

SunSat Warning

The US Department of Energy is planning to select a design for solar power satellite this year - but a task force of the American Institute of Aeronautics and Astronautics has urged the Department to 'go slow' and make thorough tests of all concepts before committing to a firm design. Calling the current plan 'premature', the AIAA said that not enough is known about the interaction of the proposed 2.45 GHz microwave power transmission link with the ionosphere.

Odds and Ends

Hitachi have produced a colour TV which gives a picture after one second, without pre-heating. This is achieved by heating the cathode directly.

A flexible PCB material called PPA (polyparabanic acid) could mean cheaper, thinner and lighter boards. The material was developed by Toshiba and will be marketed as 'TLF-600'.

Printing DVM

For applicatons where a voltage, representing perhaps a temperature, flow-rate or other slowly-changing variable, has to be displayed continuously and printed periodically, the DVM-700 may be the answer.

The print period is presettable by means of thumbwheel switches from 1 to 99 minutes and a negative voltage is indicated on the print-out by a change in colour. There is also the possibility of using the internal timer to initiate an external measurement cycle, such as a chromatography, and printing the result on receipt of a "ready" signal.

The instrument's input impedance is 100 Meg and it will run off 115/220 V at 50/60 Hz. The LED display is 15 mm high.

Further information from *John Morris Pty Ltd, PO Box 80, Chatswood NSW 2067.* Tel 407-0206.

A surface acoustic wave (SAW) delay line with a 0.27% variation of delay time may be of use in TV sets for LC filter replacement. The variation is accomplished by changing the magnetic field strength around the device. It was developed by Tokyo Institute of Technology.

Severe paper shortage is hitting the US computing industry. This is due to strikes amongst west coast paper mill workers.

The USSR will use PDP-8s instead of a Sperry Univac 1100/10 computer at the 1980 Moscow Olympics. The sale of the latter machine was vetoed by the US Office of Exports.

Australian Eagle Insurance Company has announced a new policy for electronic equipment installations, including computers: 473 Bourke Street, Melbourne, Vic 3000.

Ferranti are to set up a new company in Australia - Ferranti Computer Systems (Australia) Pty Ltd. Based in Sydney, the company will specialise in real-time computer applications in military and industrial fields.

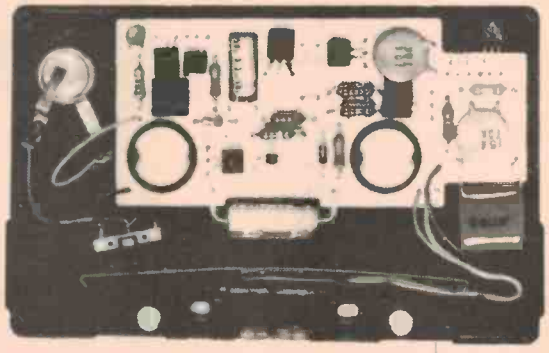
Computer Time Theft

Two former college students have been found guilty in Alberta Supreme Court, Canada, of stealing telecommunications services in order to make unauthorised use of their campus mainframe computer. The Canadian federal criminal code does not have a section specifically dealing with theft of computer time, but the students were prosecuted under a section dealing with 'theft of telecommunications services' and received one year suspended sentences. Their attorneys are considering an appeal to the Supreme Court of Canada in Ottawa.

In a similar case in Berkeley, California, a 15 year old boy is charged with felony, vandalism and grand theft of 200 hours of computer time worth an estimated US$10 000. The boy allegedly purchased a second-hand portable terminal and modem for $60 and used it to communicate with a network of six DEC PDP-11 computers at the nearby University of California computer centre.

Soon after the boy started his activities, the University system began to suffer an unusual amount of downtime. Data was inexplicably lost, and users were unable to run vital programs. Because of his age, the youth is expected to escape with little or no punishment.

TDK's Revolutionary New Product — The HD-01 Head Demagnetizer Built into a Cassette Shell.

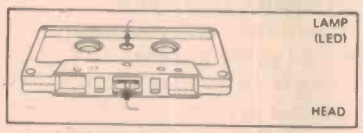


Simply load the HD-01 into any cassette recorder as you would a standard audio cassette and depress the 'play' button.

The HD-01 Head Demagnetizer was designed by TDK for easy, convenient head demagnetization of any cassette deck, insuring crystal-clear, perfect recordings every time.

The TDK HD-01 Head Demagnetizer features:

- A unique cassette format, designed to insure complete compatibility with any cassette deck.
- Powerful de-gaussing circuit instantly demagnetizes recorder heads the moment the play button is depressed. The above diagram depicts the oscillating waveform applied to the recorder heads, removing every trace of residual magnetism in only one second!
- A red LED (Light Emitting Diode) built into the HD-01 cassette shell will light up the moment your recorder heads have been completely demagnetized.



The TDK HD-01 Head Demagnetizer ends forever the fuss and mystique surrounding the demagnetization process and is much easier to use than conventional wand-type tools. Anyone can use the HD-01 and get perfect results every time.

The TDK HD-01 Head Demagnetizer is completely self-contained, battery operated and portable. It can be taken anywhere and stored with your present audio cassettes. The TDK HD-01 is ideal for all types of cassette decks especially those with heads located in hard to get at places such as:

- recorders with heads positioned in the front of the unit but which point to the rear.
- those with 'pop up' loading mechanisms which can not be detached, thus making the heads almost inaccessible.
- cassette decks with heads positioned laterally with respect to cassette loading (car decks are good example of this type).
- automatic loading machines.

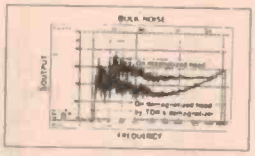
WHY IS DEMAGNETIZING SO IMPORTANT?

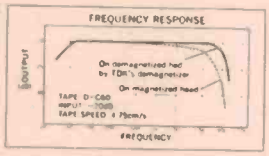
TDK, in conjunction with many cassette deck manufacturers, recommend that cassette decks be maintained on a regular basis. Cleaning the heads, capstan and pinch rollers is one important aspect of that maintenance program. — Periodic demagnetizing, about every thirty hours of use, is the other. Failure to do so will cause a build-up residual magnetism on the heads, which can seriously affect tape and machine performance in the following critical areas:

1. The noise level in the low and midrange frequencies is increased by 5 to 7dB, thereby reducing the overall signal-to-noise ratio.
2. Pre-recorded tapes can also be affected with midrange and high frequency distortion, as well as attenuation by as much as 2 to 6 dB, virtually eliminating any hopes for clear sound reproduction.

The interaction of these factors will not only prevent both the tape deck and tape from displaying their true performance capabilities, but will severely limit the Dynamic Range properties of both, rendering pure sound reproduction an impossibility.

The following comparison data clearly demonstrates the effect of residual magnetism on recorder heads in the areas of both Noise Level and Frequency Response.





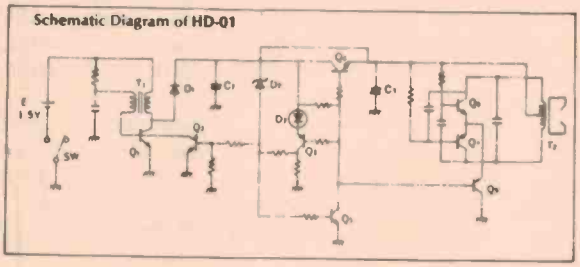
TECHNICAL DATA

Major Components:
Transistors (8)
Diodes (2)
LED (Light Emitting Diode)

Power Supply – Control Section – Oscillation Section – Head Section

Specifications:

Maximum Magnetic Flux Density	200 Gauss
Oscillation Frequency	630 Hz
Shape	(External Dimensions) Conform to IEC Standards
Battery for Power Supply	G-13 1.5 volt, Silver Oxide Battery (option)



TDK

For additional information, direct all inquiries to:

CONVOY INTERNATIONAL PTY. LTD.
4 Dowling Street, Woolloomooloo, N.S.W. 2011
Telephone: (02) 358-2088. Telex: AA23111

News Digest

Crystal Contract

NASA have given a $US800 000 contract to Arthur D Little Inc. to develop a technological basis for crystal production in outer space.

The study will consist primarily of an experiment for a 1982 Spacelab flight which will focus on the adverse effects of surface tension in the crystal-growing process.

Applications for this sort of work include semi-conductor crystal manufacture.

China Develops Satellite Launcher

China has the capability to place a geosynchronous communications satellite by 1980. This comes with the development of the 'Celestial' booster, which will enable high-altitude devices for civilian and military use to be launched.

Electronic Mail

The first public international electronic mail service, called 'Expresspost' will start this year between the US, Argentina, France, Belgium, West Germany, Iran, the Netherlands and the UK.

The service will cost about US$5 per page and will guarantee same-day delivery. The transmission is performed by scanning the printed matter optically and then digitising the resulting output. Transmission rate is about 1 sheet per minuted.

Meanwhile, back in the US, the Postal Service is beginning tests on equipment that can transmit 600 pages per minute for US internal use. Also being tested is a machine which can receive at 300 pages per minute and put the pages into envelopes.

The Postal Service is running into problems, though - powerful opponents in government circles have pointed out that regulations prevent the Service from venturing into electronic mail. They suggest that this potentially highly profitable operation be left to the private sector.

Auto Dialler

A Sydney firm is now offering an LSI-based automatic telephone dialler.

Called the Corona AD-7081/2, the device can hold up to 40 phone numbers of up to 20 digits each. The numbers are entered into the memory via the keypad and an automatically-recharged battery will keep the memory going for 24 hours during a power failure.

Other features include a pause key which can be used to insert a set time delay at appropriate places in the number (ie after the exchange code) and an auto-repeat facility which will re-dial a given number if it is engaged.

The device also incorporates a speaker which allows the user to monitor the state of the line without lifting his handset.

Further details are available from *Emona Enterprises, CBC Bank Building – Haymarket, Suite 208/661 George St., Sydney 2000.*

New Tape From BASF

BASF have accompanied the release of their new Chromdioxide Super cassette with a bit of a lash against their competitor's products.

Their literature includes these statements - "... contrary to wear rumours in competitive literature, all its (BASFs) research so far has proven the opposite is true" and "BASF reaffirms its belief in chromium dioxide as the ultimate cassette formulation".

Could it be that the new 'chromium substitutes' such as TDKs SA and Maxell's UDXL-II are beginning to bite into the high-price end of the market?

We have yet to see convincing evidence one way or the other on CrO_2 head wear - it's a difficult thing for anyone except a manufacturer to measure - but *both* sides surely can't be right?

Unitrex Calculator Contest

The winner of January's competition was M Neill of Victoria, who produced one of the 48 possible answers (excluding reflections and rotations). He also included the general form of the solution. The answer he gave was: 12, 13, 44, 6; 7, 43, 16, 9; 14, 11, 5, 45; 42, 8, 10, 15.

This month's problem can only be described as a cracker.

XXX represents a three digit number. x and y are both less than ten.

When operating in base x, 1452 + XXX = 2220. When operating in base y, 1452 + XXX = 1776 (the year the Americans gained independence, by the way). What is XXX?

Write your answer, your name and address on the back of an envelope, stamp it and put our address on the front: Unitrex Calculator Contest (March), ETI Magazine, 15 Boundary Street, Rushcutters Bay, NSW 2011. Closing date is Monday, 2 April 1979.

Errata

Simple Interpreter, January 1979

The source listing in the centre of the article did not reproduce very well and can be difficult to follow. The major problem is that the 3E byte at 01BD has printed as 3F which causes the 'yes/no' jump logic always to act as 'no' jump logic.

On page 61, column one, line 13, should read as '... j, k, q, x, and z occur rarely'.

Digital Stopwatch ETI 590

This appeared on page 78 of the October 78 issue. The error is in the circuit diagram, although the pcb is correct. The connections from pins 5 and 6 of IC12 which lead to IC8/3 and IC13/1 should instead be from pins 4 and 5 respectively. Similarly, pins 5 and 6 on IC13 should have been 4 and 5.

ETI 490 Speech Compressor

Some constructors of the Speech Compressor in our December issue have noticed an oscillation which causes the LED to flash at low input levels. The cause of this is an instability in the LED driver section of the LM324, (IC1/3). The cure is to place a 100n capacitor in parallel with R4 in the feedback of IC1/3.

ETI 642 S-100 Static RAM Card

On page 57 of the February '79 issue, two IC43s were incorrectly shown. The lower of the two is correct. The IC above and to the left of it is IC44, a 74LS154. In the list of ICs at the top of the diagram, IC45 should be shown as a 74LS175.

ETI 134 True RMS Voltmeter

In the August '77 issue, on pages 72 and 73, the wrong values were shown for R4 and R5. These should be: R4, 1k2; R5, 15k. We apologise for the error.

MIDLAND IS QUALITY CB

But don't take our word for it..

"Comparisons on-air with our regular rig brought comments like: 'B . . . . . great', 'It's the better by far', 'Fabulous rig.' We feel that these comments are accurate and we had no option but to rate this rig as excellent for both transmit and receive."

"Generally, the rig behaved so well on air that we were left a little flabbergasted. We had become a little sceptical of AM rigs of late, but the MIDLAND 886 certainly changed that."

Other specifications were also quite good and the excellent noise suppression highlighted the attention to detail that has made MIDLAND a well respected name in CB."

CB ACTION No. 22 Page 30.

D-1438

WAS $249.50 -

MIDLAND 76A-886 NOW $199.50

★★★★★★★★★★★★★★★★★★★★★★★★★★

WHAT'S NEW?

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REAR WINDOW WIPER

This is the NEW Dick Smith Wiper Kit - for the average car handyman this unit is easy to install. Has spacers to allow for different types of cars and comes complete with full scale permanent pattern and all instructions. 12V DC operation. Has automatic stop. Also ideal for marine uses.

$39.95

Comes complete with switches, wiring etc.

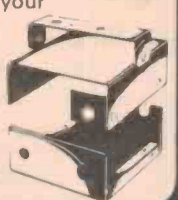
A-8505

★★★★★★★★★★★★★★★★★★★★★★★★★★

PROJECT CASE

Great for mounting switches, pilot lights, displays etc in your car. Complete with brackets, fixing screws, 88 x 70 x 34mm

H-2500



$1.50

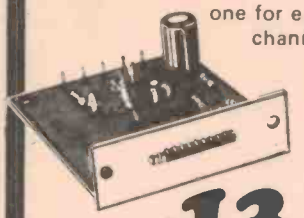
KIT BUILDERS & HOBBYISTS

Ask for our FREE 16 page colour kit catalogue next time you're in a Dick Smith Store - or drop us a line and we'll send you one.

SOMETHING TO BUILD

LED LEVEL METER

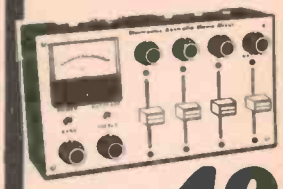
Easy to build, just as easy to add on to your amplifier for a striking visual display of relative power output. Get two — one for each channel!



K-3370 $13.50

MOVIE MIXER

All the features you'd ever want to add pro sound to your movies. Auto fade, tone controls too. Also ideal as a conventional audio mixer.



K-3492 $49.50

ARE YOU GAME?

X-1200

Be the first on your street to own a home computer that enables you to use your own colour TV to play dozens of educational and exciting games. Play educational games (children can improve their maths), exciting games like Blackjack, Spitfire, Dragrace and many more. 17 game cartridges to choose from at $24.50 each. Easy terms available to approved applicants. $29.00 deposit — $2.90 per week.

$259.00

BEST VALUE IN A HOME COMPUTER

You've seen the rest, now here's the best. The Sorcerer 8k (basic) or 16k ($1,250). Space doesn't allow us to give full details. . . call into a Dick Smith store for a demonstration. You'll agree it was worth the wait!

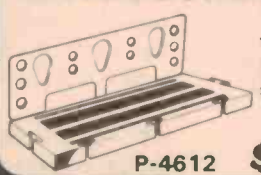
$995.00 X-1190

MONITOR X-1196

Add this video monitor to your home computer. Yes, works with the Sorcerer, Tandy's TRS-80 (Save a bundle buying our monitor!) Exclusive to Dick!

$149.50

DESIGNING CIRCUITS?



P-4612

Here's the handiest breadboard you'll ever find. Components plug into positive connections, major components such as pots, switches, etc mount on a front panel. Get rid of birds nests and costly mistakes.

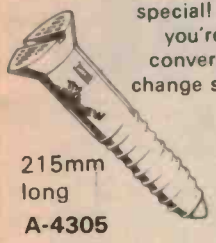
$22.50

HERE IT COMES!

DICK'S NEW JUMBO CATALOGUE IS IN THE APRIL ISSUE OF ELECTRONICS AUSTRALIA — FREE

NOVELTY RADIOS

Just the gift for someone special! Or leave it around — you're sure to have a great conversation piece! Twist to change stations - or adjust the volume by the knob. A real laugh!



215mm long
A-4305 **$9.95**

Know any male chauvinist pigs? Give him a MCP radio. Twist the tail for volume, tuning on his back. Earphones supplied.

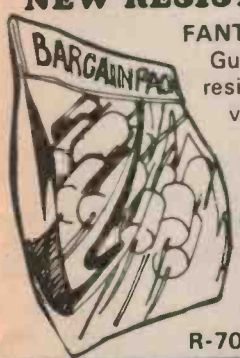
$9.50 A-4310

FREE POWER!

Yes, it operates on solar power! Plus in-built batteries for night operation. Watch has LCD (Liquid Crystal Display) with 5 functions - hours, minutes, seconds, day and AM/PM. Complete with band, makes an ideal gift - or buy one for yourself.

X-1040 **$39.50**

NEW RESISTOR PACK

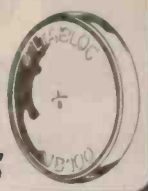


FANTASTIC BARGAIN
Guaranteed over 200 resistors, all preferred values within range 1 ohm - 10 Megs, ¼ watt - all brand new and fully guaranteed. Hurry! Limited Quantity.

R-7015 **$3.00**

QUICK! VERY FEW LEFT

We thought we'd run out – but found a few more. Very few! Don't miss out. 1.2V, 900mAH - less than half the normal price.



S-3302 **$1.75**

VISITING THE EAST?

Dick's new Hong Kong store is NOW OPEN!
DUTY FREE PRICES — PLUS AUSTRALIAN GUARANTEE'S
Shop in confidence at Dick Smith Hong Kong!

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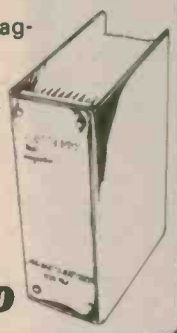

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REVIEW: ENTERPRISE PROGRAMMABLE

The Sinclair Enterprise programmable calculator has just been introduced into this country from the UK. Does it compare in price and quality with US and Japanese units?

WHEN REVIEWING something like a calculator, which after all depends very strongly for its appeal on its ease of use, it is usually worthwhile to start with the ergonomics of the design — how it fits the user.

The case of the Enterprise Programmable is fairly attractive and just about the right size to be hand-held. The display is a bit limited in viewing angle due to the use of integral lenses on the LEDs but is quite readable. There are also a couple of rubber feet to stop the machine sliding away from an energetic finger.

The keys are nice and positive and well laid out and the on/off switch is in just the right place to be operated by the left thumb when the machine is hand-held.

Getting into the battery compartment is a bit strange — the front of the calculator unclips, revealing not only the battery but also the key mechanisms. These seem to consist of a plastic button on a thin plastic hinge which is positioned over a flexed metal dome. Pushing the button down causes the dome to flex the other way, making contact with the pcb itself.

A label in the battery compartment (which is situated above the display) warns the owner to use *only* alkaline batteries — why this should be important, we can't fathom.

There is also a small 'earphone' type jack socket for an external power supply. All in all, it's an attractive unit.

Functions

As a normal scientific calculator, the Enterprise is about standard — it switches from fixed point to scientific notation automatically, although it displays only five significant figures in the scientific mode (normally it displays eight). The arithmetic accuracy is eight digits.

There are two levels of brackets and seven memories — pressing "sto n" followed by a number from 0 to 6 will store a value in the relevant memory. Similarly, "rcl n" and "M + n" will affect the memory specified by the next keystroke.

The calculator has the full set of scientific functions — sin, cos, tan, arcsin, arccos, arctan (all these work in degrees only, for some reason), e^x, ln, 10^x, log, y^x, x^2, $\sqrt{x}$, 1/x and π.

It also has the facility to convert a value from degrees to radians or vice versa.

Programming

The calculator has a 79-step program memory. Pressing the shift key twice puts it into the program mode. This means that the current step number and key code are displayed.

The display codes may be prefixed by an F, indicating that the key was 'shifted'.

The code numbers don't correspond to the key positions. It is traditional to link key code and key position in programmables (ie 43 is the key in the fourth column, third row), but the lack of this feature can be fairly easily overcome by the use of a code/position table.

A curious thing happens when the clear and clear entry keys are used in a program — it seems they both have the same code number. A bit of judicious button-pressing convinced us that they actually did the same thing!

For example:

key	display
9	9
+	9
5	5
C or CE	9
6	6
=	15

– the same result with either key.

The calculator does *not* have fully-merged key codes – only the shift key is incorporated in the code. Functions like "arcsin" require two steps, as do all the memory functions. The "goto" function (which jumps to another part of the program) requires three steps, as does the "go if negative" function, which branches if the display shows a negative number.

The other programming functions are "step" and "back", which move the current program position through the memory. The only program editing facility is the ability to overwrite current codes.

The Enterprise is not the most comprehensive of programmables, although probably adequate for most purposes.

Accessories

The calculator comes complete with a mains adapter, a carrying case, an instruction booklet and three books of programs. The package also includes an alkaline battery and a felt pen for writing programs with! The battery is a nice touch but the pen is perhaps a bit excessive.

Above: The complete kit, including manuals and even a pen! Below: The battery compartment, showing the key mechanisms. On next page: The programming manuals.

The instruction booklet is comprehensive and explains itself reasonably well. It assumes a moderate amount of prior knowledge – someone who doesn't know what a logarithm is won't have much use for the scientific functions anyway.

The program library (containing over 300 programs) is in three parts, each with a number of spare programming forms at the back (that's what the pen's for!). The programs are each on a separate page of the books, which are loose-leaf and can be rearranged to suit the user.

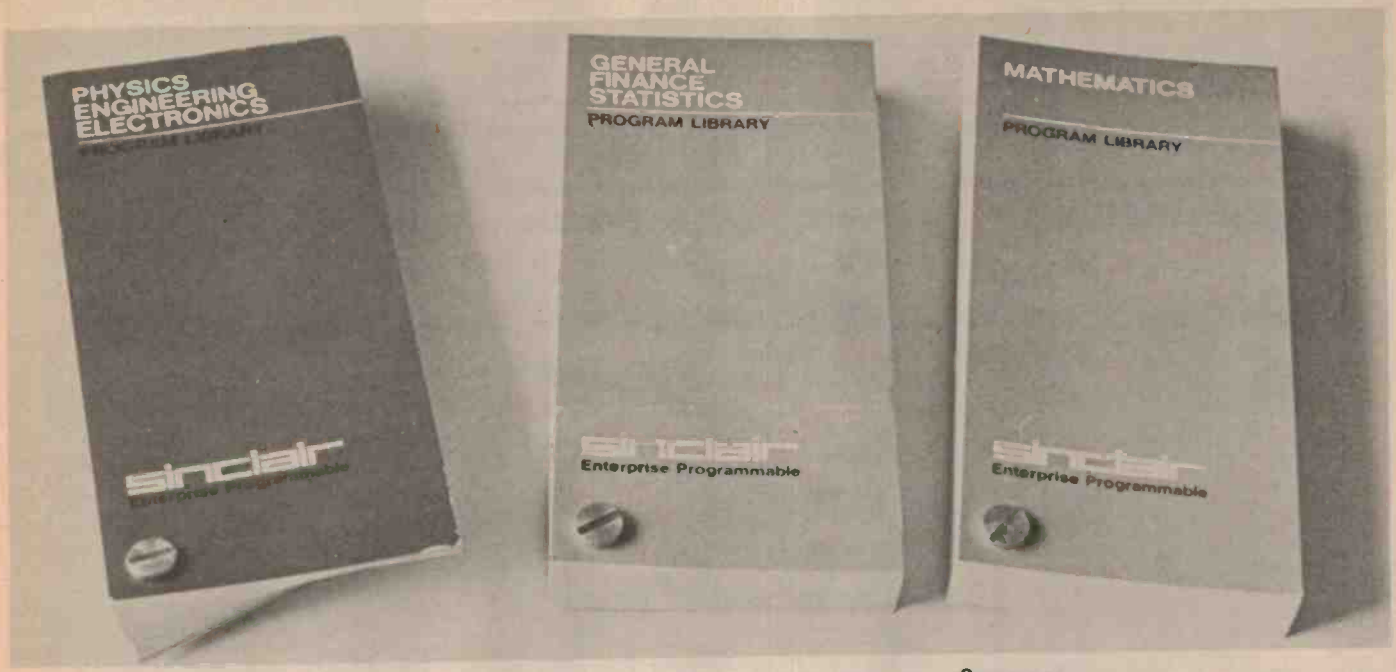
The first volume contains general-purpose programs, such as a universal calendar, measurement units conversion routines and a series of games programs. It also includes business programs for calculation of discounted cash flows, mortgage repayments and the like.

Also in the same volume are the statistical programs, including linear regression (line-fitting) and the chi-squared test amongst other things.

The programs themselves are laid out in the form of a table with the key used and the step number. This format would have been much more useful if it had included the key codes, allowing a check to be made on the program memory's contents after the program had been entered.

The second volume is of mathematical programs. These include the hyperbolic functions, iteration routines and even such obscure things as coding functions. All of the programs look fairly efficient and are well documented.

Volume three is a bit of a waste. It deals with physics, engineering and electronics. Basically, all that the author(s) have done is to dig out about a hundred commonly-used equations and put them down in the form of programs. If the user knew the equations



already, all he would have to do would be to enter them himself 'by ear'. If he didn't know the equations, seeing them in program form wouldn't do him much good anyway. An example of this is a program to work out the radius of gyration of a straight rod – the equation is $L^2/12$.

One exception is a group of programs which give the Fourier coefficients of several common waveforms. Not a true fourier analysis, but possibly useful anyway.

Most of the fun of a programmable is in *generating* programs rather than in running someone else's anyway and so the program library is just an added attraction.

Summary

The Enterprise is selling in this country for around $80. For what you get, that's quite a good buy.

It's a bare-bones scientific programmable – good enough to be useful in a lot of applications but having few frills. It would be ideal for an engineering student or a small business owner.

The Enterprise Programmable is available from Emona Enterprises, Room 208, CBC Bank Building, 661 George St, Sydney 2000.

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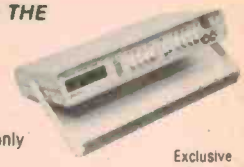

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SOUND

What Is Equalization?

A dictionary would tell you that to equalize is to make equal or uniform. Wally Parsons, ETI audio contributor, discusses.

ALL MEN (and women) are said to be created equal, but they don't all stay that way. Some become fat, others thin, some tall, some short, some rich, others poor; in other words, some are more equal than others. And the same is true with audio electrical and acoustical signals. Sure, they start off okay; but as soon as a musician pushes a sound out of his horn and sends it hurtling to a microphone little gremlins start chewing at it as it makes its tortuous way through the air, into the microphone, the bewildering maze of wires and transistors, cutters, pickups, loudspeakers, listening room. Indeed, it often seems miraculous that it emerges from all this as something even vaguely resembling the original. And then, of course, there is man, ever ready to show mother nature the errors of her ways, tinkering with this signal to make it conform to his own concept of perfection.

Then, too, sound was never meant to be recorded; therefore we have no choice but to make our equipment conform to the nature of sound, because the laws of physics are definitely not going to change to suit our convenience, except possibly to do us mischief, as outlined in Murphy's Law.

Okay then, what do we equalize, how do we equalize, and, for that matter, why do we equalize?

Types Of Equalization

Equalization can be divided into two basic types as regards function: Correctional, in which the purpose is to correct for faults in some part of the chain which produces deviations from flatness in frequency response, and Adaptive in which the response is deliberately caused to deviate from flat in order to improve the operating characteristic of some component in the chain, or to allow optimizing some other parameter, such as noise or distortion.

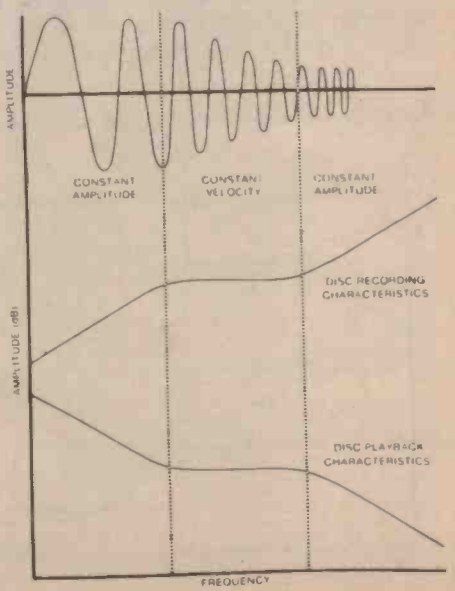
Adaptive Equalization

Several problems occur if we attempt to record or broadcast an audio signal and reproduce it with a flat characteristic from microphone to loudspeaker. As an example let us consider the case of a cutter engraving a disc recording. If a constant voltage is applied to the cutter, this will translate as a constant velcoity of cutting stylus motion. Now, suppose we attempt to record a signal of 1000 Hz and at an amplitude such as to produce a stylus velocity of 10 cm/sec. One cycle will occur in 1 msec and will result in a stylus swing in each direction of 0.025 mm, that is, it will reach maximum displacement in one-quarter cycle which takes 0.25 msec. Now, if we record a signal of 100 Hz at the same velocity, the amount of displacement will be TEN TIMES the 1000 Hz value, or 0.25 mm. 20 Hz would cause a swing of 1.25 mm. Now try to visualize this on a microgroove disc. To allow adequate spacing between grooves, even with no safety factor, would require spacing the grooves at least 2.5 mm apart. If we record over a total of 7 cm of the record surface at 33.3 rpm our maximum possible recording time would be just over 8 minutes. Remember, this assumes no guard space between grooves, which would easily cut this time in half, and assumes we can use the full 7 cm, which would be most unlikely for reasons beyond the scope of an article on equalization. It also assumes we can cut such an amplitude without running into formidable problems with the cutter, and that we can find a pickup which would trace such an amplitude. Remember, too, that 10 cm/sec is not that high a velocity. Clearly, some compromise must be made.

This adaption consists of "equalizing" the recording system so that all frequencies below an agreed upon standard, namely 500 Hz will be recorded at a constant *amplitude* rather than velocity. This results in an attenuation at the rate of 6 dB/octave, and in actual practice this curve is modified at frequencies below about 80 Hz.

Now, it just so happens that magnetic pickups are velocity responsive devices, that is they give equal output voltage for equal stylus velocity. Since our recording was made with constant amplitude below 500 Hz the velocity falls as frequency goes down, and if played back with a magnetic pickup the res-

Fig. 1. Characteristics of phonograph recording and playback processes.



ponse will fall at the rate of 6dB/octave. Clearly, we must now equalize this response by introducing a response characteristic which increases at this rate as frequency is reduced.

The reader who has been following this closely and who has some knowledge of noise (not the kind sometimes called "music", but the other kind) will realize by now that if we continue to record at a constant velocity as frequency rises above our 500 Hz turnover, eventually the point will be reached at which noise generated by surface irregularities in the recording will be equal to or greater than our signal. In addition, noise generated in the pre-amplifier will assume a high level in comparison to the signal. The reader will also realize that this does not have to be, since if we continue to record at a constant *amplitude* we can overcome this noise in much the same way as we did at lower frequencies, i.e.: increase response at the rate of 6 dB/octave as frequency rises. (this is just another way of describing a 6 dB/octave roll-off as frequency drops). It will be appreciated that this could result in stylus velocities beyond the capabilities of the pick-up cartridge, and indeed this is one reason for the use of a modified constant amplitude characteristic: statistical distribution of energy also alleviates some of the potential problems, which makes a fair amount of boost possible.

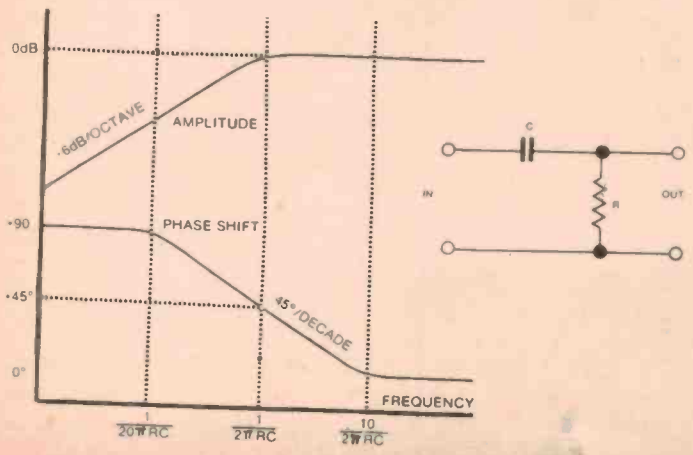
Another example of this type of equalization is encountered with magnetic tape. A completely loss-free system would show a playback response characteristic which rises at the rate of 6 dB/octave when the tape is recorded with constant flux in the gap, which, in turn, is the result of constant current through the coils of the record head. However because of the tape and head characteristics the response will begin to level off and ultimately drop as frequency rises. The 6 dB/octave slope can be readily corrected (and is) by an appropriate low frequency boost circuit in the playback system, but the high end loss is primarily the result of tape self-demagnetization and playback head losses, with the tape loss characteristic playing a prominent part at lower speeds. This means that inherent tape noise will eventually swamp the signal so that we cannot restore in the playback equalizer, but must do so during recording.

Unlike disc recording the amateur tape recordist is in a position to impose operating conditions during the recording process which conflict with the realities which we have been discussing. Increasing the signal level during the recording process brings the risk of overloading the tape or requires a reduction of overall level which causes deterioration in signal/noise ratio. Boosting response during playback also increases noise in the active region of the equalizer. As is so often the case in audio work, the end result is a compromise or, with luck, a fine balance between various conflicting requirements.

At the present time it is not my intention to get too involved with equalization circuits; volumes have been written on individual aspects of equalization and doubtless more will be written in the future. However, a brief examination of methods is useful in order to understand the proper use of equipment.

Fig. 2 shows a simple high-pass passive filter, having a first order, or 6 dB/octave slope, along with a normalised frequency and phase response curve. Fig. 3 shows its low-pass counterpart. In figs. 4a and 4b we see these circuits modified to provide low boost and high boost respectively. Notice that the low-boost circuit and its characteristic are derived from the low-pass circuit while the high-boost circuit and its characteristic are derived from the high-pass circuit. It is also clear that a low-pass and a high-cut characteristics are strictly speaking, the same thing, and a high-pass and low-cut are also equivalent. This has led to the mistaken belief which is often encountered even today that bass boost and treble cut are the same thing and vice-versa. An examination of the modified circuit used to provide actual boost immediately shows the fallacy of this notion. *All* equalisers attenuate *all* frequencies equally, except in the relatively narrow region in which boost or cut is required.

Fig. 2. Transfer characteristics of simple single pole RC high pass filter.



Location Of Circuit

The location of an equalizer in a circuit usually involves the reconciliation of several conflicting elements, and is generally determined by the type of circuit (bass boost, treble boost, etc.) nominal signal level, and the operating band.

Since a bass boost circuit involves considerable reduction in mid and high frequency level it is generally desirable to put most of the system gain before the equalizer in order that noise components may be attenuated along with signal. This is also true for high frequency attenuation. However, hum components would then be boosted along with signal; therefore, too much gain will require special attention to design aspects aimed at minimizing hum. Conversely, a high frequency boost circuit should be inserted early enough in the system as to raise signal above the noise of succeeding stages.

Where signal level is fairly high, as with some high output magnetic pickups such as Decca and Empire, our greater concern is amplifier overload, particularly at high frequencies, in stages prior to the equalizer.

If you're starting to get the idea that perhaps equalization, when combined with pre-amplification, can best be accomplished when the equipment is designed for, and associated with, the components with which it is to be used, then you're right on target. Indeed, this is generally considered to be good practice in professional circles. Not only are tape equalizers incorporated into the tape machines with which they are to be used, but turntables may incorporate the required pre-amplifier/equalizer circuits. In over twenty years of audio work I have yet to comprehend the logic behind the common practice of building magnetic inputs into a control unit. But it helps to explain the differences often encountered between results published in equipment reviews and the users' own experience.

Phase

Before moving on to the subject of corrective, or selective equalization some attention should be paid to the matter of *phase*. Hundreds of dollars are often spent on the construction or purchase of, for example, a phono preamp, and great attention paid to noise, channel balance, overload, accuracy of equalization (to within 2 dB) and yet it is seldom realized that,

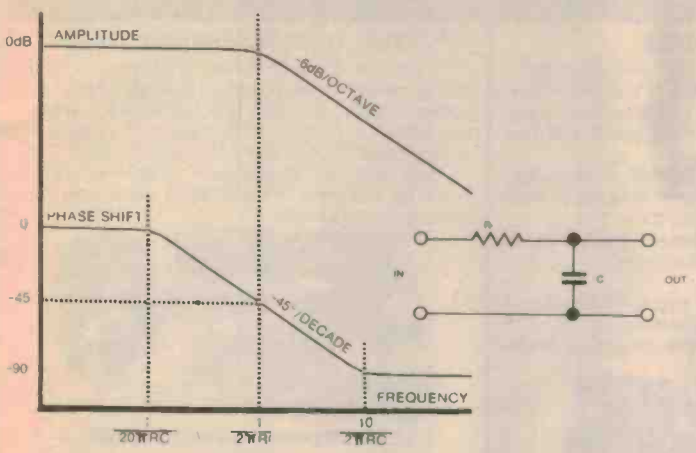


Fig. 3. Transfer characteristics of simple single pole RC low pass filter.

in producing a stereo image, one of the three major factors in directional perception is relative phase. In addition, all matrixed 4-channel systems currently in use utilize a specified phase relationship between channels to encode and decode the additional channels. One common characteristic of all of the impressive demonstrations of quadraphony has been the use of very high quality components. Since equalizers are among the first functions to suffer in making economy cuts in domestic equipment, it's small wonder that quadraphony and even stereo reproduction in the home are often disappointing.

How does this happen? Take another look at the phase and amplitude characteristics in figs 2 and 3. At the turnover frequency, that is the 3 dB down (or up) point, the phase angle has shifted 45° and reaches its ultimate 90° shift a decade away, which also corresponds to the 20 dB point. Now, if common 10% and 20% tolerance components are used in two different equalizers (example, each of a pair of stereo channels), the final curve may indeed we well within 1.5 to 2 dB tolerance in each channel, but if each yields a difference in phase over a broad frequency band of as little as 30° the difference between channels may vary anywhere from 0° to 60°. This is quite considerable in comparison with the 90° shift called for in the parameters of *any* quadraphonic system, even the Dynaco-Haffler passive ambience network. As for stereo perception, although there is much disagreement among authorities as to the ear's sensitivity to phase shift, much of this disagreement involves steady tone conditions and single channel reproduction. When it comes to the perception of a synthesized stereo image as in present day 2-channel systems, as little as 15° has been observed to have a profound effect on imaging, particularly with regard to depth and elevation. In my own experiments I've been able to produce as much as 10 dB channel level difference with no serious effect on the stereo image other than a shift in localization, and yet switching in a simple tone control circuit constructed of standard tolerance parts and with both channels nominally in the flat position will produce a subtle yet real change in image stability and solidity. The indication is quite clear: the precise matching of characteristics between channels is probably of even greater importance than the absolute accuracy of characteristics. This means precision parts and the associated costs.

Corrective Equalization

This might also be described as "discretionary equalization", since it refers to alteration of response in a manner and to a degree completely at the discretion of the operator. In a very real sense the concept of "correct" is irrelevant here. Adjustment is in accordance with the ear's own concept of right and wrong. Accordingly, no hard and fast rules can be laid down nor can definite "how to" instructions be given. However, most of the considerations already outlined apply here, so we may now proceed with an examination of the equipment and techniques available, secure in the knowledge that there is no such thing as magic, and that, rather than use technology to make things better, we can only use it to make things not as bad as they might be.

Uses of Equalizers

Discretionary equalization is used because either we don't think the sound we're getting is correct, or because, correct or not, we don't like it and want to make improvements or produce some special effects. It's something like the photographer who uses a skylight filter to obtain a more realistic colour balance, and the one who uses a red filter to simulate a Martian landscape. Since recordings are made by human beings much of the time, who monitor through loud-speakers with their own characteristics in rooms with their own acoustics, and who apply their own judgement as to what the final sound should be like, it is not surprising that the music lover or audiophile may be in disagreement with the producer from time to time. Perhaps you don't agree that the brasses needed a little extra bite by means of a 7 kHz boost, or you feel that the strings could have been brought more forward and made less disembodied by adding a little mid-range boost. Indeed, perhaps you don't mind a little structural noise of the concert hall, and feel that the producer sacrificed too much bass in order to suppress it. For this kind of correction you will want to use an "equalizer" or tone control of some kind to introduce the appropriate compensation. It may be sufficient to use a simple control circuit such as that outlined in figs. 5 and 6 to get some bass boost, or treble cut. But then there's no way for you to know the exact equalization used in the original recording, and even less chance that a simple circuit could duplicate its mirror image anyway, so at best you can still only adjust it until it sounds better.

If this is not satisfactory, you might try using what is called a "Graphic Equalizer", so called because such a device normally uses slider controls side by side and their settings provide a graphic representation of the response characteristic achieved. With this device you have several controls each of which controls the response over a narrow range of frequencies. It may divide the spectrum into as few as five broad bands or as many as thirty odd very narrow bands. These provide very precise response control indeed, but you still can only adjust response until it sounds right. Just like a simple tone control.

Another type of device is known as a "Parametric Equalizer" because it varies the parameters which define a response characteristic, that is centre frequency, bandwidth, and degree of boost or attenuation. In general, such devices offer fewer choices than a graphic equalizer with regard to the number of centre frequencies which may be operated upon simultaneously. However, in actual use it is generally more flexible largely because of the ability to vary the bandwidth and to choose centre frequencies. In some types it is possible to operate on the same frequency band twice or to operate on two closely spaced frequencies and to combine characteristics to obtain a final response which is completely unobtainable with any other type of component. The parametric equalizer has been widely used in professional work, and is the type of equalizer normally found on each channel of a recording or broadcast production console. There aren't too many in commercial production for consumer use yet, but there is every reason to expect that increasing numbers will be offered to the audiophile. For my money it is the preferred unit of choice for operating on the programme characteristics, provided it is not required to serve other functions.

BUILD A COMPUTER KIT AND SAVE

KB05 FULLY ENCODED KEYBOARD

Eliminates messy wiring between keyswitches and encoder. The KB05 is a full featured keyboard kit fully encoded for all 128 ASCII characters. Based on a design published in ELEKTOR November, 1978, it is an ideal low cost keyboard for microcomputer use. This clever design uses a single sided PCB to connect the switches and the encoder IC and few links are required. The kit includes 2 spare user definable keys and a metal mounting bracket to hold each switch accurately in place. The switches are supported on this bracket not on the PCB as with inferior designs. Spare mechanisms, cursor option and number pads are available.

KB05 encoded keyboard kit $84.00
KB06 cursor option $4.95
KB07 number pad $11.95

EA2650 STARTERS KIT

Described in EA May, 1978, this is an ideal project ideal for the beginner or educational applications. The kit comes complete with all instructions for assembling and running the 2650 computer, all components including 2650 microprocessor, PIPBUG ROM and 1K of RAM. The kit can be expanded to 4K and requires a serial terminal such as the EA LOW COST VDU detailed below. Sample programs are included for you to run and a cassette interface can be readily added so that programs can be stored on low cost cassettes.

EA2650 starters kit $65.00

EA LOW COST VDU SELLOUT!

This low cost stand alone VDU was described in EA February, 1978. Accepts parallel ASCII input and produces 16 lines with 32 characters per line with onboard sync generation and video driver. Supplies direct video to a converted TV set or to an RF modulator if required. The kit includes sockets for the RAM and character generator IC's, all components plated thru PCB, and step by step instruction manual.

EA VDU sellout (until stocks cleared)
$75.00 save $22.50!!

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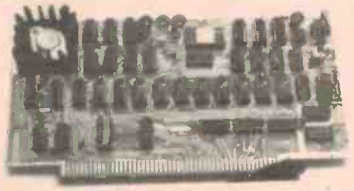
DG640 VDU ON S-100 BUS

A most professional unit for serious microcomputer users. Features 16 lines and 64 characters (32 with strap select), upper and lower case with chunky graphics and full S-100 bus standard.

This is not a half kit! The DG640 kit includes:

- professional quality plated thru hole PCB with hard gold edge connector.
- all prime quality guaranteed components.
- sockets for all integrated circuits.
- 12,000M/C crystal.
- comprehensive owners manual (54 pages) describing assembly, troubleshooting, and operating software for 2650,Z80,8080,6800.



DG640 kit $149.50 (PCB with manual $35.00)

EUROCARD 2650 SINGLE BOARD EXPANDABLE 2650 COMPUTER

This professionally engineered 2650 single board computer is the answer to all those who want a systematically expandable computer system. The DB1001 uses a simple E58 bus which is readily adapted to S100 and Z80 bus requirements. The DB1001 uses the 2650A chip and has fully buffered address and data lines, on board 1K operating system in Eprom (PIPBUG SUPPLIED but easily reprogrammed), 1K RAM and a crystal controlled clock on a top quality plated thru PCB with hard gold edge connector. Readily expanded on the E58 bus for more memory, I/O and will accept floppy discs and high speed printer. The kit is supplied with all components, owners manual and full service backup. A conversion kit for the EA2650 is available.

DB1001 single board computer $135.00
($35.00 PCB with manual)
DB1001/EA2650 conversion kit $99.00

DB1008 8K STATIC 2114 RAM

A very useful add on memory module to support the DB1001 computer on the E58 bus, this 8K RAM is fully buffered and has been arranged as 2 4K blocks with DIP switch address boundary selection. The kit is supplied with all components, sockets for all memory IC's and a plated thru PCB with hard gold edge connectors and full instruction manual.

DB1008 8K memory kit $175.00
($35.00 PCB with manual)

EPS100 ECONOMY POWER SUPPLY

This popular modular power supply kit is ideal for use with micros. Based on the EA "BRUTE" power supply the EPS100 supplies 5V @10A regulated, +,– 12V @1A regulated as well as unregulated 8V,+/–16V for the S100 BUS. The module includes an on board heatsink which must be mounted on a suitable metal case for adequate heatsinking.

EPS100 power supply kit $60.00

ET1632 UART/BAUD RATE GENERATOR

Converts serial to parallel and parallel to serial. This low cost baud rate generator can be set for any speed from 50 to 9600 BAUD (continuously adjustable with multi turn trimpot) and can be set for 5 to 8 bits per character with 1 or 2 length stop bits. Requires +5V, –12V. and kit includes all components and 40 pin socket.

632U with full instructions $18.50

ETI 630 HEX ENCODER/DISPLAY

This simple kit includes a pair of 4 bit encoder/latches driving large .5" digits to display the HEX equivalent of any 8 bit data word. Ideal for troubleshooting and also programming in machine code.

ET1630 HEX DISPLAY $14.50

SECI CASSETTE INTERFACE

This reliable unit is easily aligned without a CRO and is KANSAS CITY STANDARD useable up to 1200 Baud. The SECI uses top quality multiturn trimpots for accurate long-term timing adjustments and is supplied with the clock preset to 4800 Hz. A computer generated test tape is included so that you can readily check the operation at any time. Connects directly to a low cost tape recorder and has TTL level input/output for connection to the microprocessor. Requires +5V and provision for optional regulator has been made on the PCB.

SECI Cassette interface kit $24.50

DB1048 4/8K ROM BOARD WITH HIGH SPEED CASSETTE INTERFACE

This card supports the DB1001 on the E58 bus and has provision for 2708 or 2716 EPROMS. Included on the board is a software controlled cassette interface (300 characters/sec!) controlling two tape recorders with full file handling. The DB1048 is supplied with a preprogrammed EPROM with the tape interface software, a utility tape with useful routines, all components, plated thru PSB and owners manual.

DB1048 ROM Board/Cassette interface $130.00

The graphic equalizer is probably more familiar to the amateur, since it's been around much longer and several such units have been published as construction articles (See ETI June 1977). The great virtue of this unit especially the 1/3 octave type lies in its ability to notch out or boost one or more very narrow bands of frequencies, making it especially useful in compensating for the irregularities of such components as pickups (RIAA Equalized), loudspeakers, and room acoustics. Indeed one of its earliest and still common applications among professionals is in equalizing control room/speaker systems. For this purpose, the speakers are each fed with pink noise and the response measured via a calibrated microphone and a real time analyser or other means of measuring response characteristics. The graphic equalizer is inserted in the speaker channel before the power amplifier and adjusted until the desired response (usually flat) is achieved. This procedure is then repeated for each speaker in the system. It should be noted that the response is valid only for the location of the measuring microphone and for the exact acoustical conditions which exist at the measurement.

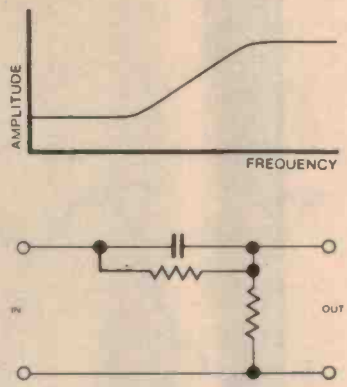


Fig. 4b. High boost circuit and response curve.

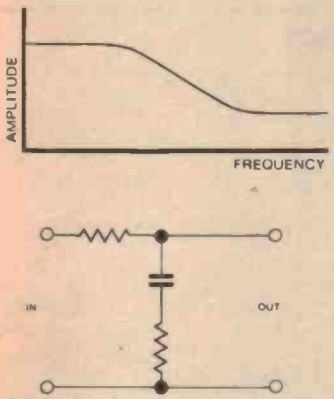


Fig. 4a. Low boost circuit and response curve.

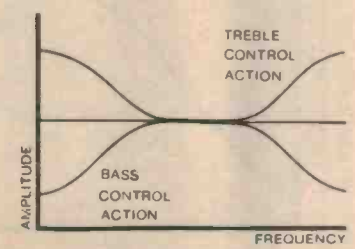


Fig. 6. Range of boost and cut action available from "treble" and "bass" controls.

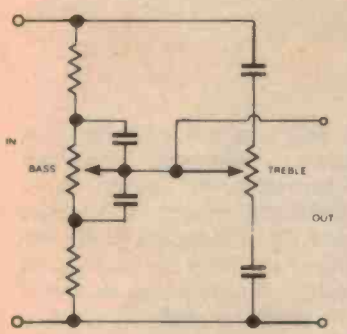


Fig. 5. Typical tone control circuit.

Two problems arise here, especially for the amateur audiophile. To begin with the previously referred to phase problem can impair the system imaging characteristics. On the other hand it may improve a characteristic which was already deficient because of the phase shifts inherent in the previously uncorrected irregularities. In other words, the assets may exceed the liabilities, both in qualitative and quantitative terms. That's what I mean by an inability to lay down hard and fast rules.

The second problem is more serious. After purchasing or building such an equalizer, especially the graphic type, there is the temptation to use it to correct faults in what is actually a poorly designed system. I can recall one enthusiast who built such a unit from a kit and installed it in a system which was little more than junk. Aside from sounding terrible, it also burned out speakers and destroyed an output transistor.

Why? Well, take a look at fig. 8 which is the representative response and impedance curve which might be expected of a small bookshelf speaker of the sort which promises to outperform speakers three times its size and selling for ten times the price. Although it may boast a response down to 30 Hz, its response at that frequency is down a good 20 dB, and its impedance is equal to the voice coil resistance, around 6 ohms. Now, to flatten the response of such a speaker requires a power increase of 100 times. If, in order to operate at high sound levels, it requires 10 watts of power in its mid-range, 1000 watts would be required. That's quite a lot to demand of a 60 watt amplifier whose ratings are already optimistic, to say nothing of what such power would do to the poor little speaker. Actually, most such equalisers only offer about 12 dB of boost, but if this is combined with a so-called loudness control, it's easy to see the kind of abuse possible.

Another point worth considering is that if you use the control to correct for the equipment faults, you can't use it for programme correction at the same time. If you have 10 dB boost available and you use it all for boosting speaker response, you have nothing left over for programme correction. And the amount of boost available is a function of the equalizer and power amplifier reserve plus speaker handling capacity.

Another consideration is energy distribution. A common assumption is that power levels tend to be about the same at all frequencies. This is not true; as is demonstrated in fig. 9, an energy distribution curve averaged from the results of a variety of studies. It shows that the largest amount of energy in orchestral music is concentrated in the range between about 100 Hz and 500 Hz dropping off rapidly above and more gradually below this band. It should also be remembered that 500 Hz is a common cross-over frequency in 3-way speakers and that with a current trend away from constant resistance networks, many such speakers exhibit high impedances and considerable reactive components in this region, which imposes severe limitations on the power capabilities of many amplifiers. This, in turn, limits the usefulness of many equalizers in this region, especially in the boost mode, where the result is often high distortion and damaged equipment. With a great deal of hard rock, electronic and synthesizer music high frequency energy tends to be considerably greater than with orchestral music. Now, the tweeter of a 60 watt speaker system

may be capable of handling typically from 5 to 10 watts of actual power. This is reasonable enough in relationship to the orchestral distribution curve, but an excessive boost in the region handled by the tweeter carries with it the distinct possibility of requiring it to handle anything up to the full output of the amplifier, which may be 60 watts or more. Further, if the tweeter level is padded down (with an L-Pad, I hope) to match the other drivers, this might save them, but much of this power is then dissipated in the pads, and may exceed their ratings.

Then there's the tape recorder. Remember the high frequency boost in the record mode? Well that uses up part of the headroom available. You now have the same problem as with speakers.

Add one final word about high frequency boost. *Every* phonograph pickup has limitations to its trackability. And when it does mistrack it can generate very large high frequency components, which is one reason why it sounds so bad. Moreover groove damage also results, and even if the damaged groove is later tracked with a better pickup there are still quite a lot of extraneous high frequency "garbage" signals generated. If you boost the component signals along with the desired signal, the rest of your equipment doesn't know the difference and will react in the various ways already outlined.

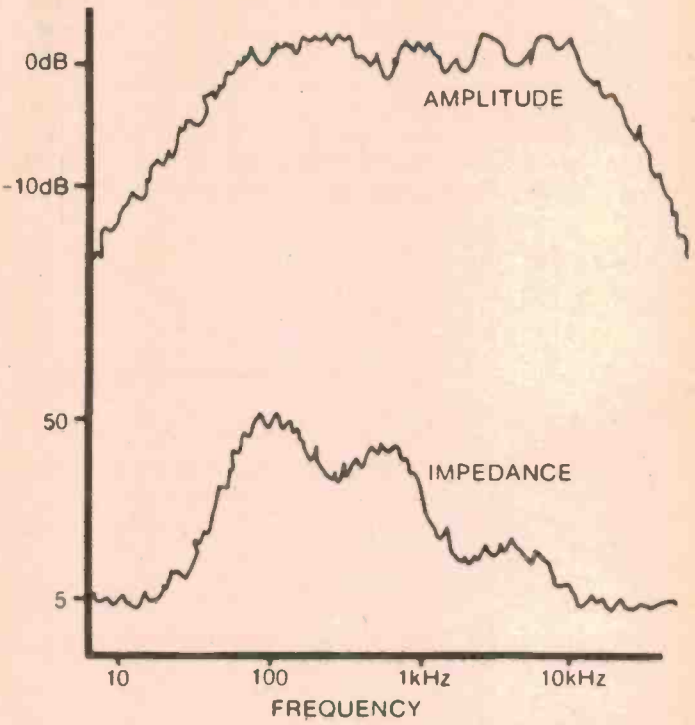
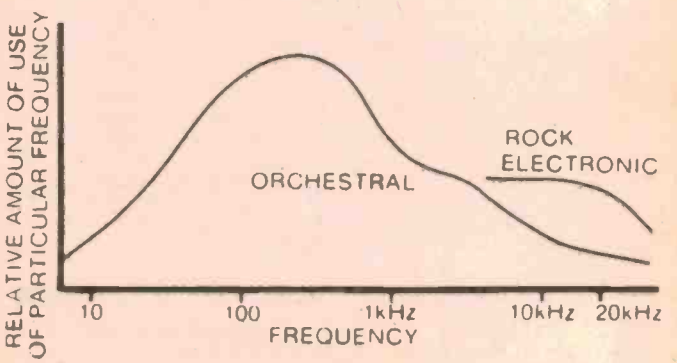


Fig. 8. Typical performance characteristics of low price small size (and high hype) loudspeaker example.

Fig. 9. Energy distribution graph for various types of music.



Circuit Location

The same considerations apply as were outlined with regard to adaptive equalizers; locate at a high enough point in the system to avoid overload problems without boosting noise, and still be functional. Most commercial control units provide a recording output and a monitor return just before the volume control which effectively bypasses all controls including volume and tone, which are used only for monitoring. Installing a graphic or parametric equalizer at this point usually is the most satisfactory as it can then be used for recording and for listening. In general, the most useful point is at the same level as is used for switching. However, if the device is used to correct for speaker/room acoustics the more logical location is immediately before the power amplifier. Unfortunately, this cannot be done with most receivers or integrated amps without opening and modifying the unit. And this is a good argument for the use of separates. But that's another story.

Conclusion

At this point the reader might well wonder what useful purpose is served by these equalizers. In many instances they do more harm than good, but this is largely the result of using them as a substitute for good design. If the performance level sought requires the use of a large Klipschhorn, get a Klipschorn, not a $99.95 super compact speaker special and a magic box. It won't do the job. DO pay attention to the acoustics of the room and the proper placement of a well designed speaker driven by a suitable amplifier. And DO use pickups and other equipment of appropriate quality. Then select the appropriate equalizer if you have use for one, and use it to deal with lesser acoustic problems or to make small alterations to programme quality.

In light of this the reader may be interested to know that my own system uses no equalizers of the discretionary type. A set of large transmission line speakers in a properly treated room provides high level performance through the full audible range with imaging matched by only a very few professional systems. Phono preamps are matched to their own Stanton and Shure pickups each on its own turntable, and are not interchanged. The only need for additional equalization occurs occasionally when taping radio and TV broadcasts and 78 rpm discs. Under those conditions a fixed equalizer is designed and inserted in the line. So far the only real problem encountered is with a particular recording in which a phaser is used in derived quadraphonics - it sweeps the signal around the room and drives the cats crazy.

SOUND BRIEFS

Stereo TV Sound

Several Japanese TV manufacturers are currently preparing models incorporating stereo sound; meanwhile the USA's AT&T has applied for Federal Communications Commission permission to provide stereo transmitting and receiving equipment to domestic TV stations. The company recently introduced a new transmission system extending the normal TV audio bandwidth (of 5 kHz) to 15 kHz.

Baby AR-9

Acoustic Research has released a less expensive version of the AR-9. The new and smaller model - known as the AR-90 - uses the same three upper-range drivers however instead of the AR-9's 300 mm base driver the AR-90 uses a 255 mm unit.

Cop This

Heard about the Western Australian dealer who had the CIB after him following his advertising a couple of TEAC decks at give-away prices.

He was such a good salesman that not only were the police convinced there was no skull-duggery (in fact they'd been imported from Singapore) but one of the CIB officers returned the next day - and bought a complete system!

Strathearn Out

Belfast's Strathearn Audio is no more. The company had previously been financed by the British Government despite withdrawal of support by the Northern Ireland Development Agency. According to Hansard, no less than 16 million pounds has been injected into the ailing company.

Although Strathearn won a recent design award, their earlier designs have long since been overtaken by their competitors.

We understand that the Strathearn factory may be taken over by AIWA.

Our condolences to AGS Electronics who were appointed sole Australian distributor for Strathearn last month!

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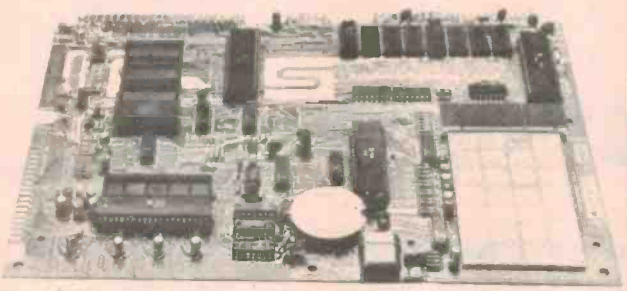

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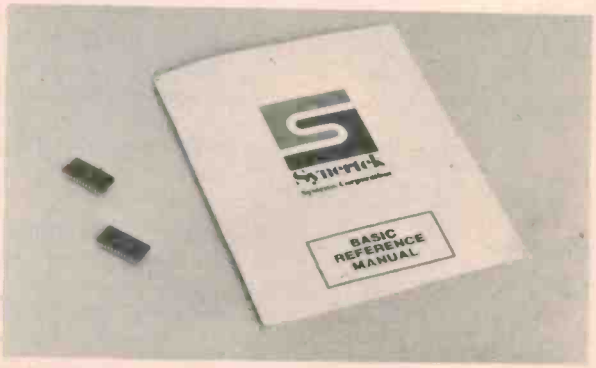

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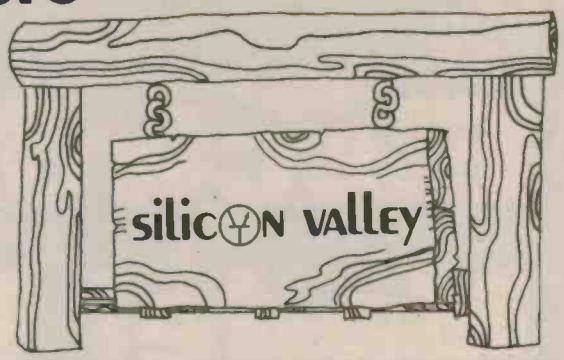

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- Port Expansion Kit (Available now)
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We have enhanced software as well as hardware. The software has simplified the user interface. Our standcard SYM-1 system can be programmed EITHER in machine language for those users wishing to gain an in-depth understanding of microprocessor operations, or can be loaded with object code developed on a cross-assembler resident on another system. For those users who want to develop in assembly language directly on SYM-1 our optional RESIDENT ASSEMBLER/EDITOR can be purchased and plugged into the ROM/PROM expansion sockets ALREADY PROVIDED.
Similarly, those users wishing to develop in a higher level language can purchase BASIC 8K ROM (no complex loading from disc or cassette) and does not need RAM memory.
Monitor status is easily accessible, and our monitor gives the keypad user the same full functional capability of the TTY user.
*KIM is a product of MOS Technology.

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- Software Breakpoint Feature.

SYM is a Versatile Computer Tool

WHAT YOU BUY IS NOT ALL YOU GET!
Future growth and expansion is a key requirement in any system and such growth has been designed into SYM-1. Unlike any other systems which you "discard" once you've mastered them SYM-1 GROWS WITH YOU.
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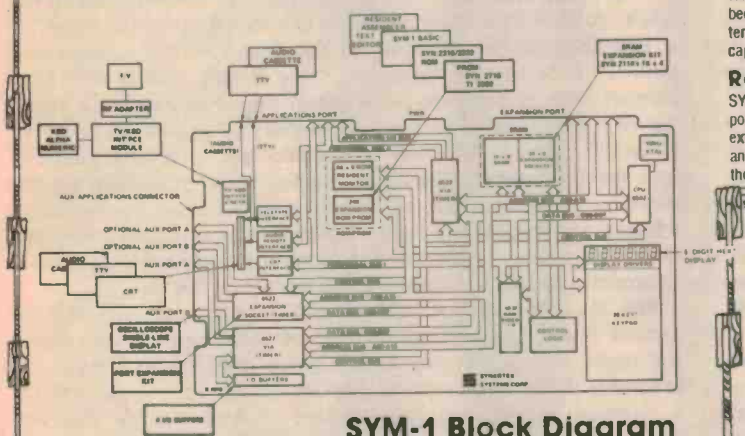
Connector sockets have also been provided to our optional CRT-TV/KB Interface Card, which includes an ASCII Keyboard. This card will enable any home CRT monitor or TV to be turned into a versatile video terminal, with the addition of a standard RF adapter supplied by the user.



SYM-1 Block Diagram

Using SYM-1

STAND-ALONE MICROCOMPUTER: With the addition of a user-provided 5-volt power supply the SYM-1 becomes a functional stand-alone microcomputer development system. In this configuration the user can select any memory addresses, read/modify data and execute or single-step through programs.
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With the addition of our TV/KB Interface option board, plus a standard RF Adapter the SYM-1 becomes a complete computer system, with your TV or CRT monitor used as a video display terminal. The full alpha-numeric keyboard available on the TV Interface card has the same capability found in larger and more expensive computer systems.

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SYM-1 incorporates the tried and tested SY6502 8-bit microprocessor. This "micro" with its powerful architecture has been incorporated into a multitude of system types. It has been used extensively on TV GAMES where reliability is a must. The powerful COMBO's and VIA's (SY6532 and SY6522) RAM's (SY2114) and ROM's (SY2332) have all been extensively used and proven in the field.

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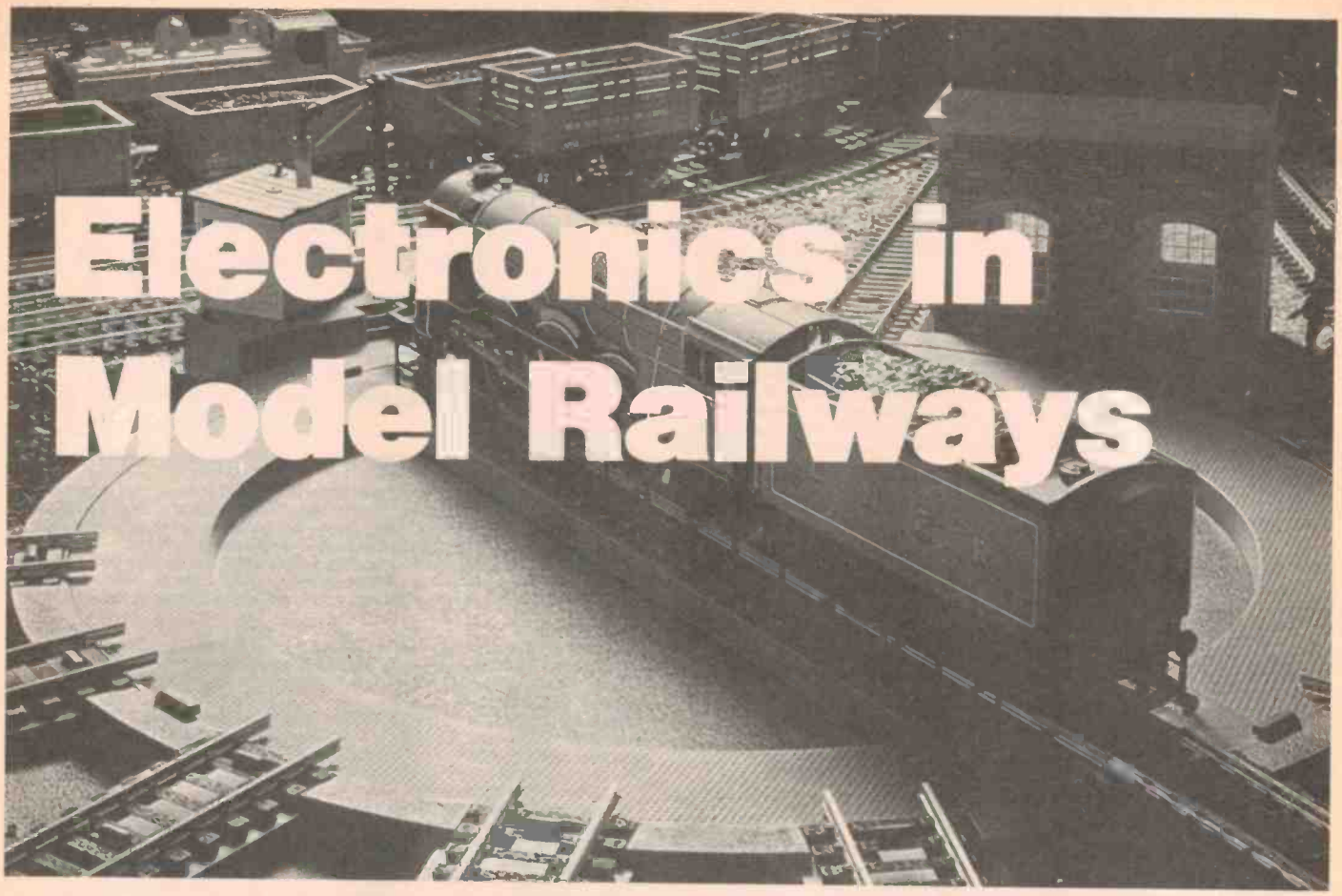


Electronics in Model Railways

"PLAYING WITH TRAINS" is probably how most readers would describe Model Railroading, the latter being the much preferred expression. Of course, there are a lot of people who do not just "play with trains". Names such as Hornby Dublo or Triang bring back memories of bygone youth to many an adult.

Nevertheless, the hobby is not just one of running a train around a circle of track under the Christmas tree; the mature model railroader invests a great deal of effort into scale realism of operating models, structures, scenery and track. And if you tie that need for realism into the extensive growth of electronics as a hobby in the last ten years or so, you'll see why the expert on precision scale operation is keenly interested in how electronics can help this hobby.

Or, to look at it another way, there are so many variables possible in controlling several trains on a model railroad – as indeed there are in a real one – that it's not surprising that several companies have used model railroads at trade shows to demonstrate microprocessor versatility. A recent example was discussed in Byte magazine for July 1977.

Apart from computer control, which is really outside the scope of this short article, there are several uses for both digital and analogue electronics in the model train empire. Let's discuss them in stages – control, signalling, lighting and sound.

Control

Most model locomotives use 3, 5 or 6 pole dc permanent magnet motors. A few use brushless, ironless rotor motors and a very few ac motors. Power is picked up directly from the two rails, and reversal of track polarity reverses the locomotive direction except in the case of the ac motors, where an extra "kick" of ac triggers a reversing contact in the locomotive.

The Christmas train set power pack is nothing but a full wave rectifier delivering pulsating unfiltered dc to the track via a 100 ohm variable resistor as speed control. This gives very poor control at low speeds for the simple reason that stall current on a permag motor is much higher than its low speed current. Consequently there's a tendency for jackrabbit starts. Now the dyed-in-the-wool hobbyist wants precise control of low speeds because nearly all layouts have miniature freight yards – box-cars and cabooses have couplers operated by magnet remote control so the operator can make up and break down his trains. The more or less ideal speed control – or one approach anyway – looks like the circuit of Fig. 1.

This type of control has several features; the variable dc output has a pulse ripple added at lower speeds to vibrate the motor armature and reduce motor cogging and 'stiction', secondly it has a low source impedance for the motor, thirdly a delayed action can be switched in and out so that the controlled inertia of a heavy train can be simulated together with brake levers; and lastly it's short-circuit proof by virtue of heavy duty transistors and an overload trip. The last is indeed essential because short-circuits abound on the model railroad!

Though the circuit I've shown uses two darlington transistors, commercial versions are available, particularly from the USA, using op amps, SCR control or pulse width modulation. Even the renowned Heathkit has introduced a version. The most important feature is probably that superimposed pulse, for if it's too small in amplitude or too high in frequency, it is not effective; but if it goes too far in the opposite direction, the resulting buzz or rattle from the motor becomes objectionable. Anyway, you electronic fans with a dusty train set in your attic, dig it out, build a momentum-pulse-throttle and you just might pick up an extra hobby!

In terms of current rating, the power pack shown should

Model trains, like the Hornby Dublo model right, have reached a level of sophistication where they require electronics for control. Peter Thorne explains .....

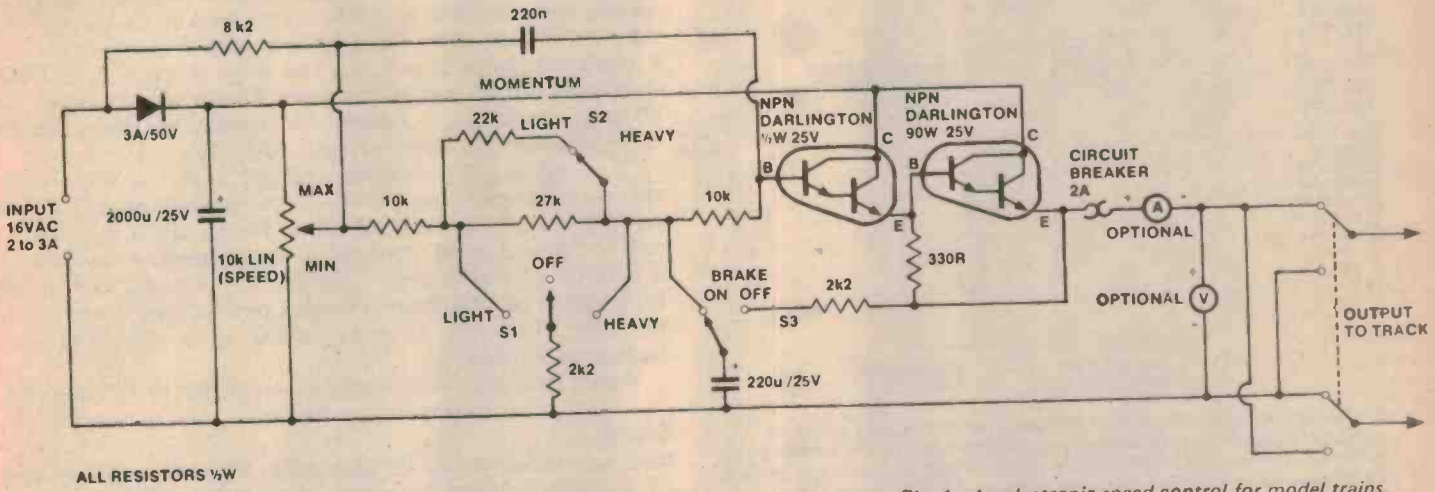
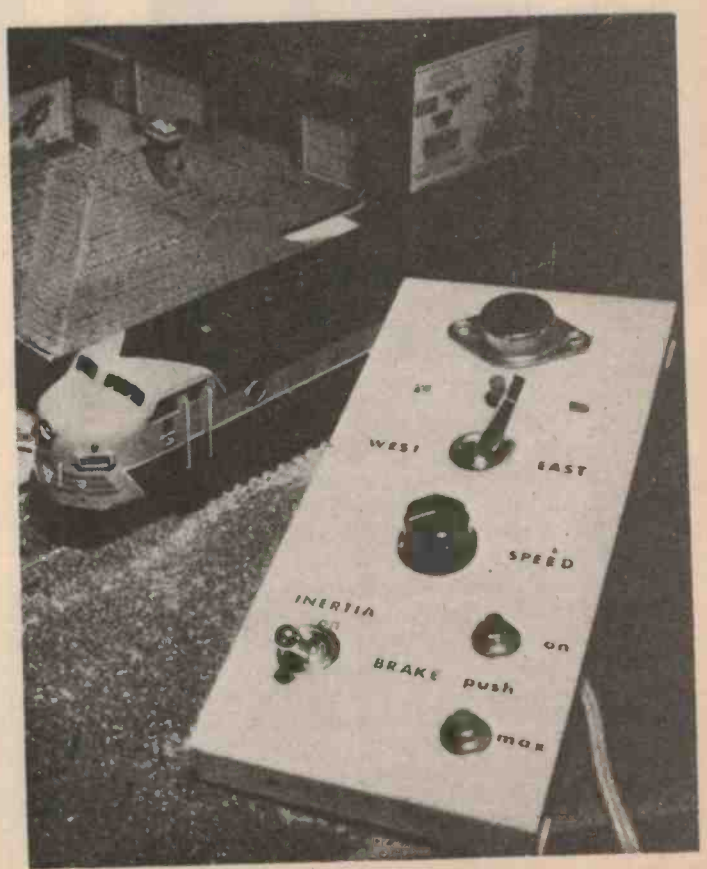


Fig. 1. An electronic speed control for model trains.

be capable of about 2.5 A at 12 V. This is adequate for any HO scale models, which scale 1:87, even with double heading locomotives. As you'd anticipate, the current requirements decrease with scale size – the second most popular scale is 1:160 (or n for Nine mm, which is the track width). Going up a size to 0 scale (1:48) many motors will need the full 2.5 amps. By the way, in case you home computer builders are thinking "why waste money on electronics for toys", some of these "toy" locomotives retail for over $1000 apiece and lately have been appreciating in value at well over 20%.



Signals

A natural for digital IC application is signalling. Model signals in two (red and green) or three aspect (red, yellow, green) with minature 12 volt, 60 milliamp lamps are readily available, Until recently, relays were widely used by modellers to operate these lamps in controlled sequence and often automatically disconnected a section of track ahead of a red signal for automatic train control. The relays used were typically low resistance coils in series with the power supply to the track. When the locomotive entered a particular track section, the relay contacts closed. All model railroads use track sections from 200 mm to 6 m long insulated from each other and switchable to alternate power packs. This facilitates the operation of multiple trains.

Complete model railroads still exist using these series relays for automatic control and signalling; but they're a maintenance nightmare for their intermittently proud owners. Up to date techniques use TTL gates driving red, yellow and green LED's for signals.

Relay driver ICs can be added to drive the small 12 V signal lamps if preferred and also to operate good solid 12 V relays for automatic stops and starts.

The interface between train and TTL is a little more

Electronics in Model Railways

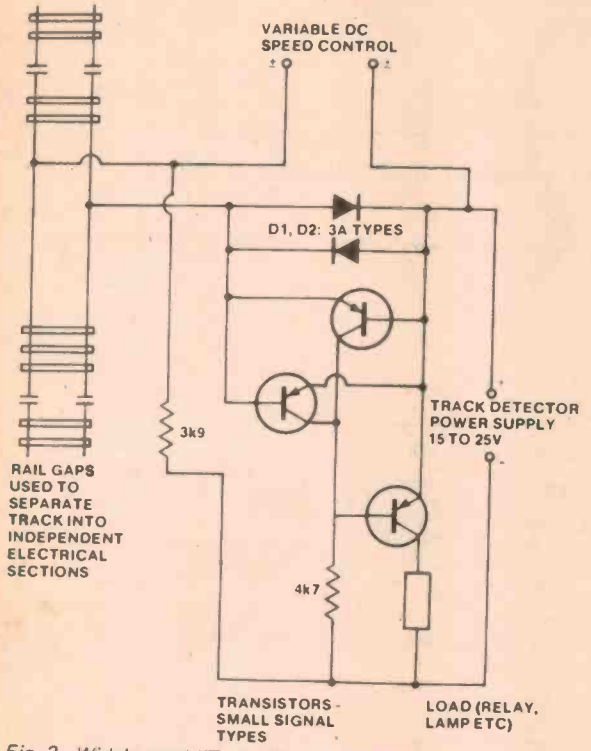


Fig. 2. Widely used "Twin T" track detector circuit. Q3's load de-energises whenever a resistance appears across track in the section being detected, regardless of whether power is connected to that track section. Consequently presence of any train or item of rolling stock can be sensed remotely.

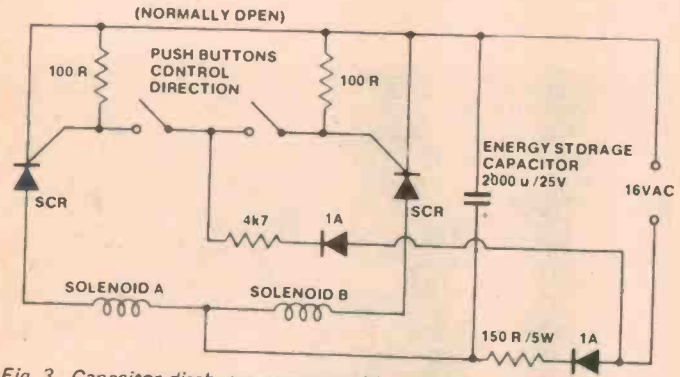


Fig. 3. Capacitor discharge system enables solenoids to be thrown with small average energy. System also prevents solenoid burnup if accidentally left powered-up. SCR switch control enables small current push buttons to switch heavy current. The SCR's automatically switch off when capacitor stored charge zeroes.

tricky; you've noticed, of course, that the track has only two rails which are required to conduct power (in either direction) to the locomotive. The requirement to detect locomotive presence led a few years back to a widely used detector circuit known as a "Twin-T".

The simple circuit is shown in Fig. 2. The circuit detects resistance between the rails as high as 50 k, but is insensitive to the connection of the power supply in the circuit, so it will respond only to the presence of a locomotive motor or any rolling stock with a 10 k to 47 k resistor wired between its wheels. Other less subtle interfaces are magnetic reed switches between the track, triggered by disc magnets under rolling stock – ideal for JK flip-flop operations, or opto-electronics, where ambient light can be interrupted by the movement of rolling stock to trigger or detrigger a light activated SCR, for example.

With a light activated system, the light source and the opto detector must be angled to the track to avoid gaps between moving rolling stock causing light modulation.

Turnout Control

Turnouts (switches, or points) control train routing. Remote control of these, on the models as on the prototype has nearly always been electric. The usual method is the use of a solenoid motor (Fig. 5). A soft iron armature can be moved into either of two high flux copper wound coils, depending on which is energised – using 16 volt ac or dc. The armature is linked mechanically to the movable track section to control the train's alternate paths. These coils of necessity are about 2 to 4 ohms resistance and hence can draw 4 amps. If left connected to the supply for more than a second or so, the 50 W of heat show – rapidly. So recently the electronically minded modeller adopted capacitor discharge.

Typically a 220 μ capacitor charged to 25 V stores enough energy to operate a couple of low resistance coils and as you can see from the circuit, there's no fire hazard if the power is left on. Also a small transformer can be used. Also shown is a method of discharging the capacitor into the coil via an SCR, which permits the controlling push button to carry only the low SCR gate current, instead of a contact-blowing multi-ampere current.

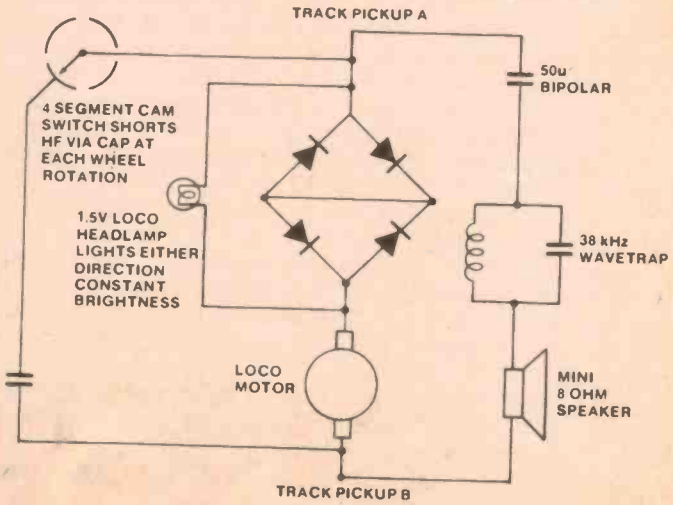
Again, the basic control circuit is adaptable to TTL control.

Sound

Now you hi-fans know it's impossible to reproduce the sound of a gigiantic steam locomotive without a 100 W amp and a four cubic foot bass reflex enclosure. Except those model railroad nuts don't believe you! Quite expensive, at about US$350, is a Pacific Fast Mail sound unit that transmits sound and motor power through just those two rails. The sound is synchronized to the piston position, that is for a two cylinder steam engine there are four "chuffs" per driver wheel revolution. Plus bell sound and the required wailing steam chime can also be sent from the trackside to be nicely reproduced in a miniature speaker located in the locomotive tender.

The PFM unit synchronizes the "chuff" sounds by transmitting a 2 V 38 kHz (approx.) signal superimposed on the dc motor voltage going to the track. The dc voltage source (a transistorized circuit, which is a simplified version of the

Fig. 4. These components, mounted in locomotive tender reproduces audio signals superimposed on dc motor voltage. Cam switch signals synchronization of "chuff" sound to trackside audio generator.



circuit shown in Fig. 1) has a low resistance choke in series with its output: this prevents the 38 kHz and the audio tones from disappearing into the speed circuitry. When the 38 kHz reaches the locomotive, it is intermittently shorted out in a capacitor (see Fig. 3). The capacitor is grounded four times per drive wheel revolution via a phosphor-bronze contact, which rubs on the inside of a drive wheel equipped with insulated quarter sections. As the 38 kHz signal shorts out, a relay operates in the track-side unit, sending out transistorized hiss to the locomotive-borne speaker. Being highly inductive, the locomotive motor bypasses neither the 38 kHz nor hiss – nor bell nor steam chime sounds, all of which are solid-state generated in the PFM box with full operator control. And even though the speaker is less than 50 mm in diameter, the sound is very effective.

Another electronic gimmick in the PFM system is the bridge rectifier of Fig. 3. There's a constant voltage drop of 1.4 V across the bridge, since it's in series with the motor – regardless of the motor/voltage polarity. Connect a miniature 1.5 V headlamp across the bridge and presto – constant brightness, regardless of motor speed.

A California-based firm – Modeltronics, produces sound systems that are completely contained in the model – also synchronized for "chuff". The supply voltage for the noise generator and miniature amplifier is derived from the track voltage much as the PFM "constant lighting section". Of course, the Modeltronics system does not offer bell or chime – yet.

LED Hazard Flashers

Pop a 3 mm red or yellow LED into the cabin roof of a model diesel, drive it from an internal LM3909 flasher integrated circuit, oscillating at 0.3 Hz, powered up from 0.5-3V, and you've duplicated real life on the "Atcheson Topeka and the Santa Fe".

Grade crossing flashers in model form are available ready made, with miniature 12 V lamps, just like signals. To flash, take an 555 IC timer, put one pair of lamps from IC output to trail, another pair from output to rail, apply 12 V, time to 20 per minute and grade flashers are in business.

Lighting

Whole passenger trains can be lit up using a supersonic generator at around 25-40 kHz. This can be fairly easily constructed using a 10 W audio power amplifier with the conventional negative feedback re-phased to positive. Connected in parallel with the train motor power, with a blocking choke between the two, constant lighting can give a superb visual effect with artificial twilight on a layout. Switch off the generator – and the lights go out. Each train group of lights uses a 220 n capacitor in series to block the otherwise additive lighting power from the dc motor voltage.

Radio Control and Carrier Control

As a purely personal observation, I feel the next and imminent step in electronics with model railroads is radio control. At least one experimental, but practical circuit has already been published. All that's needed are very low current motors, powered by rechargeable NiCad batteries together with radio receiver, variable speed and direction controls, and sound generator circuit plus amplifier. Of necessity the concept requires extreme miniaturization because for HO scale (the most widely used size), the space available for everything is hardly more than 5 or 6 cubic inches. The entire receiver and motor drive circuit can easily be derived from model aircraft RC designs, particularly if the new Signetics NE544 motor/servo driver chip is employed. On-board sound – for example a diesel horn sound, can use a 556 IC in the self-oscillating mode generating two tones, each around 250 Hz, amplified by an LM380 audio chip.

Individual function control is practical using 555 tone generators in the transmitter with phase lock loop decoders in the receiver. The advantage of this type of control is that the modeller has become free of the power-to-the-rails restriction.

In summary, I hope this overview shows how another hobby can adapt techniques of electronics in order to add to the fun.

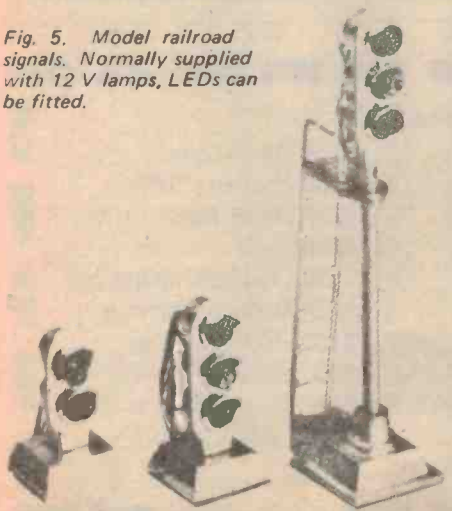
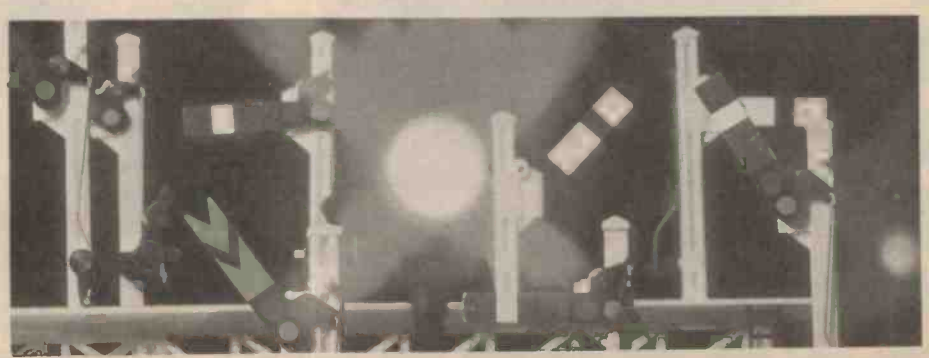


Fig. 5. Model railroad signals. Normally supplied with 12 V lamps, LEDs can be fitted.



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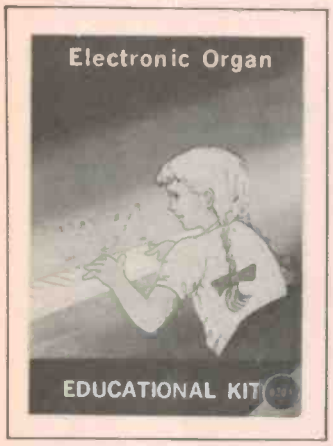

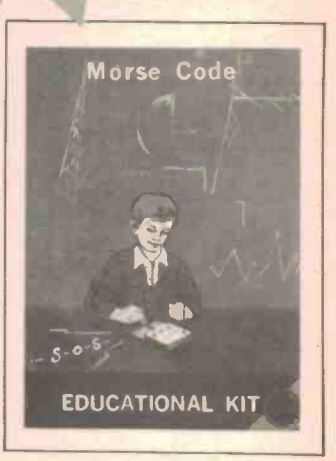

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PN3642	.20
PN3643	.20
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74LS10	.25
74LS11	.28
74LS12	.28
74LS14	.95
74LS20	.28
74LS21	.28
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74LS74	.46
74LS75	.55
74LS78	.50
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74LS93	.80
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74LS109	.45
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74LS169	1.50
74LS174	.70
74LS175	.85
74LS190	1.25
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74LS367	.70

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4002	.25
4007	.25
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4011	.25
4012	.25
4013	.52
4014	1.30
4015	1.30
4016	.50
4017	1.30
4018	1.20
4020	1.40
4021	1.30
4022	1.30
4023	.25
4024	.90
4025	.35
4027	.70
4028	.95
4040	1.30
4042	1.10
4043	.95
4044	.95
4046	1.55
4049	.55
4050	.55
4051	1.20
4052	1.20
4053	1.20
4066	.75
4068	.35
4069	.30
4070	.35
4071	.35
4072	.35
4076	1.75
4077	.35
4078	.35
4081	.35
4082	.35
4441	.95
4510	1.40
4511	1.30
4518	1.40
4520	1.40
4528	1.20
4502	1.20
4553	6.75
4555	1.10
4581	3.00
4582	1.00
4584	.75
4093	.70
40014	.60
40097	.90
40098	.90
74C02	.35
74C08	.40
74C10	.40
74C14	1.60
74C20	.45
74C48	2.40
74C73	1.10
74C76	1.15
74C90	1.50
74C93	1.50
74C175	1.75
74C192	1.85
74C193	1.85

• TTL.

7400	.25
7401	.20
7402	.25
7403	.25
7404	.20
7405	.25
7406	.45
7407	.45
7408	.30
7409	.34
7410	.30
7413	.54
7414	.45
7416	.50
7417	.45
7420	.30
7421	.30
7422	.30
7426	.40
7427	.40
7430	.30
7432	.40
7437	.50
7438	.40
7439	.40
7440	.30
7442	.70
7447	.90
7448	.95
7450	.30
7451	.30
7453	.30
7454	.30
7460	.30
7470	.50
7472	.45
7473	.50
7474	.50
7475	.65
7476	.40
7480	.95
7483	1.10
7485	1.40
7486	.50
7489	2.87
7490	.40
7491	1.00
7492	.70
7493	.40
7494	1.05
7495	.92
74100	1.95
74107	.55
74121	.50
74123	.85
74132	1.10
74145	1.80
74150	1.60
74151	1.00
74153	1.00
74154	1.40
74157	1.00
74160	1.30
74172	1.10
74173	2.40
74180	1.12
74192	1.33
74193	1.33
74367	1.00

• VOLT. REGS.

7805	1.00
7812	1.00
7815	1.00
7818	1.00
7824	1.00
7905	1.50
7912	1.50
7915	1.50
7918	1.50
7924	1.50
78L05	.40
78L12	.40
78L15	.40
78L18	.40
78L24	.40
79L05	.80
79L12	.80
79L15	.80
79L18	.80
79L24	.80
78CB	2.30
723	.50
309	1.90
317	2.90

• DIODES.

0A90	.15
0A91	.15
1N4002	.08
1N004	.08
1N4007	.16
1N5401	.43
1N5404	.35
1N4148	.06
1N3493	1.70
1N3493R	1.70
AAY30	.33
W02 BRIDGE	.90
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C106D1	.65
C106Y1	.39
SC141D	1.30

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1 W. E12	.07
5 W. W/W	.25
Min. Presets all values	.18
Min. Trimpots all values	.48
Min. M/Turn Trimpots	1.25

• LINEAR IC.

301	.40
307	.86
308	1.20
311	.75
324	1.25
380	1.70
381	2.87
555	.35
556	1.20
565	3.45
567	3.12
741	.30
747	1.15
3900	.99
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93448	10.20
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TL080	1.15
TL081	.52
TL082	.95
TL084	1.90
CA3140	1.50
MC1494L	6.65

• TANTALUMS — TAD 35V.

0.1-1uf	.15
1.5uf	.20
2.2uf	.25
3.3uf	.25
6.8uf	.30
15uf	.55
22uf	.55
4.7uf/16V	.20
10uf/25V	.25

• CERAMICS.

1pf-0.0047	.05
0.0068-0.01	.08
0.1	.12
0.22	.18
0.47	.24

• TRIMMER CAP.

5pf-65pf	.30

• SUPP. CAP.

NS5,0.5uf	.60
NNS30,3uf	2.00

• CAP. RP can.

2500uf/35V	1.35
5600uf/40V	1.99

RG can type —

6800/50V	4.80

• ELECTRO. CAPS. PC TYPE —

6.3V-470uf	.20
10V-4.7uf	.08
22uf	.10
100uf	.12
16V-10uf	.08
22uf	.12
33uf	.08
47uf	.12
100uf	.15
220uf	.15
470uf	.16
640uf	.42
1000uf	.32
2200uf	.50
2500uf	.62
25V-1.5uf	.08
2.2uf	.08
3.3uf	.08
4.7uf	.08
10uf	.08
22uf	.08
25uf	.12
33uf	.10
47uf	.10
100uf	.18
220uf	.24
330uf	.24
470uf	.32
1000uf	.48
35V-2.2uf	.08
3.3uf	.08
10uf	.11
100uf	.18
220uf	.21
1000uf	.53
2000uf	.71
2200uf	.88
50V-0.47uf	.08
1uf	.06
2.2uf	.08
3.3uf	.06
4.7uf	.06
10uf	.08
22uf	.13
33uf	.15
47uf	.12
100uf	.16
220uf	.23
470uf	.60
63V-0.47uf	.08
1uf	.08
2.2uf	.08
4.7uf	.10
10uf	.12
25uf	.15
47uf	.16
100uf	.23
220uf	.37
330uf	.40
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MCT2	.65
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H/U Wire, 10/.254, per mt	.12
H/U Wire, 617K1/11, per mt	.20

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Panel Mount	.65
In Line type	.28
PC Mount type	.46

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0.25A, 0.5A, 0.75A	.16
1A, 1.5A, 2A, 3A, 4A, 5A	.10
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Las Vegas

ON THE FIRST day alone of the Winter CES, 38 487 people crowded into the Las Vegas Convention Centre to see the latest in electronics for the home, car and office. (Total attendance count is over 50 000). The exhibits ranged from the most mundane in portable transistor radios to some exotic, even bizarre, gadgets. Several trends merged at the show:

The really fast-moving consumer item for '79 is video - both video cassette recorders and the pre-recorded tapes to go with them. Many small dealers are now starting to stock video equipment (previously handled by specialist outlets).

Home computers are not yet the raging success previously predicted - several new models have appeared, at least in prototype form, but they didn't stir all that much interest. Perhaps many dealers are thinking twice, following bad experiences with expensive TV games.

Audio components are shrinking. The latest amps and tuners from Japan can only be described as tiny - some making use of switched-mode power supplies to save space.

Calculators - look for a new programmable from Casio which operates in BASIC, and two new calculator/electronic organs!

In-car entertainment equipment is now extremely sophisticated, offering such facilities as graphic equalisers and Tate Directional Enhancement of the SQ quad system (quad apparently survives in cars).

Most people, it seems, would rather not talk about CB.

Telephones and telephone answering machines are less expensive and more popular, but are not yet a major consumer item.

Miscellaneous Gadgetry

There seems to be a growing trend towards small devices which do everything - well, it's only natural. Cassette players with calculators built in will attract a buyer who wants a cassette player and another who wants a calculator. Neither will begrudge (apart from the cost) carrying round the 'unwanted' half of the device because it's likely to be useful. Perhaps Casio have gone too far with their "world's smartest cigarette lighter" - a combination of lighter, alarm clock and calculator. Would a non-smoker buy this one?

Another trend is towards minaturisation - Matsushita have produced an AM/FM radio only 10 mm thick. They have also developed a 'paper battery' for use in similar units. This uses the same chemicals as an ordinary dry battery (manganese dioxide and zinc) but has a stainless steel plate as the electrode.

The main advantage of this construction (apart from thinness - 0.8 mm) is that it can be formed in any shape - to fit around the neck of a speaker - for instance. The voltage is still 1.5 V and a 20 mm x 70 mm piece will hold 27 mAh - enough to run an LCD calculator for 1000 hours continuously. The only problem may be loss of standardisation.

Sharp's portable radio/cassette player (the GF8585) can 'remember' up to seven tape locations and find them again - useful if you have seven disco 'jingles' or seven sound effects which you want to call up as required.

American CBers can now pretend to be perfectly normal - the Panasonic CQB-5915 40 channel CB/cassette player /AM-FM receiver looks just like any other in-dash audio unit - apart from the microphone, that is. Hide the mic away in the glove compartment and a casual glance will reveal no trace of CB. Panasonic also produce a model with an 8-track instead of cassette.

Lastly, a cunning idea from a company called Page Alert Systems - a silent car alarm. It's an 'intelligent' alarm which accepts inputs from door switches and from small microphones which detect "metallic' noises. Unlike most alarms, it doesn't sound the horn - instead it sets off a 'pocket pager' carried by the owner, who then calls the police and tells them where the car is, what its number is, et cetera. The thief is then (hopefully) caught in the act. How will professional car thieves get round that one?

Electronics Show Report

Over 50 000 people plus more than 500 exhibitors equals quite a Consumer Electronics Show. Dan Presser of Melbourne-based Caldor Corporation was in Las Vegas for the recent winter CES and sent us this report.

Car Audio

Car hi-fi is a better describtion – many firms were exhibiting systems with more knobs than the average home stereo. Graphic equalisers, built-in clocks and active crossovers abounded.

The 'Panasonic CQ8700 AM/FM stereo radio with auto-reverse cassette player and digital clock' has solid-state tuning with a digital display, using a quartz crystal controlled oscillator controlling a phase-locked loop which can be 'scanned' to pick up strong stations automatically. Naturally, it also includes Dolby and a solid-state VU meter! The designers ran out of space and had to mount the clock/frequency meter display on the cassette door. The only thing it doesn't do (apart from make coffee and tell jokes) is amplify the final product. A separate power amplifier is required – but read on.

Another remarkable device which would, presumably, come next in the signal path is the Pioneer CD-7 graphic equaliser with echo. A seven-band equaliser may seem rather excessive to some, but remember it reduces the blood pressure – the more knobs you have to play with in a traffic jam, the less frustrated you get and so ...

An interesting feature of the CD-7 is the 'IC echo'. This delays the signal (presumably with a charge-coupled delay line) and re-mixes it with the original to give a sound which seems to be playing in a large room. This sounds more pleasant to most people.

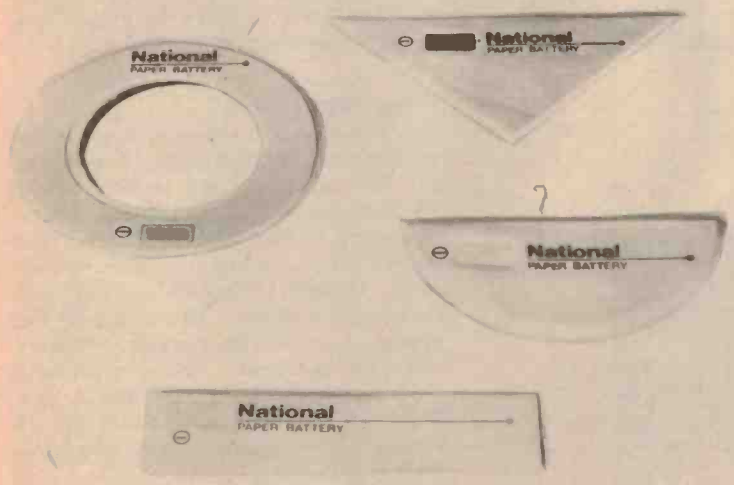
Finally, the power amp – Sanyo's 100 W RMS model PA6100.

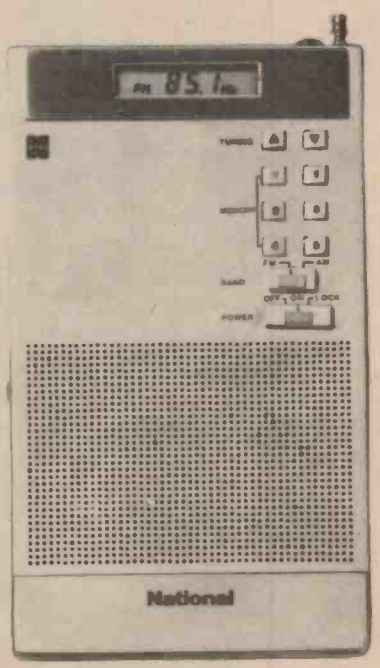
We calculate that it will draw in the region of 15 A on peaks, although Sanyo seem to have found a way round telling people this. Their press release says that, "An additional feature is the low current the unit draws, only 0.8 A at idle, thus insuring it against a drain on the car battery". Well, perhaps they're right – anyone who runs it at full power won't do so for long since it's probably deafeningly loud.

TV

Some interesting new advances in TV technology were on show – such as a system for receiving full-colour printed matter which is sent multiplexed in the audio of an otherwise ordinary signal. The print quality of the Matsushita TV is very high – 150 lines per inch. Each A4 sheet takes 2 minutes to print.

However, there is also a growing call for stereo TV sound in the States, a facility which may not be compatible with this system. The competition between stereo, printing and other possible TV additions will be an interesting one – we only hope that it doesn't



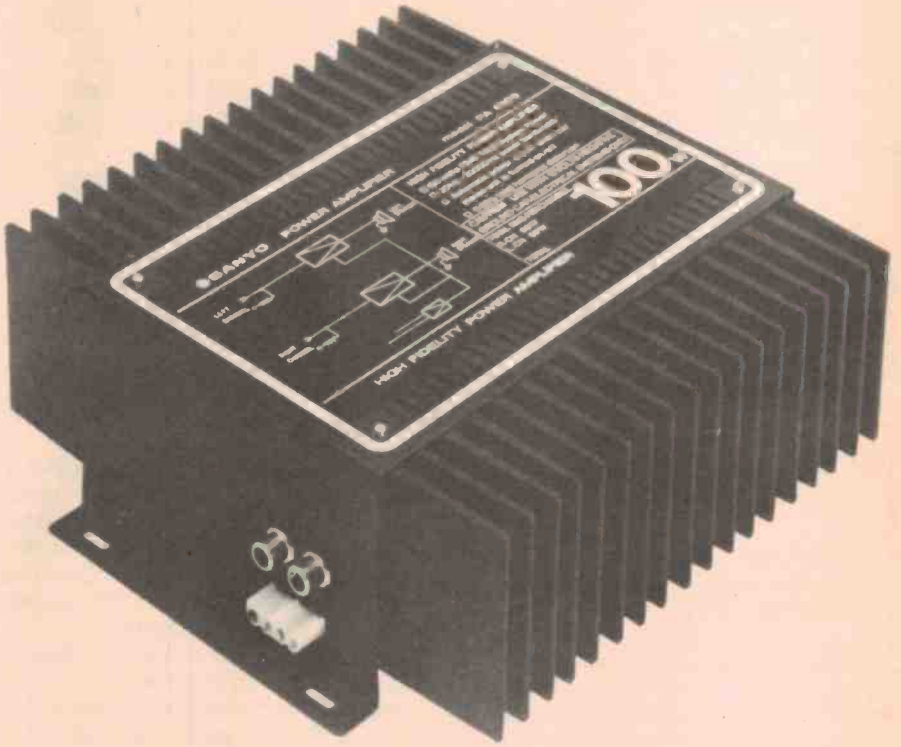


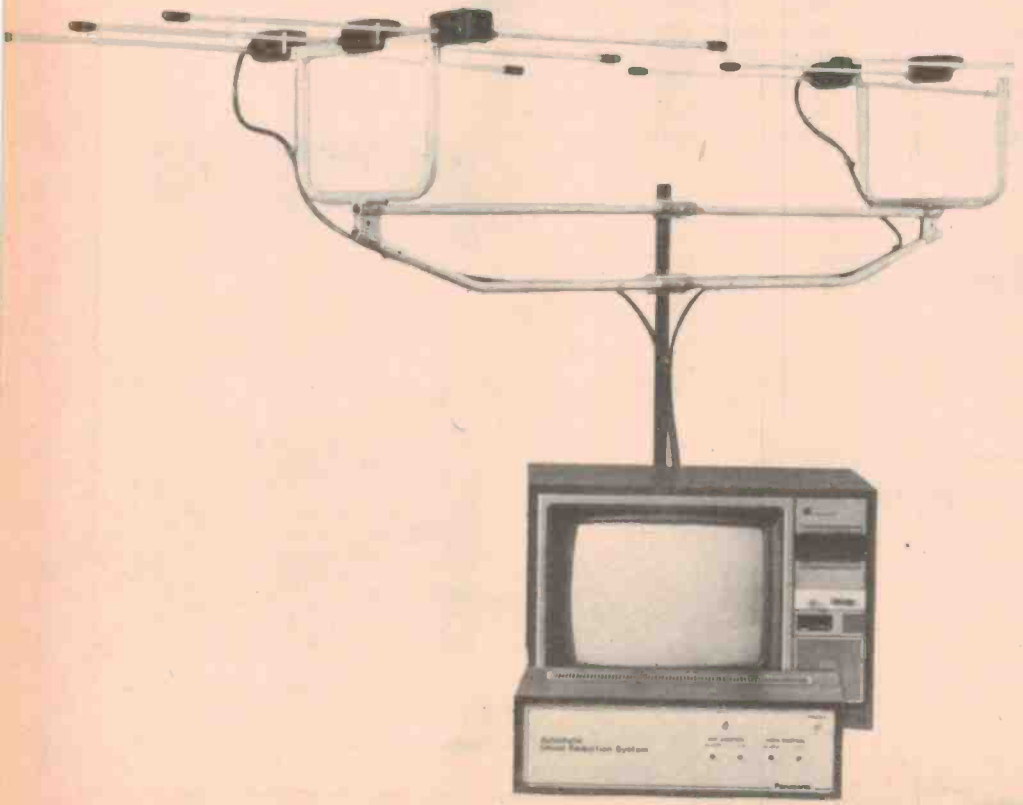
Las Vegas Consumer Electronics Show Report

go the same way as hi-fi quadraphonic sound. Remember quad? There was so much competition between rival systems that the public sat on the fence and bought nothing.

Have you ever been in the annoying situation of wanting to watch the news on one channel while missing the minimum amount of a film on another? You have? Then the Sharp Dualvision was invented just for you. It allows the picture shown on a second channel to be displayed in a miniature (and monochrome) inset into the main colour picture. The set also has remote control and a remarkable feature called Color System-5 which, "instantly adjusts colour, tint, brightness, contrast and fine tuning with one knob". Whatever will they think of next?

Matsushita are offering a system which eliminates ghosts (the signal reflection variety) from TV pictures. They have used two lines of attack – an 'automatic antenna' and a box of signal processing equipment.





As each channel is tuned in, the electronics directs the antenna towards the best signal source. The 'ghost' signal is then removed by means of 'special circuits' (not much detail available on these, we're afraid) which cancel out the ghost image by delaying the original and re-mixing. At a guess, we'd say a bit of auto-correlation was at work – or perhaps it's simply exorcism?

Videocassette Boom

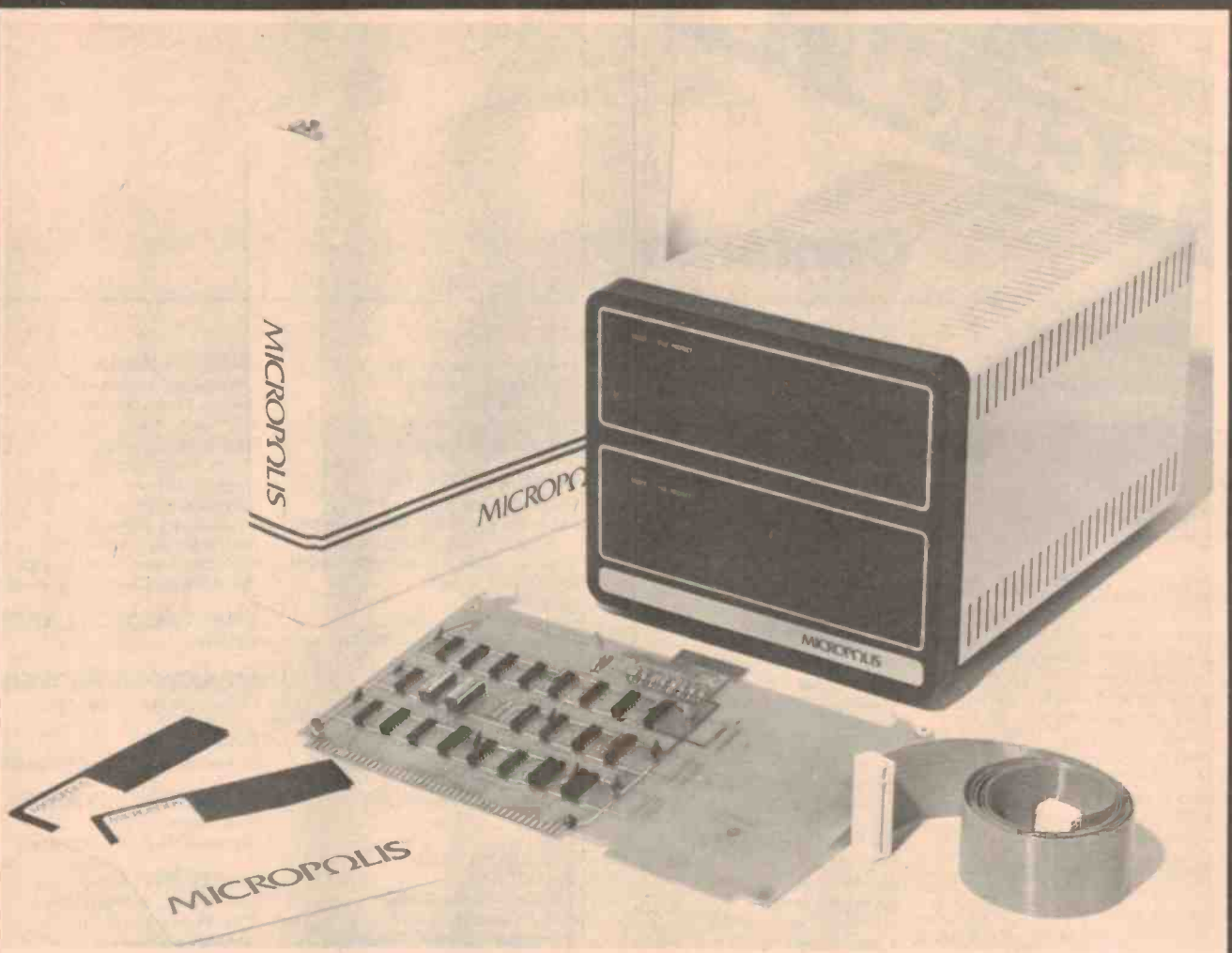
There has been a major increase in the videocassette market in the US recently. All sorts of things are available, from TV cameras to VC fast copiers. Everyone seems to have gone VC crazy. The largest effort, though, appears to have been directed towards selling pre-recorded cassettes. These include old movies, new movies, cartoons, cookery and pop concerts. There is even a growing demand for soft-porn VCs. They sell for between 40 and 60 US dollars to what seems to be a potentially very large market.

The name of one range of cassettes seems to sum up the whole thing – "Television That Won't Rot Your Mind"!

Number Two ETI CIRCUITS

Contents

Please note: the Circuits Books are intended as 'ideas directories' — they are not meant for the beginner.



Pictured is a dual drive unit also available.

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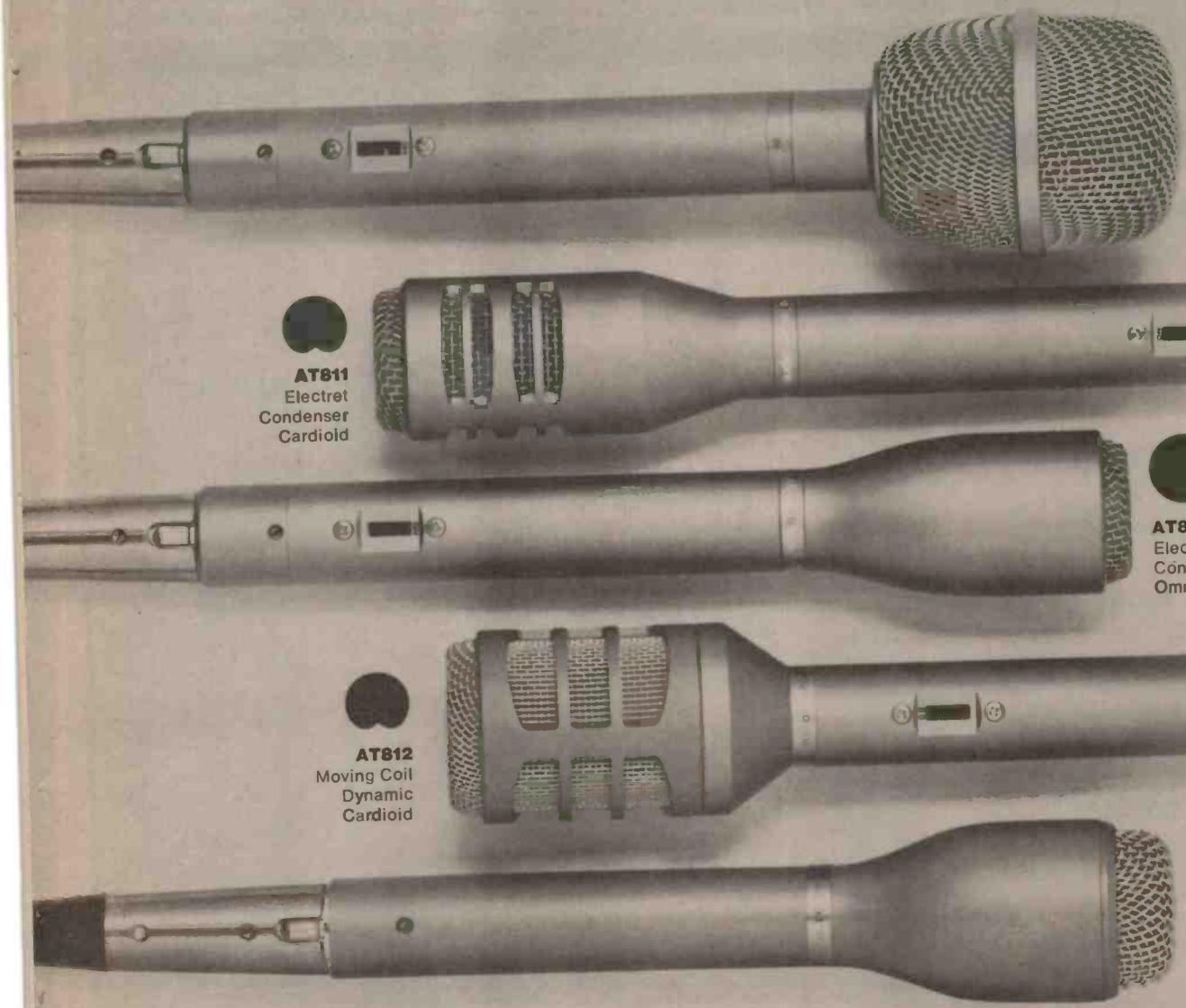

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ETI 068	$1.40
ETI 071	$1.40
ETI 072	$1.80
ETI 083	$1.80
ETI 084	$1.70
ETI 085	$1.30
ETI 130	$1.90
ETI 134	$1.90
ETI 135	$1.90
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2.2uF 35V	.25	.20
3.3uF 25V	.25	.20
4.7uF 35V	.25	.22
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10uF 16V	.25	.23
10uF 35V	.30	.28
15uF 16V	.30	.25
15uF 35V	.50	.45
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47uF 16V	.65	.60
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0.1 watt, .1" spacing		
100, 250, 500, 1K, 2K, 5K, 10K,	.20	.17
25K, 50K, 100K, 250K, 500K, 1M	.20	.17

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8 Pin DIL	.25	.23
14 Pin DIL	.33	.30
16 Pin DIL	.35	.30
18 Pin DIL	.55	.50
24 Pin DIL	.70	.65
40 Pin DIL	1.40	1.20
28 Pin DIL	1.20	1.10

POTENTIOMETERS

.25 watt rotary carbon single gang, Log or Lin.

1K, 5K, 10K, 25K, 50K	50
100K, 250K, 500K, 1M, 3M (Lin)	50

CERAMICS

10pF to 680pF	05c
820pF to .0015uF E12 Values	06c

Include 30c postage for free catalogue.

ELECTROLYTICS

			1-9	10 up
4.7 uF	25v	PCB	0.08	0.07
10 uF	25v	PCB	0.09	0.08
10 uF	50v	PCB	0.10	0.09
22 uF	16v	PCB	0.08	0.07
22 uF	35v	PCB	0.10	0.09
33 uF	16v	PCB	0.09	0.08
33 uF	50v	PCB	0.11	0.10
47 uF	16v	PCB	0.10	0.09
47 uF	35v	PCB	0.12	0.11
100 uF	10v	PCB	0.11	0.10
100 uF	16v	PCB	0.12	0.11
220 uF	25v	PCB	0.15	0.14
470 uF	16v	PCB	0.17	0.16
1000 uF	25v	PCB	0.38	0.36
2500 uF	50v	Axial	1.95	1.85
2200 uF	25v	PCB	0.55	0.90
6800 uF	50v	LUG	4.75	
5600 uF	40v	PCB	2.90	
4700 uF	35v	Axial	2.10	

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ETI 480 100W Module Kit	
Includes Heat Sink Bracket	$19.75
ETI 480 50W Module Kit	
Includes Heat Sink Bracket	$16.00
12 volt Electronic Siren Kits	
1. "Whip"	$8.00
2. "Wail"	$8.00
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Horn Speaker to suit	$8.50

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Project 721

Aircraft Band Converter

AN INTEREST IN what can be heard on the shortwave frequency bands between 3 MHz and 30 MHz often kindles an interest in what can be heard 'beyond' 30 MHz, apart from TV and FM broadcasting stations.

For many communications hobbyists a variety of fascinating services can be found on the very high frequency (VHF) bands above 30 MHz. One of the more interesting bands lies between 118 MHz and 126 MHz – the aircraft band.

Domestic aircraft communications, both private and commercial, generally involve a pilot talking from his plane to a traffic controller at an airfield as well as talking to other pilots. Signals from aircraft can be heard over quite long distances as they are flying quite high and thus the horizon, from the aircraft, can be up to several hundred miles away.

There are 360 channels allocated in the aircraft band, each assigned a specific use or for use in a particular area. Amplitude modulated (AM) transmission is used which simplifies the requirements for a receiver to listen on this band.

Apart from a hobbyist interest, we have had occasional enquiries from readers who wish to have a receiving system to monitor a particular channel or channels for various reasons.

This converter should suit either purpose very well.

The Converter

Why a converter – why not a complete receiver? Firstly, a shortwave listener will already have a receiver. A converter to 'change down' the aircraft band frequencies to a suitable band between 3 MHZ and 30 MHz is a simple, and inexpensive, solution. For those wishing to monitor some portion of the aircraft band the output of the converter could be connected to an ordinary multi-band transistor portable to provide quite adequate results. Alternatively, a fixed frequency IF (intermediate frequency) strip with detector and audio stages could be constructed.

For simplicity and cheapness we have modified an existing and well-proven design – the ETI707A 144 MHz solid state converter. This was designed for radio amateurs and others interested in reception of signals on the 144 - 148 MHz band. It was originally described in the February 1976 issue and since then many hundreds have been successfully built – by beginners and experienced constructors alike. It is a very successful design, so why re-invent the wheel?

The converter is crystal locked – that is, a quartz crystal oscillator is mixed with the signals from the antenna, the signals then appearing at a lower frequency at the converter output. The frequency of the crystal used will determine the frequency band of the converter output.

For a number of reasons, we chose the output (or IF) frequency to be around 10 MHz. Inexpensive crystals are available for the aircraft band to give an IF output from the converter of 10.7 MHz – a standard IF frequency. The same crystals can be employed if you wish to use a tunable shortwave receiver following the converter. There is a minor inconvenience though – the tunable receiver's dial has no simple relationship to the input frequency. The advantage is that inexpensive crystals cost around half that of a crystal made to order to provide a direct frequency relationship.

The choice is up to you. Choosing and ordering crystals is covered later in the article.

As the converter has quite a deal of gain, resulting in very good sensitivity, an RF Gain control has been provided. Very strong signals on a channel near to the one being monitored may cause interference. Judicious use of the RF gain control will reduce or remove the interference while enabling you to still hear the desired signal. Then again, a very strong signal on the channel you are monitoring may overload your receiver, resulting in very distorted reception. Reducing the RF gain will remove the problem.

PARTS LIST – ETI 721

Resistors all ¼W, 5% *
R1 . . . . . 150R
R2, 3 . . . . 100k
R4 . . . . . 150R
R5 . . . . . 1M
R6 . . . . . 56k
R7 . . . . . 560R
R8 . . . . . 680R
R9 . . . . . 10k
R10. . . . . 4k7
R11. . . . . 470R
R12. . . . . 270R

Potentiometer
RV1 . . . . 100k A pot

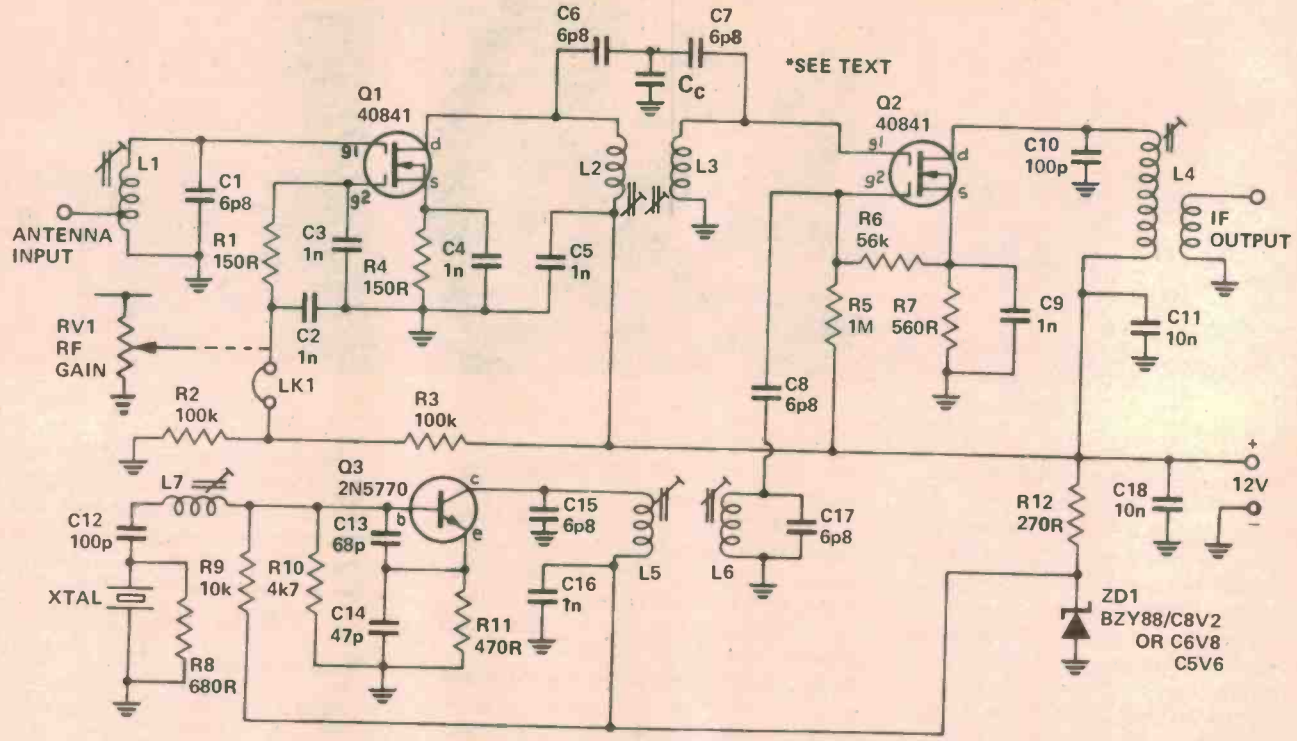
Capacitors
C_C. . . . . 22p ceramic
C1. . . . . 6p8 ceramic
C2 - C5. . . 1n ceramic
C6 - C8. . . 6p8 ceramic
C9. . . . . 1n ceramic
C10. . . . . 100p poly or ceramic
C11. . . . . 10n poly or ceramic
C12. . . . . 100p poly or ceramic
C13. . . . . 68p poly or ceramic
C14. . . . . 47p poly or ceramic
C15. . . . . 6p8 ceramic
C16. . . . . 1n ceramic
C17. . . . . 6p8 ceramic
C18. . . . . 10n poly or ceramic

Semiconductors
Q1, 2 . . . . MFE131, 40673, 40841
Q3 . . . . . 2N3563, 2N3564, 2N5770
ZD1. . . . . BZY88/C8V2 or /C6V8 or /C5V6 or /C5V1

Miscellaneous
7 x 722/1 Neosid coil formers
3 x 7100 Neosid screening cans
2 x 7300 Neosid screening cans
7 x Neosid ferrite slugs, 4 x 5 x 10/F29
coil wire
pc board . . ETI 707A
crystal . . . see text
zippy box (see text), 2 coax sockets, 2 x 20 mm, 6 BA spacers, nuts, bolts, etc.

*Resistor values may be plus or minus one standard value either side of those quoted without ill effect. Capacitor values should not be altered.

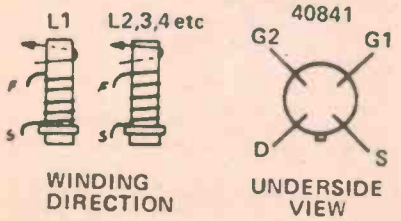
Project 721



Coil Data

Wind L2, L3, L4, L5, L6 and L7 *clockwise* up the former. L1 is wound *anticlockwise* up the former. The start of each coil is the 'cold' or 'earthy' end. All slugs are F29 type ferrite.

L1	5 turns, 22 B & S tinned copper wire spaced over 10 mm, tap at 2 turns from cold end.
L2, L3	6½ turns, 22 B & S enamelled wire, spaced over 8 mm.
L4	25 turns closewound with enamelled wire, any gauge between 25 and 30 B & S, 5 turn link at top of former.
L5, L6	5½ turns, 22 B & S enamelled wire, closewound.
L7	*10 turns, 22 B & S enamelled wire, closewound, for crystals in the range 30 MHz to 50 MHz. *6 turns for crystals in the range 50 to 70 MHz.



Construction

The printed circuit board has been specially designed for this application and no other construction technique should be employed unless you are very experienced in circuit construction at these frequencies.

It is best to commence construction by mounting the coil formers. They may be glued on the board over the pilot holes or the board drilled to the appropriate diameter for the base of the formers and then gluing the formers in place. Use the shield cans to locate and/or hold the formers on the pc board when gluing them directly to the board. It is wise to insert the slugs in the formers *after* gluing to avoid accidentally gluing them to the formers. The best type of glue to use is one of the 'instant' bond glues such as "Superglue", "Bondza", "Super 500" etc. Many glues available will not bond to pc substrate materials — particularly fibreglass pc material.

The next step is to wind the coils. They may be wound *in situ* if you wish, alternatively they may be wound on a suitable diameter former (such as a 5 mm or 3/16" drill shank) and then slipped over the formers on the board.

Take careful note of winding direction and the start and finish connections. Refer to the component overlay when soldering the coil leads in place. Do not mount the shield cans until all the minor components have been soldered in place.

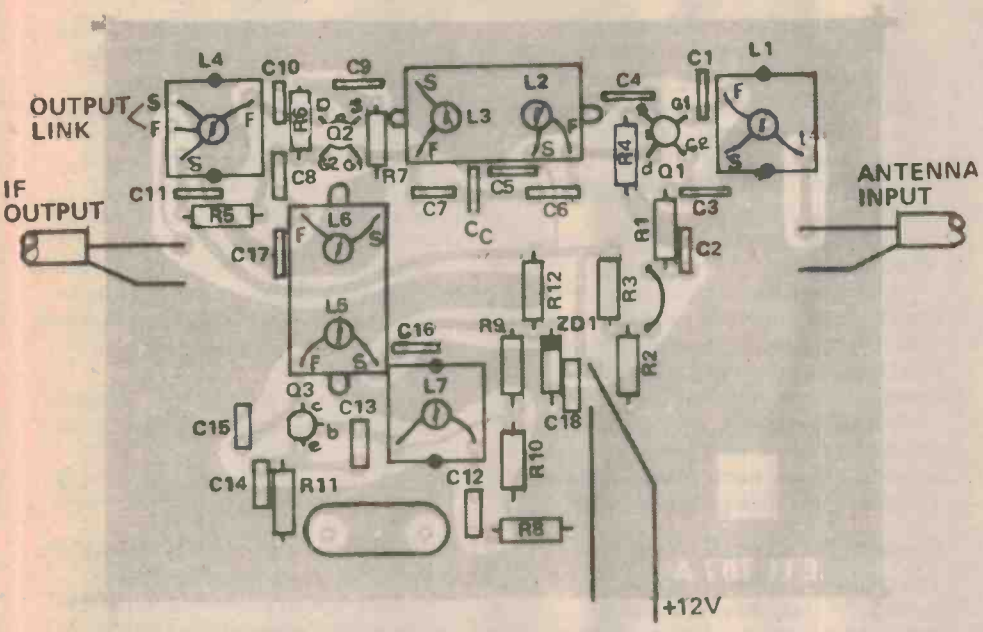
When mounting the minor components take particular care with orientation of the transistors, FETs and the zener diode. All components should be mounted right down on the pc board to minimise lead length. Stakes or pins should be used for the connections to the antenna input, IF output and dc connections.

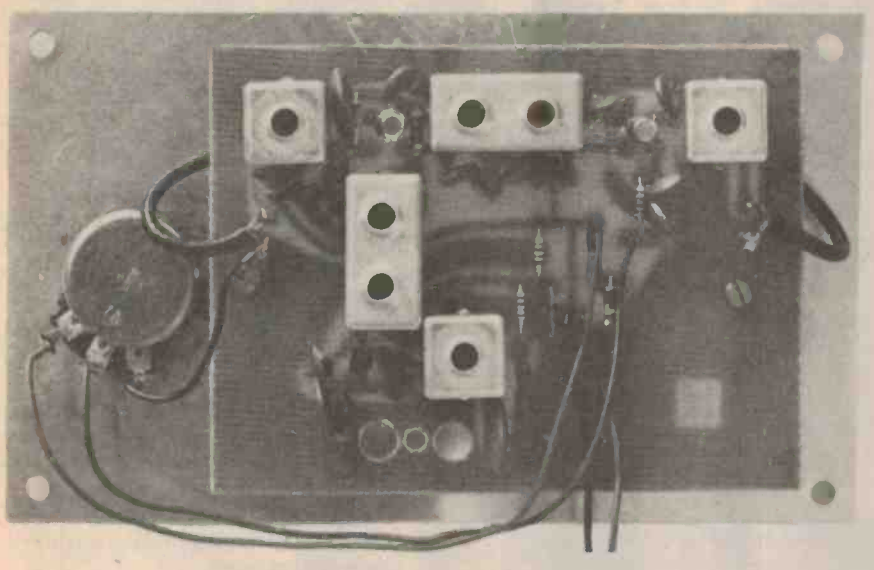
There is provision on the pc board to mount a crystal socket for a 'style-D' crystal. These have a 12 mm pin spacing and stand about 20 mm high. Alternatively, if the smaller size crystals are used, having a pin spacing of 5 mm or pigtail connections, then they may be soldered in place under the board. Take care when doing this. Do it quickly and use the minimum amount of heat to avoid damaging the crystal.

If desired, the crystal may be mounted separate from the pc board. Keep lead length between the crystal and the board connections as short as practicable in this case.

The shield cans for the coil assemblies should be mounted last. It may be a wise idea to check that the converter is working before soldering the shield pins to the pc board.

The completed converter may be mounted in a suitable box. The one we used was a small 'zippy' box measuring 159 x 96 x 50 mm overall. They are available from a number of component suppliers. The pc board was mounted on the aluminium panel using two spacers. Antenna and IF output sockets, along with the RF gain pot, were also mounted on the panel and dc power





leads taken through a hole in the side of the box. Small lengths of coax cable were used to connect the input and output sockets to the pc board connections.

Alignment

The particular method of alignment will depend on how you will be using the converter. To commence the alignment you will need to have on hand the appropriate aligning tool. You will need a plastic screwdriver-tip alignment tool to suit the Neosid ferrite cores. They are readily available from many suppliers. Most general purpose alignment tool kits available will have a suitable tool. These kits cost around $2 - $3, contain four tools with various tips and are generally called 'TV alignment' kits.

You will need a dc power supply delivering between 12 and 15 volts; the converter will draw between 30 and 50 milliamps. A receiver with a S-meter is a decided advantage when aligning the converter. You will need a signal generator, with AM modulation, covering the range 118-126 MHz.

If you are using a tunable receiver for the IF, then the following procedure should be followed:

Connect the converter to the receiver. Use a short length of coax cable. If the converter is working you will notice an increase in the noise level on a sensitive receiver when power is applied. You can check that the crystal oscillator is working by removing the crystal temporarily – a decrease in the noise from the receiver will be noticed.

1. Set the receiver frequency to the middle of the tuning range of the converter's output. The converter RF gain should be at maximum all through the alignment procedure.

HOW IT WORKS – ETI 721

The circuit is quite straightforward, comprising an RF stage (Q1), a mixer (Q2) and an overtone crystal oscillator-multiplier (Q3). Dual-gate MOSFETs are used in the RF and mixer stages as they have good gain, low noise figure and good freedom from crossmodulation and overload problems.

Signals from the antenna are first amplified by Q1 and passed to gate-1 of the mixer Q2. The oscillator, Q3, is set to a precise frequency by the crystal. The injection frequency to gate-2 of the mixer is derived from the collector of Q3, being two or three times the crystal frequency. The signal frequency and the injection frequency are mixed in Q2, their *difference* is selected by the tuned circuit in the drain – this is the desired output frequency.

A low-Q tuned circuit, L1-C1, is used between the antenna input and gate-1 of Q1. The antenna input impedance is *mismatched* to the impedance of the gate to optimise noise figure. The drain of Q1 is coupled to gate-1 of the mixer, Q2, via a double-tuned, bandpass coupling circuit consisting of L2, C6, Cc, C7 and L3. A combination of inductive coupling and common-capacity coupling is used to achieve a wide bandwidth.

Gate-2 of Q1 requires a bias of +6V for full stage gain. A link between gate-2 decoupling (R1,C2,C3) and the junction of R2-R3 allows for the connection of a gain control potentiometer.

The mixer has about 1.5 volts of bias applied to gate-2. The conversion frequency is injected at this gate and a small amount of forward bias improves the mixer conversion gain. The output, or IF, is coupled via L4 which is resonant at 10 MHz with C10. This is a low-Q tuned circuit for the broad bandwidth necessary if the tunable IF receiver is used.

The crystal oscillator stage, Q3, is designed to cope with either third or fifth overtone crystals and may double or triple the crystal frequency in the collector. Tuned circuit L5-C15 selects the appropriate harmonic. Energy is coupled from L5 to L6 which is resonated to the required frequency with C17. These two tuned circuits filter the injection frequency. This prevents any spurious mixing occuring in Q2.

Coil L7 is used to 'trim' the crystal frequency.

A regulated supply to Q3, provided by the zener diode, ZD1, prevents power supply variations from affecting the crystal frequency.

2. Tune the slug in L4 to obtain a peak in the receiver noise level.
3. Set all the other coil slugs flush with the tops of the coil formers.
4. Using the signal generator, with a fairly high output level, peak L4 again for best signal strength.
5. Set the generator to a frequency near 119 MHz and tune the receiver until you pick up the signal. Now adjust the slugs in L2 and L6 for best signal strength. Decrease the output of the signal generator so that these adjustments are made on a fairly weak signal.
6. Set the generator to a frequency near 125 MHz, or the highest frequency in which you are interested, and tune the receiver until you pick up the signal. Adjust the slugs in L1 and L5 for best signal strength. Keep the generator output at a low level for best results.
7. Now set the generator to a frequency half way between these two frequencies. Tune the receiver to pick up the signal and adjust the slug in L3 for best signal. Check the adjustment of L4.
8. Return to 119 MHz and peak the slug in L2 again.
9. Repeat the procedure, 'touching up' each slug.

If the converter is to be used on one channel, or a couple of channels less than 1 MHz apart, then all the coils need only be adjusted for best signal strength on one channel.

Overall sensitivity of the converter-receiver system is very good, signals as low as 0.2 uV being clearly audible. The gain control range is about 20 dB.

SOME CHANNEL ALLOCATIONS

Frequency	Channel Usage
118.1	Bankstown and other towers
118.7	Canberra Parafield towers
118.9	Melbourne departure
119.1	Club frequency
119.4	Sydney approach
120.5	Adelaide/Brisbane/ Melbourne/Sydney towers
120.9	Automatic information service
122.1	Area frequency
123.0	Sydney departure
124.2	Adelaide approach
124.4	Sydney approach
124.7	Brisbane/Melbourne approach
125.3	Sydney departure
125.8	Area frequency

Choosing A Crystal

The frequency injected at gate 2 of the mixer FET, Q2, may be above or below the signal frequency by an amount equal to the IF frequency. For a tunable receiver used as an IF, the injection frequency should be lower than the *lowest* signal frequency by 10 MHz. Thus, as you tune the receiver upwards in frequency from 10 MHz, you will tune signals above the lowest aircraft band frequency (118 MHz). In this way there will be a simple relationship between the signal frequency and the receiver's dial. If 10 MHz equals 118 MHz, 10.5 MHz will equal 118.5 MHz, and so on. For this situation the injection frequency will be 118 – 10 = 108 MHz. As the crystal oscillator output (collector of Q3) is twice the crystal frequency, the crystal frequency should be half of 108 MHz = 54 MHz.

If you use a tunable receiver then a fifth overtone crystal at 54.000 MHz should be ordered. Tolerance and adjustment range also have to be specified. A value of 20 parts per million (ppm) for tolerance and adjustment range is satisfactory. Firms such as Bright Star Crystals or Hy-Q should be able to supply a crystal to order.

Alternatively, a crystal at one-third the injection frequency may be used. Taking the 108 MHz injection frequency, as just illustrated a 36 MHz crystal may be used.

To determine the crystal frequency required for any case, use the following formula:

$$\text{Crystal} = \frac{\text{lowest signal frequency} - \text{IF}}{2 \text{ or } 3}$$

Inexpensive crystals intended for use in 'scanning' receivers are available from Dick Smith's. These provide an injection frequency *above* a particular aircraft channel frequency for the standard IF frequency of 10.7 MHz. For example, for the 125.8 MHz channel, the injection frequency is 136.5 MHz. These crystals have the channel frequency marked on them, not the crystal frequency.

Setting the crystal frequency

If you require accurate frequency readout then the crystal frequency will need 'trimming'. Coil L7 is provided for this purpose. For best results a digital frequency meter capable of measuring to 150 MHz is necessary.

Lightly couple the DFM to L5 or L6 via a small value capacitor and see if you get a sensible reading. You may need to connect it directly across gate-2 of the mixer, Q2.

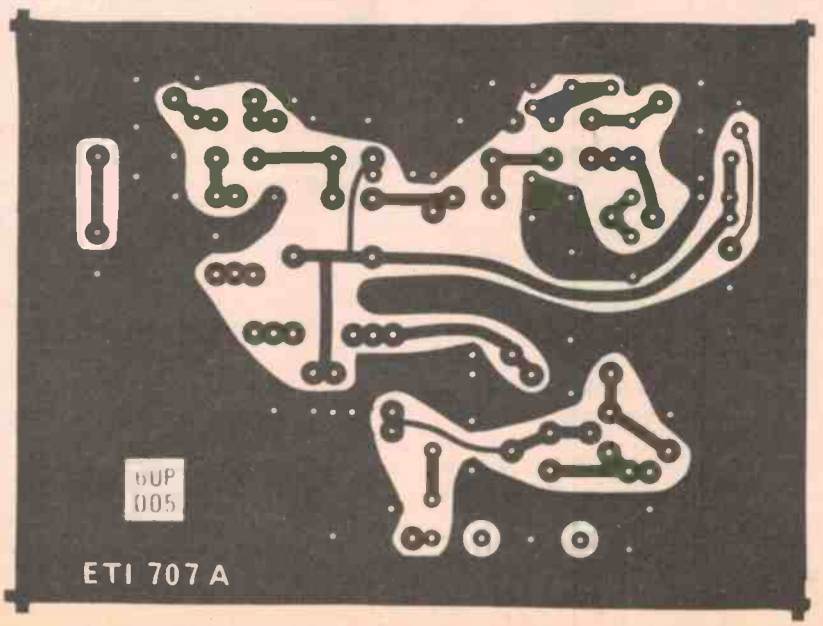
Adjust L7 until you obtain the correct injection frequency according to the crystal chosen.

Multi-channel operation

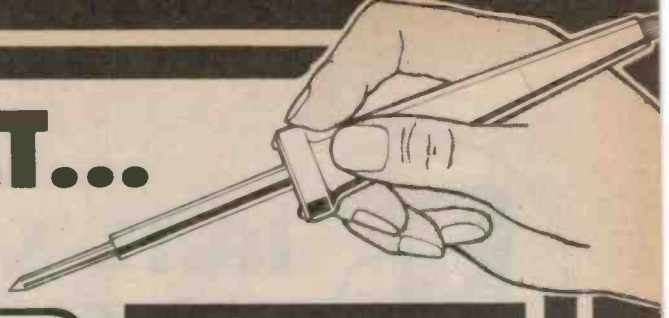
If you intend using a fixed frequency IF (on 10.7 MHz) then a group of crystals may be used to select the desired channels of interest. A single-pole, multi-position switch may be used to select appropriate crystals.

Delete L7 on the pc board and replace it with a link. The components L7, C12 and R8 are also deleted. Each crystal needs to have this circuit attached. The channel switch is then connected with the pole to the junction of R9 and R10 and the trimming coil for each crystal connects to the appropriate switch contact.

If there is sufficient interest, we may later describe a 10.7 MHz IF and audio section to complement this project.



BUILD A PROJECT...
from a Dick Smith kit



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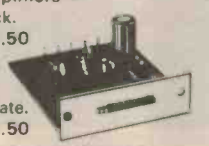

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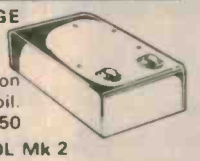

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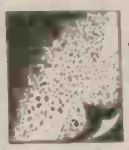

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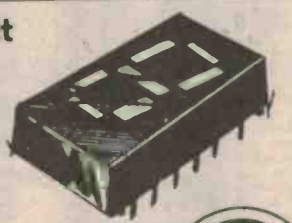

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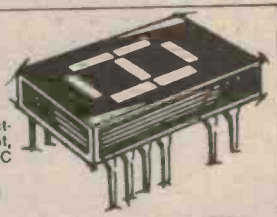

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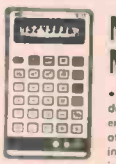

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DC CURRENT:	1 MA to 200 MA (Six Ranges)
RESISTANCE:	1Ω to 20 MegΩ (Five Ranges)
DIMENSIONS:	153 x 76 x 39mm
POWER.	9 Volt Battery (e.g. 216 Eveready)

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KILOHMS	1 10 100 1000 10000	±1% Reading	±0.5% Reading	1 ohm 10 ohm 100 ohm 1 k ohm 10 k ohm	10	1 mA 100 μA 10 μA 1 μA 100 nA

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POWER SUPPLIES

Some pointers on the use of monolithic three-terminal voltage regulators from Tim Orr.

THE PRODUCTION OF stable regulated supply voltages has been simplified by the introduction of three terminal voltage regulators. These devices make power supply design relatively simple, but the designer must be aware of other important details that can cause poor results. Consider a simple unregulated supply, fig. 1.

A mains transformer isolates a piece of equipment from the potentially lethal mains voltage and provides a suitable voltage to be rectified, smoothed and applied to a voltage regulator. The secondary voltage of the transformer is measured in volts RMS at a particular loading.

If the transformer is rated at 15 V at 10 volt-amps (VA), the output voltage will be 15 V when the load upon the transformer secondary is 10 VA (10 watts).

If the load is removed the output voltage will rise. The percentage change from load to no load is known as the transformer regulation and is typically 10 – 20%.

If the rectifier is followed by a capacitor-input smoothing circuit, the dc voltage is 1.414 (the square root of 2) times the transformer RMS voltage. Thus a 15 VRMS (loaded) transformer will generate about 20 Vdc when full wave rectified and smoothed, which will rise to about 25 Vdc when the load is removed (assuming 20% regulation, see fig. 1).

When calculating these voltages, remember that each forward biased diode in the current path will drop 0.6 V, so a full wave rectifier will cause a 1.2 V drop.

The smoothing capacitor should be selected to withstand the peak no load voltage from the transformer. Also, make certain that the polarity of an electrolytic capacitor is correct; they can literally explode if wired up backwards!

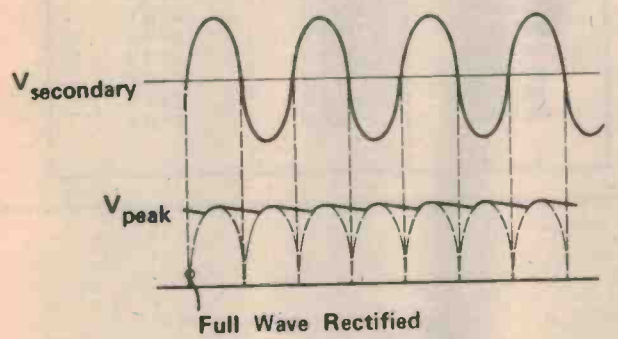
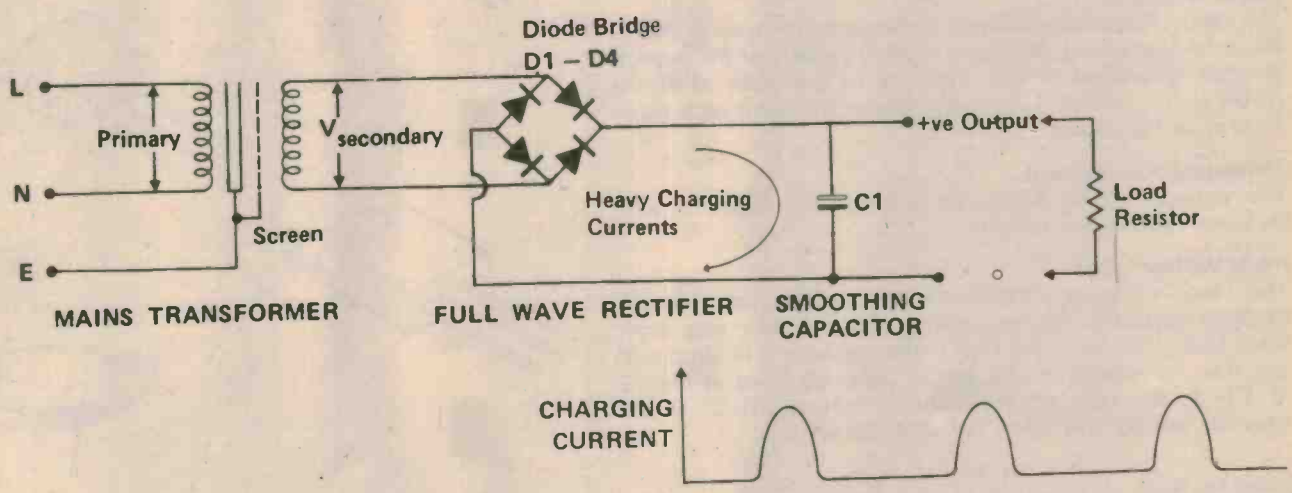


Fig. 1 (above) A simple unregulated power supply, (top) the output (with a load resistor).



There are three sections, a step down, isolating transformer, a diode bridge and a smoothing capacitor. The transformer is driven from the mains. Some transformers have a copper screen to isolate the primary winding from the secondary windings. For safety, and noise reduction, this should be connected to earth.

Another type of mains transformer uses what is known as a split bobbin; the primary is wound on one bobbin, the secondary on another. Thus the two windings are inherently physically isolated. These two transformer types are generally constructed on what is known as an 'E' core; take one to bits and you will find that it is constructed out of lots of 'E' shaped laminations. These 'E' laminations are butted into 'I' laminations, and clamped together. This butting together of the laminations can cause magnetic field problems. The wider the gap between the 'E' and 'I' laminations, the larger the magnetic field around the transformer.

The magnetic field can generate a significant amount of induced hum in nearby electronics, this can be overcome by using a low leakage toroidal transformer which is constructed from circular laminations. The primary and secondary windings are wound through the centre of the toroid. The toroidal transformer, by virtue of its 'continuous' laminations results in a low stray field and a low profile design, making it ideally suited for audio amplifier applications.

When a load is placed upon the power supply shown above, the output voltage appears as a DC voltage on top of which is a ripple voltage. This can be thought of as two separate periods, a charge period where the capacitor is charged up by the power supply and a discharge period where the load discharges the capacitor.

This charging and discharging generates a ripple voltage which has a period of 10 ms (100 Hz). A load current of 100 mA, and a 100μ

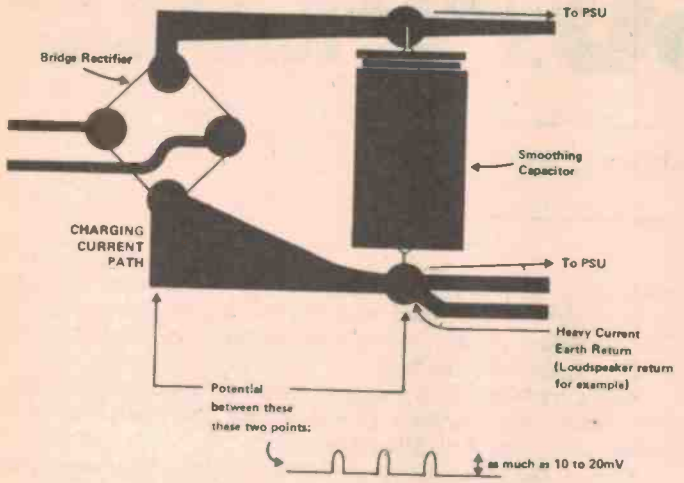


Fig. 2. Correct pcb layout for power supply design. Note the thick short tracks from the bridge rectifier to the filter capacitor.

capacitor will result in a ripple voltage of about 0.7 V p-p.

As a rule of thump allow 1 to 1.5 V p-p maximum ripple if a voltage regulator is being used. This will generally result in an output ripple of less than 1 mV.

Generally the discharge period is much longer than the charge period. This means that the transformer is only supplying power to the capacitor for short periods. During these periods the smoothing capacitor is rapidly charged, and it is quite common for these current surges to exceed several amps. This can cause mains BUZZ problems when laying out printed circuit board designs for power supplies.

The correct layout is shown in Fig. 2. If the current surge is 1 A and the track resistance is 20 milliohms then the voltage developed between the rectifier and the filter capacitor will be 20 mVpp.

Table One

V secondary at rated load	V peak at rated load	V peak off load transformer regulation 20%
5 VRMS	7.1 V	8.5 V
6 VRMS	8.5 V	10.2 V
9 VRMS	12.7 V	15.3 V
10 VRMS	14.1 V	17.0 V
12 VRMS	17.0 V	20.4 V
15 VRMS	21.2 V	25.5 V
20 VRMS	28.3 V	34.0 V
25 VRMS	35.4 V	42.4 V
30 VRMS	42.4 V	51.0 V
35 VRMS	49.5 V	59.4 V
40 VRMS	56.6 V	67.9 V

Voltage regulators

A voltage regulator takes a varying (unregulated) input voltage and produces a stable (regulated) output voltage. There is a wide range of fixed voltage three terminal regulators to choose from, with a choice of maximum current handling, output voltage and positive or negative operation. The data sheets for these devices contain lots of seemingly complex information and so a glossary of terms is given here.

Ripple Rejection

The ratio of the ripple voltage at the regulator input to that at the output, generally expressed in dB. Typically of the output, generally expressed in dB. Typically of the order of 60 dB (1000 to 1). that is, 1 Vpp of ripple at the input ends up as 1 mVpp at the output.

Temperature Coefficient

The output voltage change for a change in regulator temperature, expressed in mV/°C.

Input Voltage range

The range of input voltages over which the regulator will function normally. For example, a 12 V regulator may work from 14.5 V to 30 V. At 14.5 V the regulator will 'drop out' and lose its regulation. Regulators generally need at least 2 to 2.5 V in excess of their output voltage. At 30 V the regulator will go 'pop' (time to buy a new one).

Output voltage

The voltage at the output terminal with respect to ground. Generally within ±5% of stated value.

Line Regulation

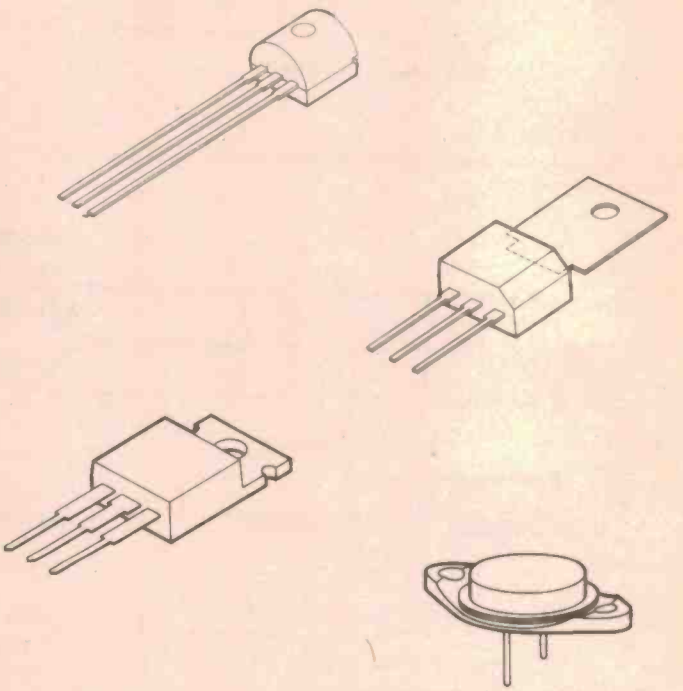
The change in the output voltage caused by a change in the input voltage, typically of the order of 0.2%.

Short Circuit Current

The output current when the output is shorted to ground.

Output Noise Voltage

The RMS noise voltage measured at the regulators output, not including any ripple.



Regulator IC packages. From top: TO-92, TO-202, TO-220, TO-3

Power Dissipation

The maximum power that the regulator can safely generate on a particular heatsink.

As a rule of thumb the regulator case should not exceed about 80°C (which is hot to touch). However, always run the device at as low a temperature as possible. It is thermal ageing that eventually kills electronic devices and for higher temperatures the ageing process is disproportionately faster.

Tricks of the Voltage Regulator Trade

Fig. 1. The conventional arrangement of a three terminal regulator. It is advisable to use a decoupling capacitor connected close to the input terminals. This prevents high frequency instability. If this capacitor is left out then regulation can sometimes be greatly reduced. The decoupling capacitor on the output helps reduce the impedance at high frequencies, where the regulator loses its performance. For best results use a tantalum capacitor.

The internal current limiting of the regulator is shown. When the load current exceeds the current limit, the output voltage drops to almost 0V. This makes the regulator short circuit protected. Another type of current protection is known as 'FOLD BACK' current limiting (shown dotted). This serves to reduce the short circuit current. These devices protect the power supply from abuse. Another type of protection device is the overvoltage clamp, which protects the circuit being supplied from an increase in the power supply voltage. When the supply voltage exceeds a certain level an SCR is triggered on and clamps the rail to ground. This is intended to pop a fuse and so disconnect the faulty power supply (which is better than replacing a $1000 worth of ICs). With foldback the short circuit power dissipated in the regulator is less than that with current limiting.

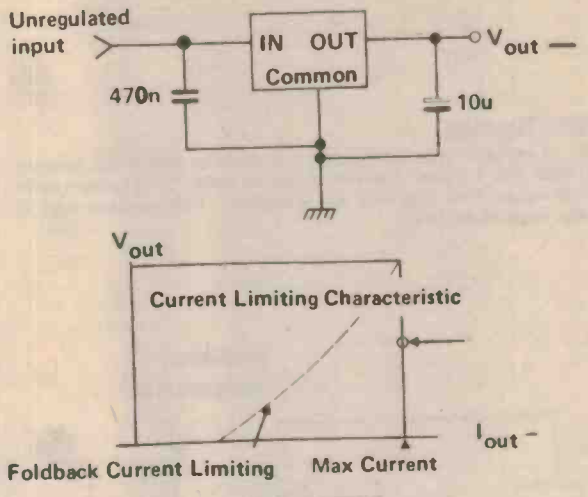
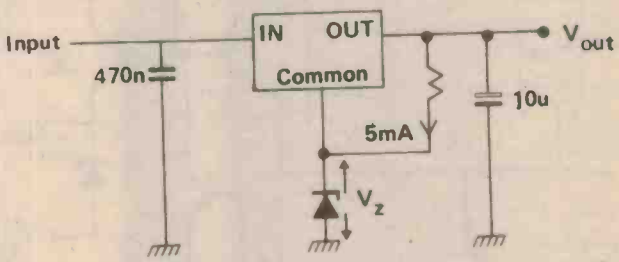


Fig. 2. The output voltage of a regulator can be increased by applying a voltage to the common terminal. This can be done by a zener diode.



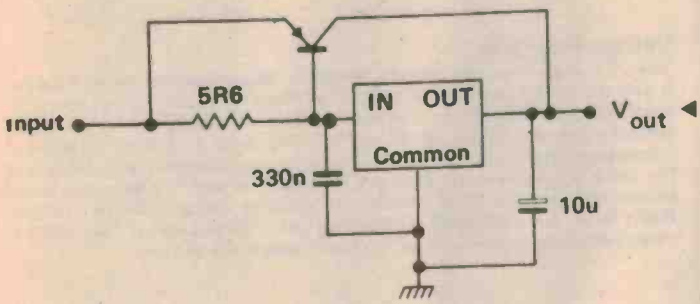
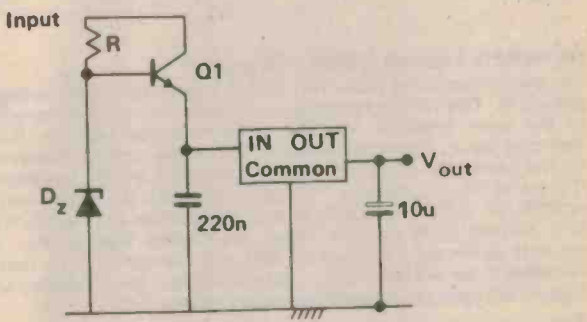


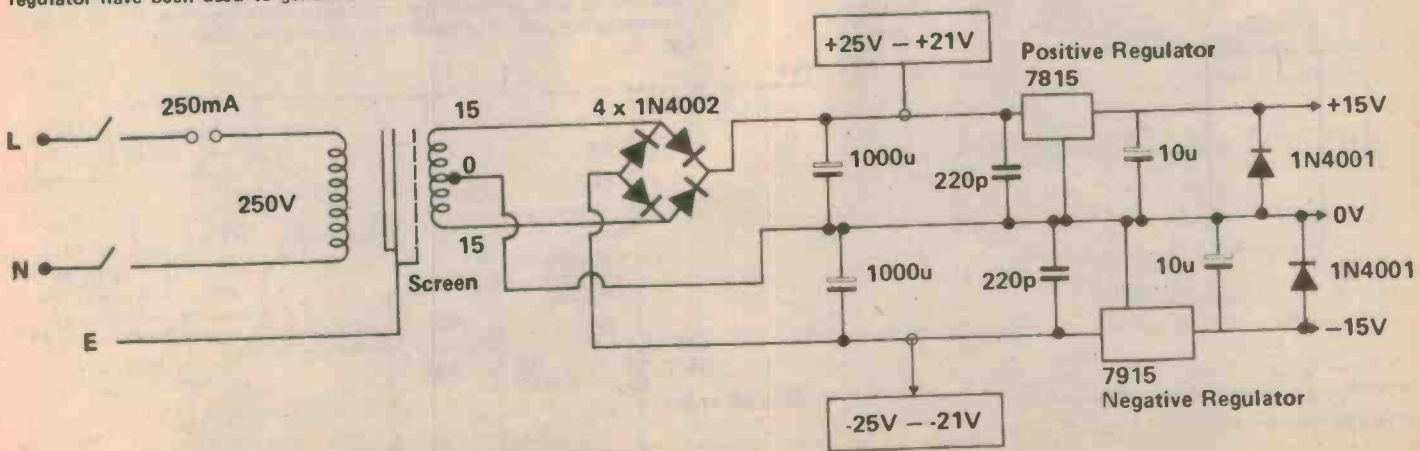
Fig. 3. The output current can be increased by using a bypass transistor. When the current flowing through the voltage regulator exceeds 100 mA (the voltage across the 5R6 being 560 mV), the bypass transistor begins to turn on. This transistor takes all currents in excess of 100 mA and yet the output still remains regulated.

Fig. 4. Sometimes it may be necessary to use a supply which exceeds the maximum voltage rating of the regulator. A simple voltage regulator 2D, and Q1 can be used to overcome this problem. 2D should be chosen so that it is about 6V higher than the regulator output voltage. This technique has the added advantage that the power dissipated in the regulator is less (the rest being dissipated in Q1), and the regulator is presented with a semiregulated voltage, so the output will have better regulation.



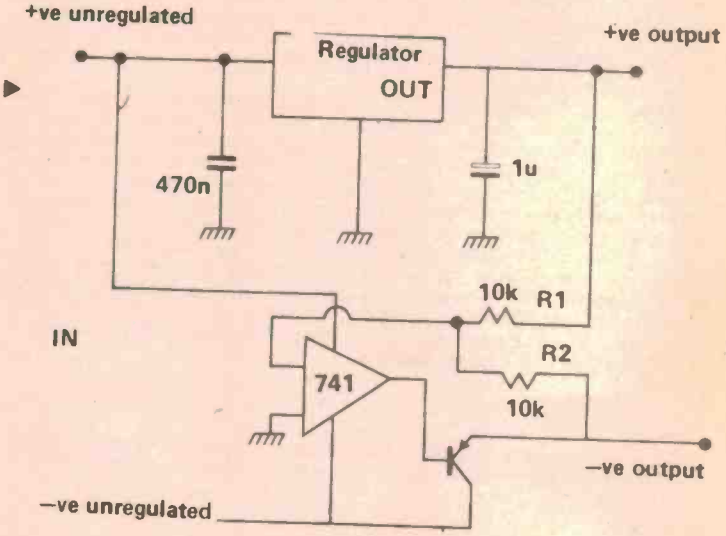
Dual Power Supply

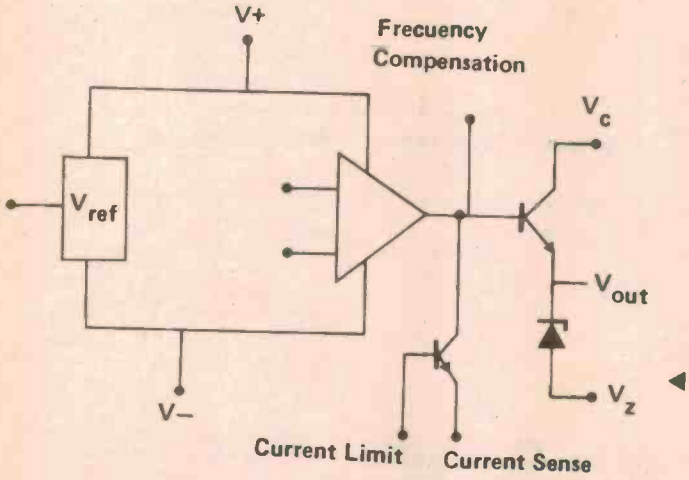
This circuit shows a complete regulated dual power supply. The unregulated rails are obtained from a split secondary transformer, a bridge rectifier and two smoothing capacitors. A positive and a negative regulator have been used to generate the + and - rails. These regulators should be mounted together with insulating washers on heat sinks. The pin out of the negative regulator is different to that of the positive regulator. The two diodes at the output prevent latching up situations (on load) whereby one side starts up faster than the other and forcibly reverse biases it, preventing it from operating.



Tracking Regulator

Instead of using a negative voltage regulator to obtain the negative rail, an op amp and a power transistor can be used. The resistor ratio, R1, R2 determines the negative rail voltage. The negative rail is not, however, current limited.





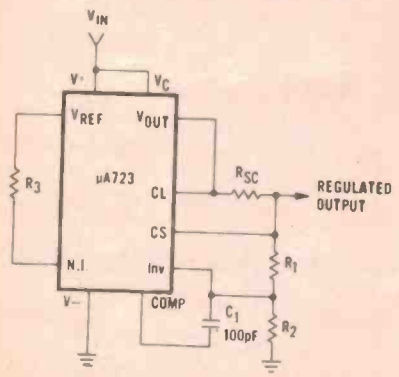
Voltage Regulator

The 723 is an 'industry' standard device. Many manufacturers produce it and the device itself is versatile. It comes in a 10 pin TO5 can or a 14 pin/DIL pack. The device contains a precision voltage reference, with a temperature coefficient of 50 ppm/°C, an error amplifier, an internal transistor capable of handling 100 mA and a current limiting mechanism. By using a few external resistors, a capacitor and maybe an external power transistor, a wide variety of regulator designs can be realised. Right is shown the block diagram of the 723 regulator. As pinouts vary depending upon package, no pin numbers are shown.

Adjustable Positive Voltage Regulator

By using a feedback path (R1, R2), a regulated output voltage can be generated. The voltage reference is connected to the non-inverting input of the error amplifier and the output voltage (via R1, R2) to the inverting input. The error amplifier drives the output transistor on the IC and hence the output voltage is controlled by the feedback voltage. If R1 and R2 are replaced by a potentiometer, the supply can be made variable. A 100 pF capacitor is used to stabilise the device. Rsc is used as a current limit control. When the current through Rsc (the load current) generates a voltage of 560 mV accross it, a current limiting transistor is turned on which in turn shorts out the regulating transistor, causing the output voltage to collapse towards 0 V.

$$V_{OUT} = [V_{REF} \times \frac{R_1 + R_2}{R_2}]$$

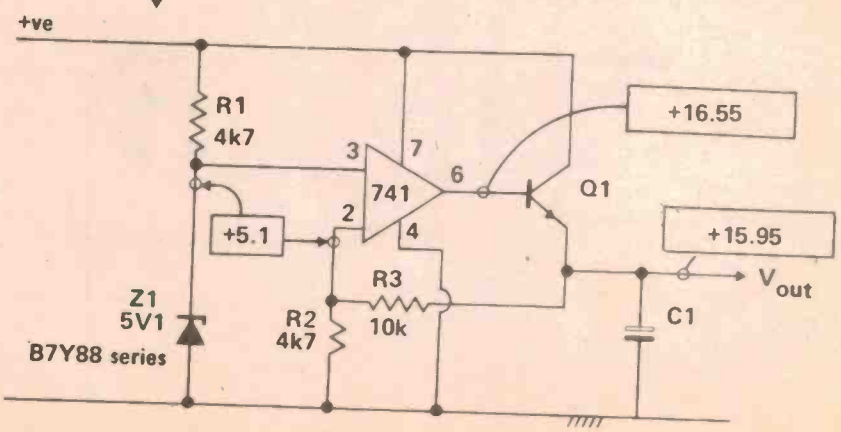


Note: $R_3 = \frac{R_1 R_2}{R_1 + R_2}$ for minimum temperature drift.

R_3 may be eliminated for minimum component count.

Regulated Power Supply

Sometimes it is necessary to make a simple power supply using discrete components when a non-standard voltage is required. The circuit shown uses all the basic elements of a voltage regulator; that is, a reference voltage ZD1, an error amplifier and a series control transistor Q1. The zener diode , ZD1, sets up a reference voltage of 5V1. This diode has a temperature coefficient of -1.2 mV/°C (a 5V6 zener is best at -0.2 mV/°C). The resistor ratio of R3 and R2 sets the output voltage and the op amp provides the error correction (regulation). C1 is used to reduce the output impedance at high frequencies.



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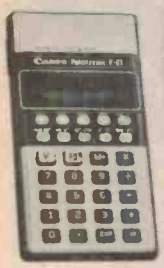

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LEARN TO MIX

DO YOU REALLY want to be a studio engineer – or do you just like playing with knobs?

An organisation in Sydney called the Academy of Sound Recording Engineers is offering a part-time course for people who seriously want to learn what studio engineering is all about. John Burnett and Steven Penning, both professional engineers, started the course about eighteen months ago, although they spent about a year before that planning it.

The Course

The content of the course is intended to teach those with at least School Certificate or Intermediate level Maths and Physics all that they will need to know to get a foothold in the industry. However, Steven Penning pointed out to us that "No course can make a fully-fledged audio engineer – that's not a realistic claim. There's *no* substitute for experience."

The course covers all the theory which is required and gives practical tuition in such diverse fields as architectural acoustics and studio management.

The course takes a year to complete, with three ten-week semesters:

Semester 1 – two three-hour lectures per week, covering terminology, specification of equipment, methods and procedures of studios and equipment, acoustic theory, physchoacoustics and basic electronics.

This part of the course is intended as a 'get you started' section to bring everyone up to the same standard.

Semester 2 – one three-hour lecture per week plus practical studio time, with the accent on studio production techniques, studio management, practical sessions involving the recording of groups and artists, multi-track mixdown, preparation of master tapes for record pressing, commercials and TV, publishing and copyright laws.

This ends the course for about half of the students – semester 3 requires a fairly high level of maths and some students are discouraged from taking it. The first two semesters will, however, provide a good grounding in the subject.

Semester 3 – two three-hour lectures per week on applied engineering, design and modification of studios, auditorium acoustics, sound reinforcement, concert PA, advanced physics, architectural acoustics, materials for sound damping in industrial applications, electronic circuit operation and design.

The organisers recommend that two outside courses – effective communication and music theory – be taken in conjunction with the course.

The Students

The course ran with thirty students last year. The cost per student is $900 for the entire course and is payable as the course continues. This includes notes, books etc. The fact that not one of the students dropped out last year indicates the popularity of the material taught.

The people who the organisers hope to attract include those who wish to follow a career in studio work, those who are in contact with studio recording already (in an advertising agency, for example) and wish to learn more about it, and those who just want to learn about it out of interest.

The group hope to run a series of short courses purely on electronics in the near future. They also see the possiblity of commissioning a purpose-built studio with learning facilities.

When we visited the existing studio we were very impressed with the standard of material taught and the way in which it was presented. We feel sure that the courses offered will prove very popular and useful.

Further information can be obtained from: The Academy of Sound Recording Engineers, Tin Pan Alley Studio, 54-56 Alfred Street, Milsons Point, Sydney 2061. Tel: 922 6301.

TEST GEAR

- metering and power supply projects

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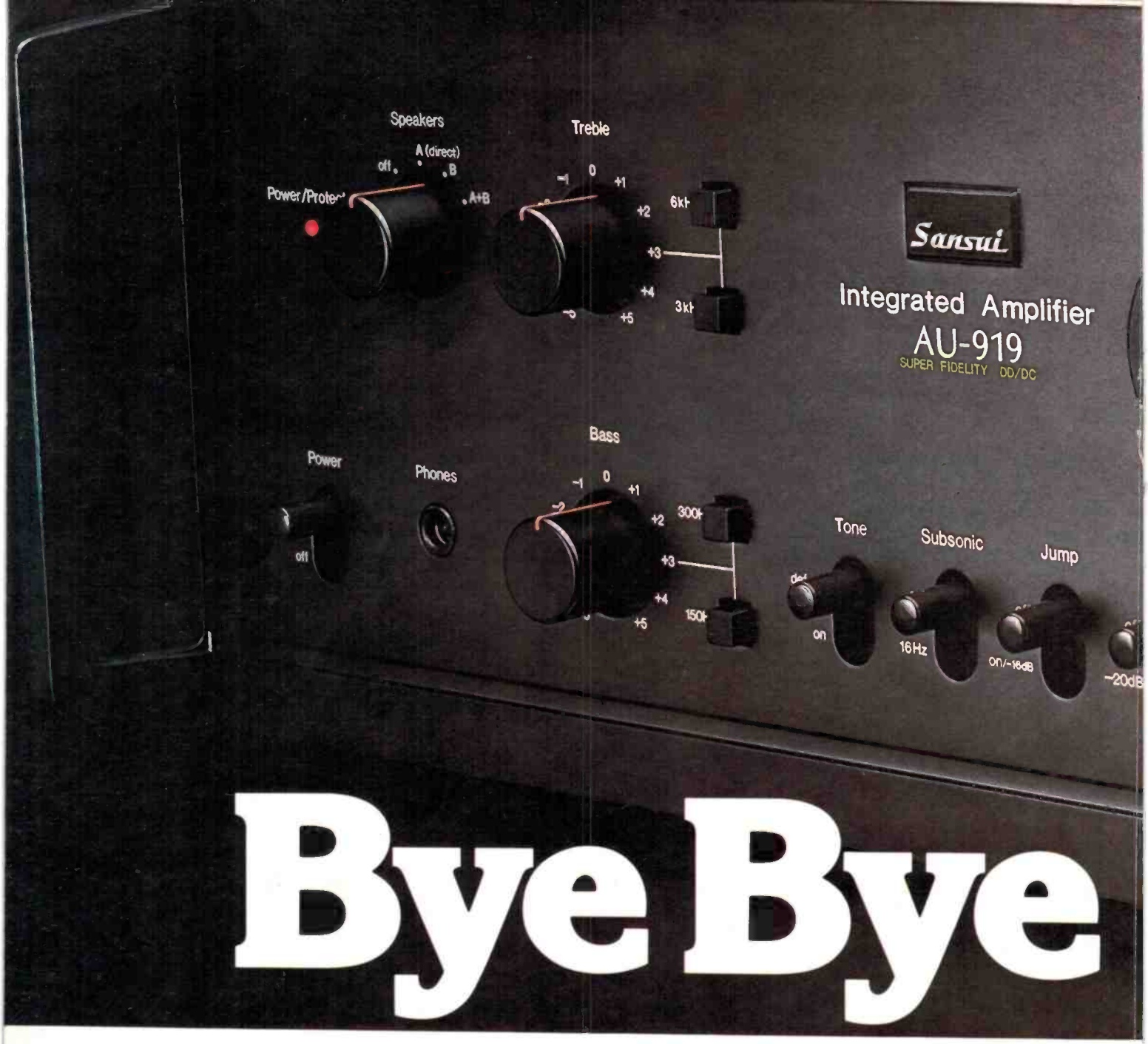

Bye Bye

Sansui's new DC amplifier has the best slew rate and rise time for the lowest TIM known to Tom, Dick or Harry.

TIM — transient intermodulation distortion — is probably the most important neglected distortion in today's quality amplifiers. That's why Sansui engineers went beyond ordinary specs to analyze and virtually annihilate TIM.

Why the ordinary way wasn't good enough

Ordinarily, a steady simple sine wave is used to test amplifiers. But it's not a realistic method because music consists of complex, dynamic signals. And Sansui is nothing if not realistic.
Sansui research showed that poor response to complex pulsive signals caused clipping and TIM. Obviously a new design approach was essential for truly superior reproduction of the original sound.
The new design is exemplified by Sansui's PAT. PEND. Diamond Differential DC circuit (or DD/DC). The results are simply extraordinary.

Why hundreds of watts may not be enough

Remember we said that TIM is primarily caused by poor amplifier response. If an amplifier cannot respond rapidly with high stable current to a sudden pulsive signal (a sudden trumpet blast, for example), serious distortion occurs. And it occurs regardless of how many hundreds of watts a "muscle-bound" amplifier may have.
Sansui discovered that the conventional notion of "transient response" was far too vague to be of much help. More careful in-depth analysis revealed that response could be accurately measured by slew rate and rise time. Slew rate tells you how many volts can be delivered in a micro-second and rise time is how long

it takes for a 10 to 90 percent rise of the peak voltage of the square wave input.

In a nutshell, slew rate and rise time tell you how much and how fast an amplifier responds to a signal.

New standards for amplifier performance

Here are the proven effects of the unique DD/DC circuit used both in the power amplifier and phono amplifier of the AU-919. Slew rate is 200V/μ sec. — the highest in the world. Rise time is 0.5μ sec. — the fastest in the world.
And to perfectly complement such unparalleled response to pulsive dynamic signals is the AU-919's frequency response — better than DC to 500,000 Hz — the widest in the world. And THD at full rated output is 0.008% — the lowest of any amplifier you can buy.

Closer to perfection

These four accurate and verifiable specifications assure virtual elimination of TIM. They assure you of clearer and more accurate reproduction of even the most complex nuances of recorded sound. With exclusive Diamond Differential DC circuit design, the "Straight DC" AU-919 integrated amplifier comes closer to theoretically perfect performance than any other comparable unit.

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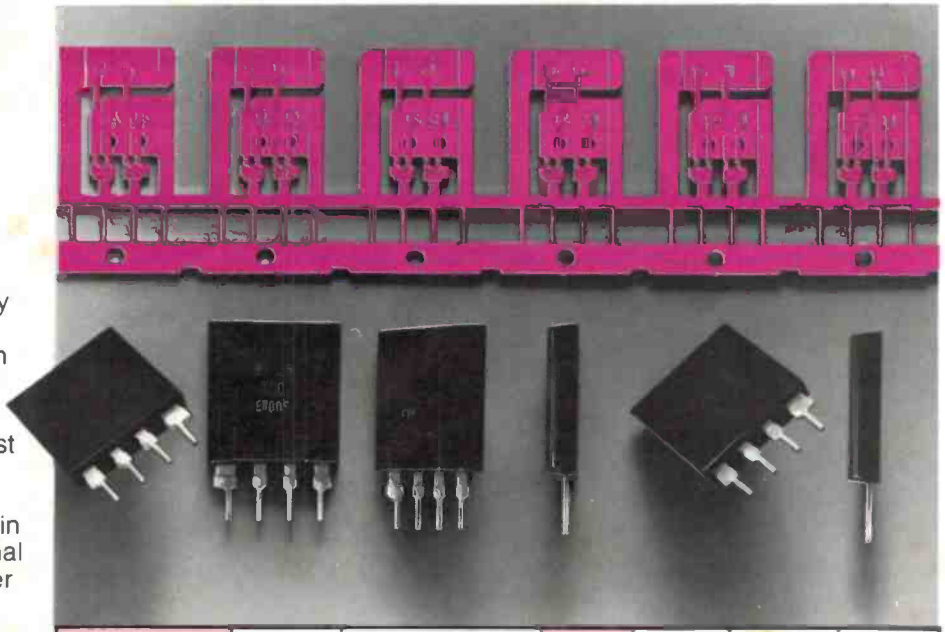
Electronic Components and Materials

PHILIPS

New SLIM series of rectifier bridges to reduce PCB size.



The new BY224 and BY225-series of full wave silicon bridge rectifiers have a thickness of only 5.5mm. This means *your* new equipment designs can cut down on PCB space needed for the older type bridges.

These bridge rectifiers consist of four double-diffused diode crystals assembled on a copper comb, and plastic encapsulated in a SOT-112 package. Their internal construction, in which the copper comb is in close proximity to the back of the device, makes them suitable for operation with a heatsink (using clip 56366).

The smaller Philips bridges BY164 and BY179 and the Mullard BWY44 to 47 series complement the BY224 and BY225 series to provide an extensive range of bridge rectifiers for both PCB and bolt-down mounting.

For older equipment the Mullard OSH series remains available.

	Type No.	'OSH' type superseded	Encapsulation	Input voltage $V_{(RMS)}$ max.	Repetitive peak input voltage V_{RM} max.	Non-repetitive peak current I_{FSM} max.	Average output current $I_{O(AV)}$ max.
PCB MOUNTED TYPES	BY179	–	All-plastic module (SOD-28)	280V	800V	25A	1A
	BY164	–	All-plastic module (SOD-28)	88V	120V	25A	1.4A
	BY224-400 -600	–	Plastic module with heat-sink face (SOT-112)	280V	400V 600V	85A	5.5A
	BY225-100 -200	–	Plastic module with heat-sink face (SOT-112)	88V 88V	100V 200V	100A	4.2A
BOLT-DOWN TYPES	BYW44-200 -400 -600 -800	OSH03-200 -400 -600 -800	Plastic single-hole fitting	140V 280V 420V 560V	200V 400V 600V 800V	40A	4A
	BYW45-200 -400 -600 -800	OSH05-200 -400 -600 -800	Plastic module two-hole fitting	140V 280V 420V 560V	300V 600V 900V 1200V	75A	6A
	BYW46-200 -400 -600 -800	OSH07-200 -400 -600 -800	Plastic module two-hole fitting	140V 280V 420V 560V	300V 600V 900V 1200V	75A	8A
	BYW47-200 -400 -600 -800	OSH10A-200 -400 -600 -800	Plastic module two-hole fitting	140V 280V 420V 560V	300V 600V 900V 1200V	180A	12.5A

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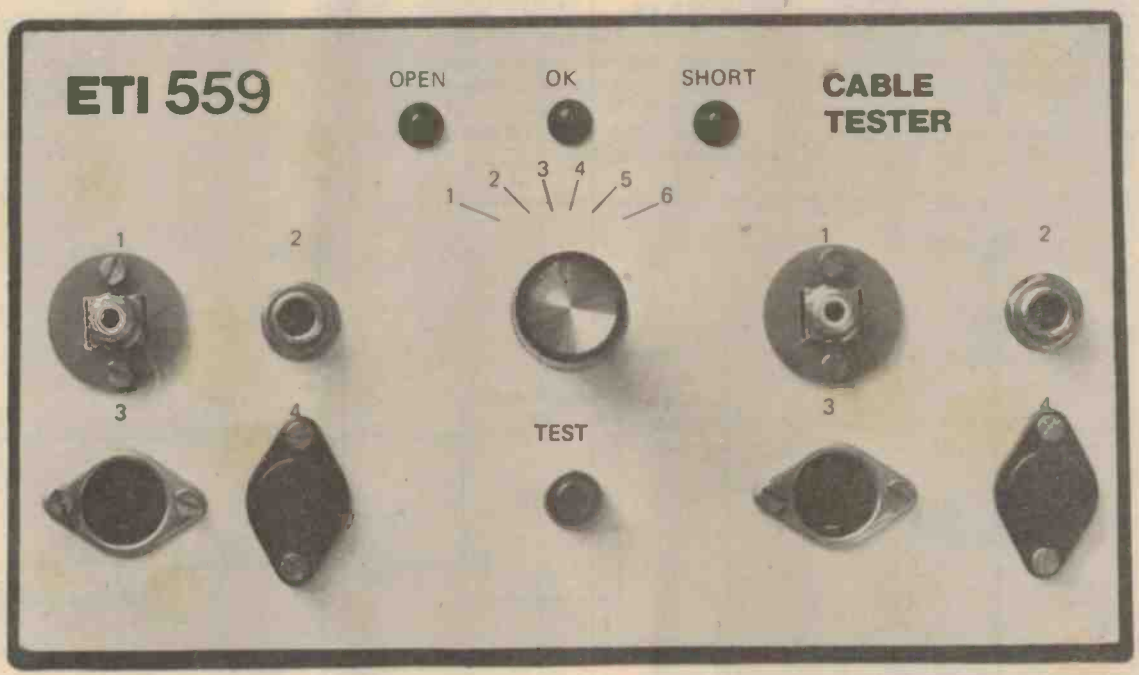
Cable Tester

Quickly test audio cables with this ingenious project.



ALMOST ALL THE faults in an audio system are caused by cables. Have you ever tried to find which cable is broken among the many connections in a stage audio system, especially with anxious people looking over your shoulder?

The answer is to check each cable before the performance, a rather tedious business.

This Cable Tester checks each wire in turn for both open circuits and short circuits to earth. Each cable can then be thoroughly tested before use and hopefully faults can be found before they cause problems.

The circuit makes cunning use of a 7474 dual D flip flop to light one of three LED's after the test switch is pushed, indicating short, open, or OK.

Construction

The unit is mounted on a standard plastic box measuring 196 x 113 x 60 mm. If it is to be used on-stage, then use the strongest box you can find, such as diecast aluminium.

Wiring the switch is the only difficult part of the construction. Note that some of the switch contacts are linked together as shown in table 1. The transformer we used is a commonly available Ferguson pcb mounting type.

The sockets we have chosen for the prototype are the most common type, however there is no reason why others can't be subsitituted. The jack plugs, J1, 2 and the RCA sockets SK1, 2 must be insulated from the metal front panel, or the earth connections will be permanently connected together through the panel. RCA sockets are available with insulating mountings, while insulating washers can be made from plastic sheet for mounting the jack sockets.

HOW IT WORKS - ETI 559

To understand the operation of the cable tester refer to the simplified diagram and the truth table in fig. 1.

IC1 is a 7474 dual D flip-flop with its clock (CLK) and D inputs held at 0V.

First lets assume an open circuit cable. ZD1 conducts, as it has 12 V across it, and turns on Q2, which holds the preset (PR) input on IC1/1 low. The PR input of IC1/2 remains high because ZD2 is not biased. When the test switch is pressed, putting a 0 on the CLR input, the outputs of IC1/1 become: Q, high; Q low. When the test switch is released, leaving both the CLR inputs high, the following outputs are obtained: IC1/1 - Q, high; Q, low; IC1/2 - Q, low; Q, high. Since the output of Q, IC1/1 is low, Q3 is turned off. Therefore LED1 is on, LED2 is off, and LED3 is off.

Now let's look at the 'short to earth' condition. The 12 V rail is shorted to earth through D1 (exit one diode). Q2 is turned off leaving the PR input of IC1/1 high. The PR input of IC1/2 is held low. When the test button is pressed the outputs of IC1/1 go: Q, low; Q, high. When the button is released, placing a high on the CLR inputs, these outputs remain the same. The outputs of IC1/2 are: Q, high; Q, low. Therefore LED1 is off, LED2 is off because the base of Q3 is held low by IC1/2, and LED3 is on, indicating a short.

Finally, if the cable is OK, the voltage across ZD1 is held at 3.3 V by ZD2. Q2 is off because ZD1 (6.8 V) is not conducting. The PR input of IC1/1 is left high and the PR input of IC1/2 is also high. When the test button is released the outputs of IC1/1 go: Q, low; Q, high. The outputs of IC1/1 go: Q, low; Q, high, when the button is pushed and remain the same when it is released. Both the Q outputs are low so LEDs 1 and 3 are off and the Q outputs are high so Q3 is conducting and LED2 is on.

The only difference between this circuit and the final circuit is that D1 in the simple circuit has been replaced with a FET constant current source, Q1. SW1 selects the wires to be tested and a power supply has been included.

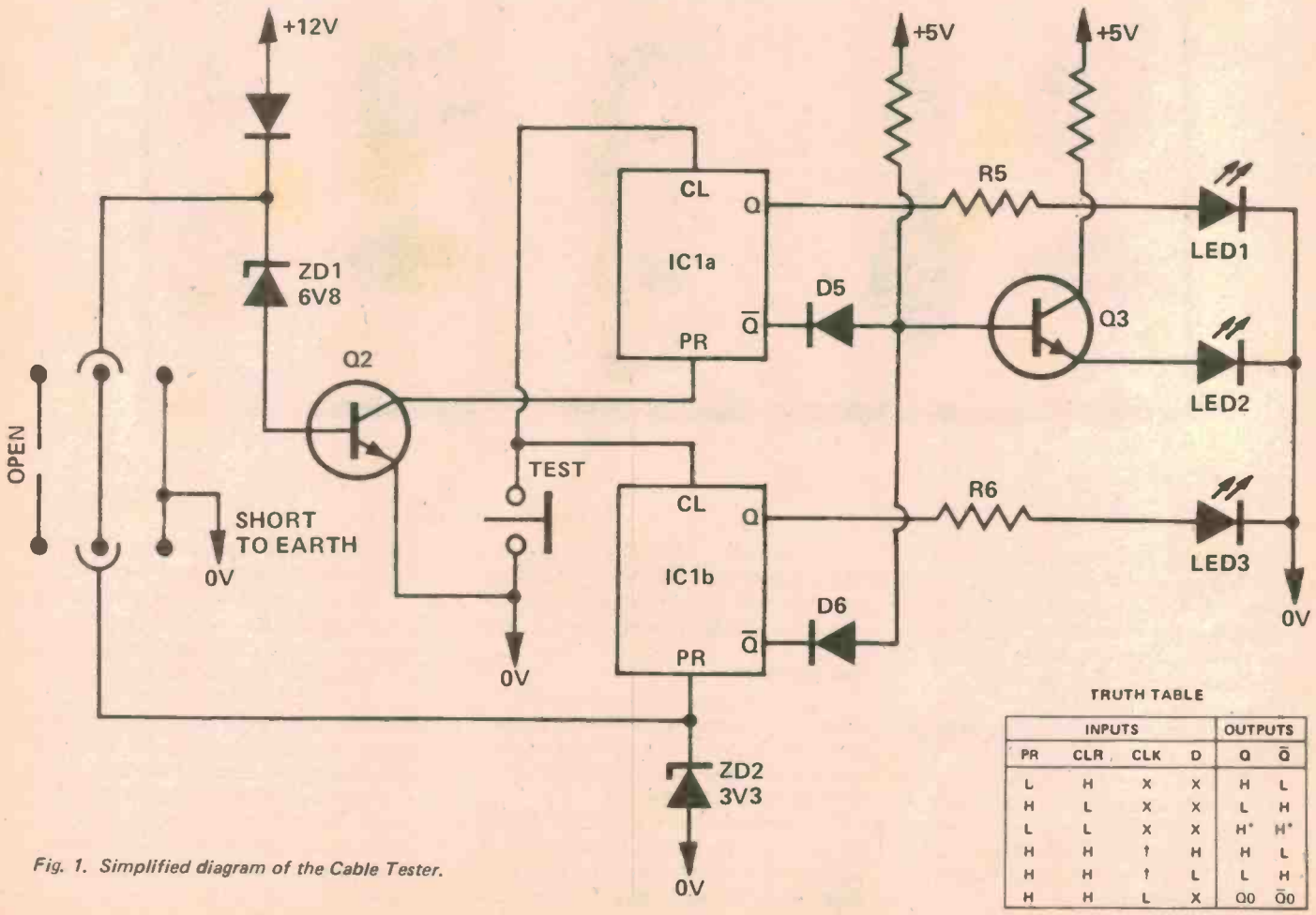


Fig. 1. Simplified diagram of the Cable Tester.

TRUTH TABLE

INPUTS				OUTPUTS	
PR	CLR	CLK	D	Q	Q̄
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	H*	H*
H	H	↑	H	H	L
H	H	↑	L	L	H
H	H	L	X	Q0	Q̄0

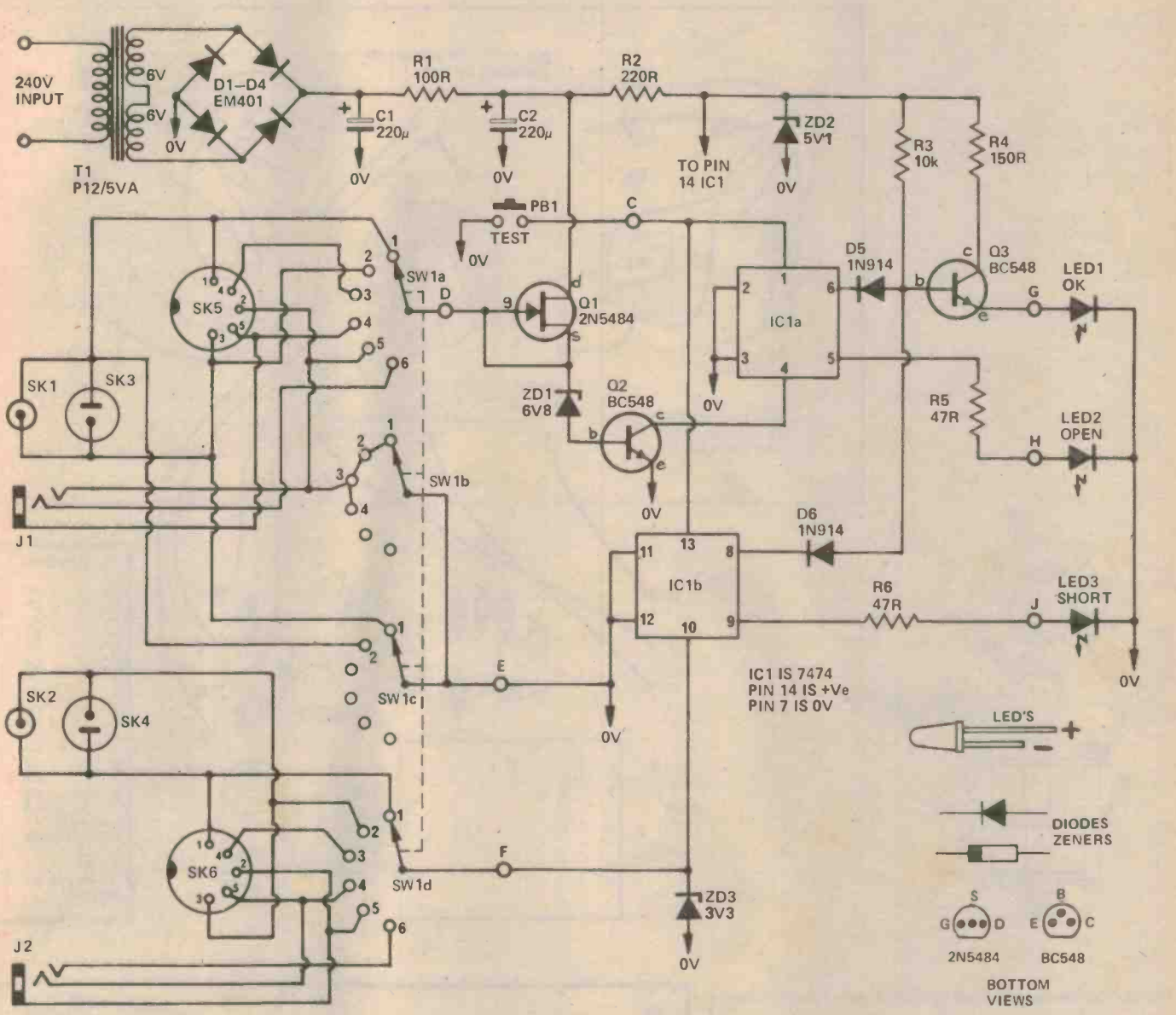


Fig. 2. Final circuit of the Tester.

PARTS LIST - ETI 559

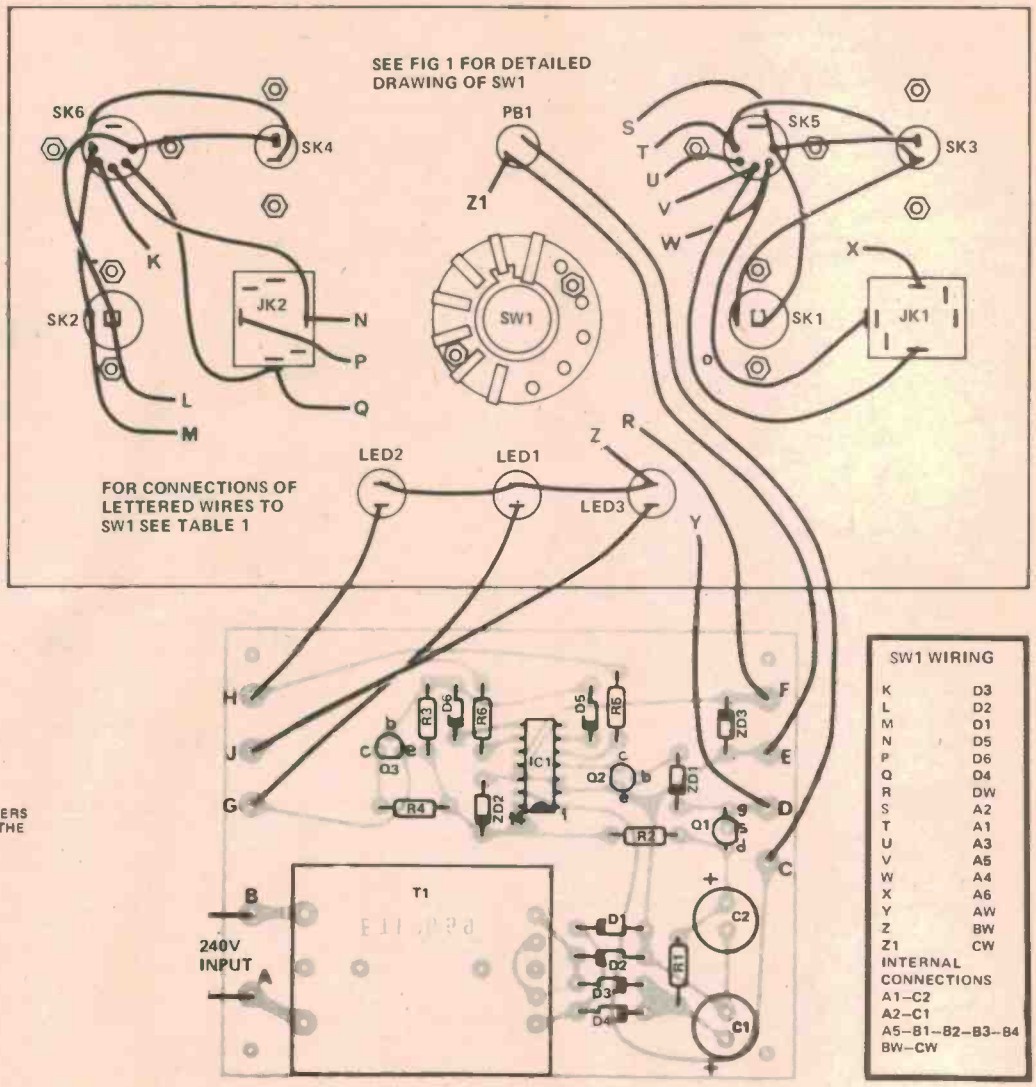
Resistors all ¼W, 5%
- R1 . . . . . 100R
- R2 . . . . . 220R
- R3 . . . . . 10k
- R4 . . . . . 150R
- R5 . . . . . 47R
- R6 . . . . . 47R

Capacitors
- C1. . . . . 220µ 25VW
- C2. . . . . 220µ 25VW

Semiconductors
- IC1 7474
- Q1 . . . . . 2N5484 FET
- Q2, 3 . . . . . BC548 or equivalent
- D1-D4 . . . . . EM401 or equivalent
- D5-D6 . . . . . IN914 or equivalent
- ZD1. . . . . 6V8 400 mw zener
- ZD2. . . . . 5V1 400 mw zener
- ZD3. . . . . 3V3 400 mw zener
- LED1-LED3. . . . Red LEDs

Sockets
- SK1, SK2 . . . . . RCA Socket
- SK3, SK4 . . . . . 2 pin DIN socket
- SK5, SK6 . . . . . 5 pin DIN socket
- J1, J2. . . . . Stereo jack socket

Miscellaneous
- SW1. . . . . 4 pole 6 pos OAK switch
- T1. . . . . Ferguson P12/5VA transformer
- PB1. . . . . miniature momentary contact pushbutton
- pcb . . . . . ETI 559
- Box to suit (195 x 110 x 60 mm); Power cord, plug, etc.



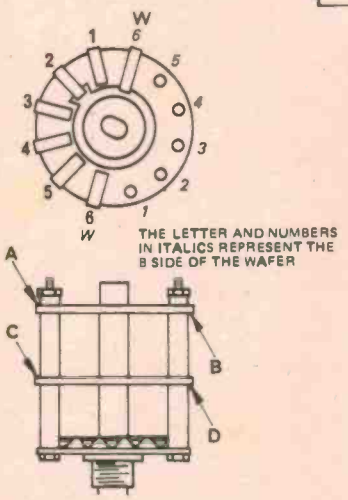


Fig. 3. Component overlay and front panel connections.

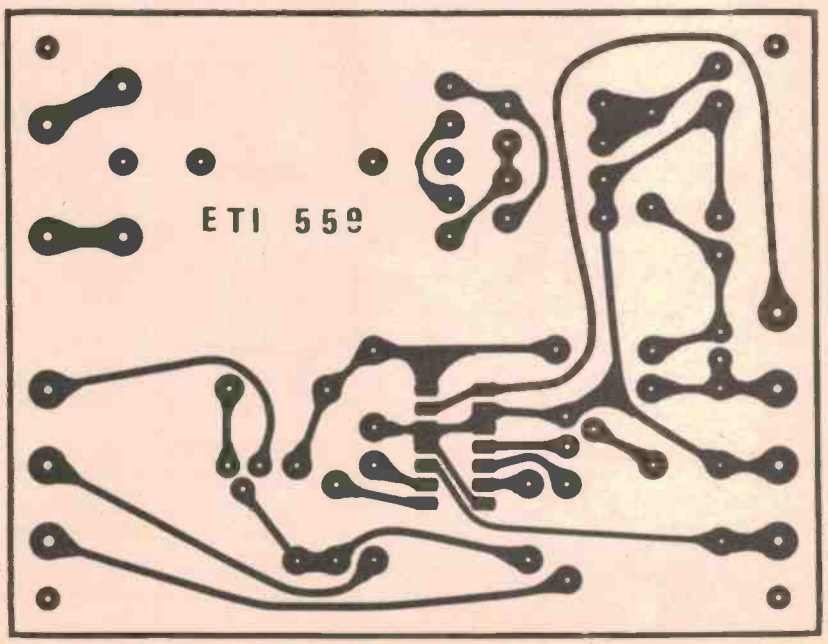


Fig. 4. Printed circuit board pattern (full size).

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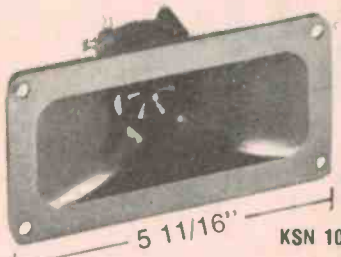

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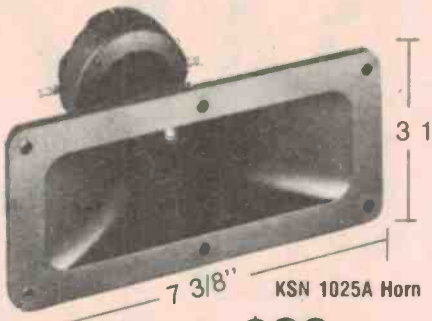

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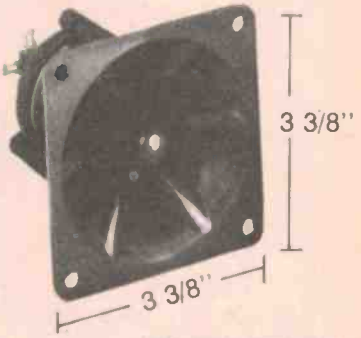

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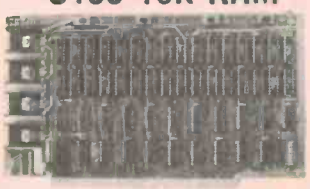

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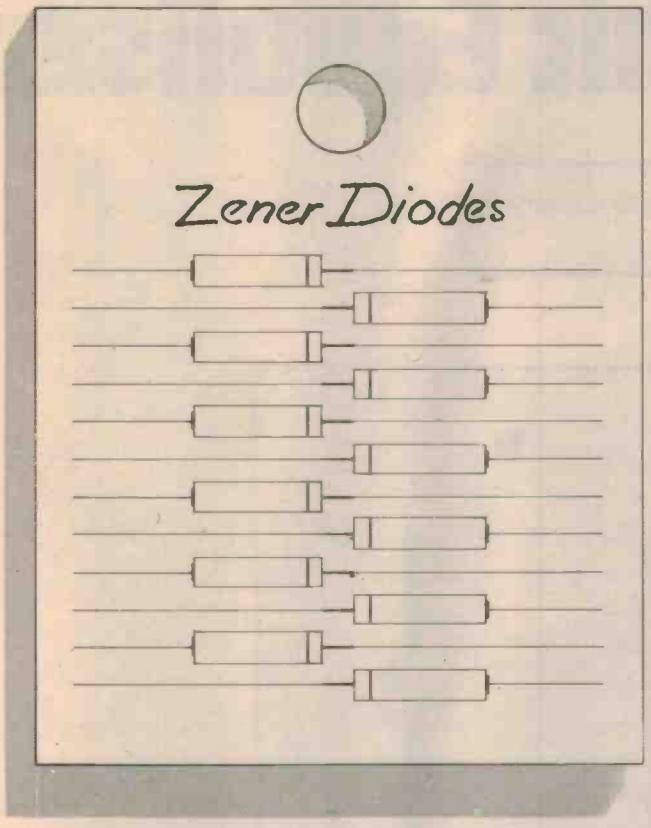

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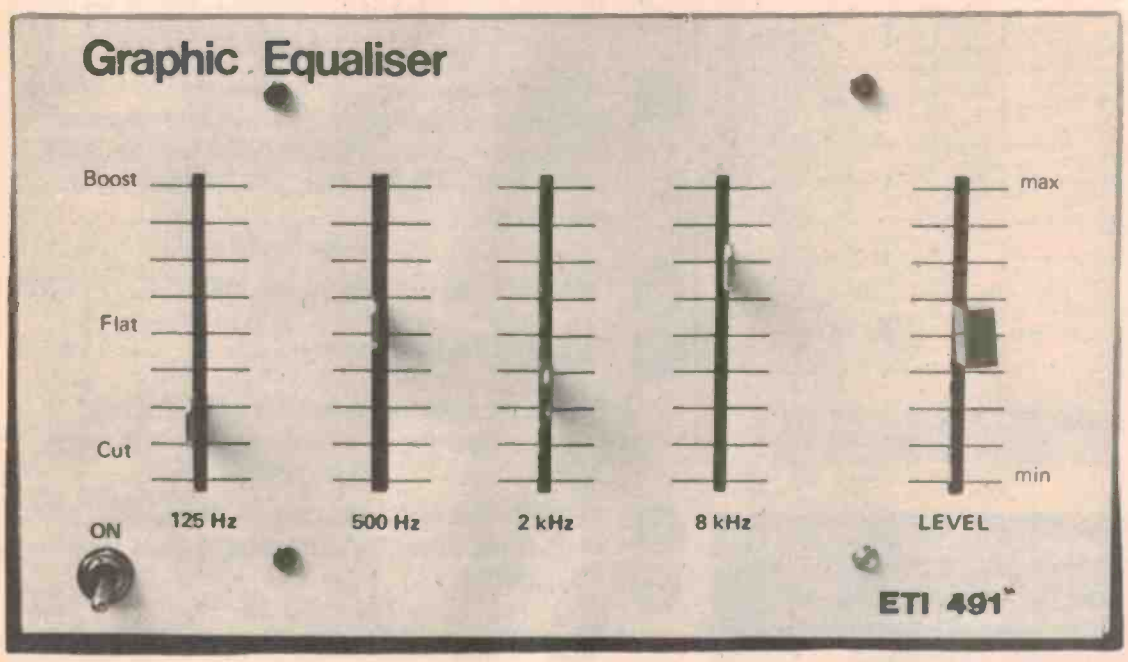
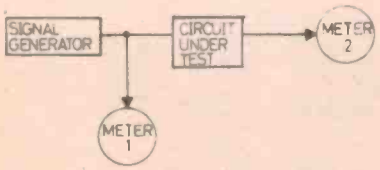


A GRAPHIC WHAT, you ask? A graphic equaliser is a complex form of tone control. It can be used to smooth out the frequency response of a hi-fi, or as a guitar effects unit. In fact, it will prove useful in any audio application.

Frequency Response

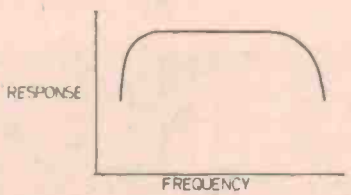
In order to explain how the equaliser works, here is a quick explanation of the term 'frequency response'.

Say we take a circuit and set it up like this:



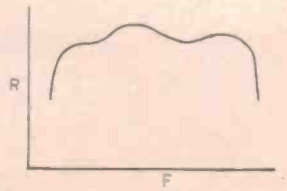
The ratio of the reading of meter 1 to the reading of meter 2 is called the response of the circuit. If the generator frequency is varied, the output reading on meter 2 varies because the circuit behaves differently when fed with different frequencies. If this ratio of input to output voltage is plotted against frequency, the resulting graph is called a Frequency Response Curve.

The frequency response of a typical amplifier looks something like this:



The central section of the curve is fairly 'flat' but when it comes to the very high or very low frequencies it rolls off as the circuit under test finds it difficult to maintain its output at these frequencies, reducing the reading on meter 2.

Once the signal from the amplifier has been passed to the speaker (which has its own frequency response as well), the response of the system overall may look like this:

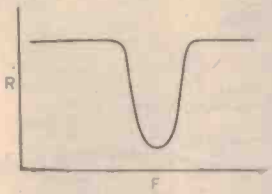


This will be further modified by the response of the room where the hi-fi is – even your curtains have a response curve! By the time the signal finally reaches your ears the overall response will be fairly well mangled.

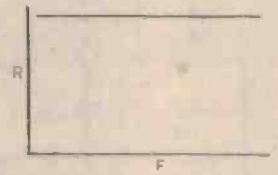
An equaliser is a device for correcting (equalising) the frequency response of a system.

Ironing out the Bumps

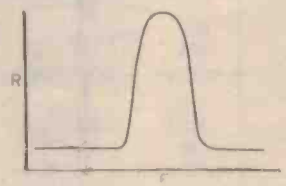
Say, for instance, that the frequency response looked like this when it reached you (rather exaggerated, perhaps!):



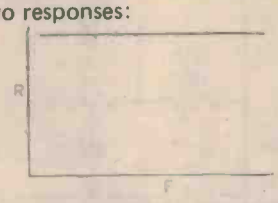
and we would of course like it to look like this:



If we have a device (called an equaliser) which has a response like this (the opposite to the one we wish to correct):



and we put it in series with the system, the overall response would be the sum of the two responses:

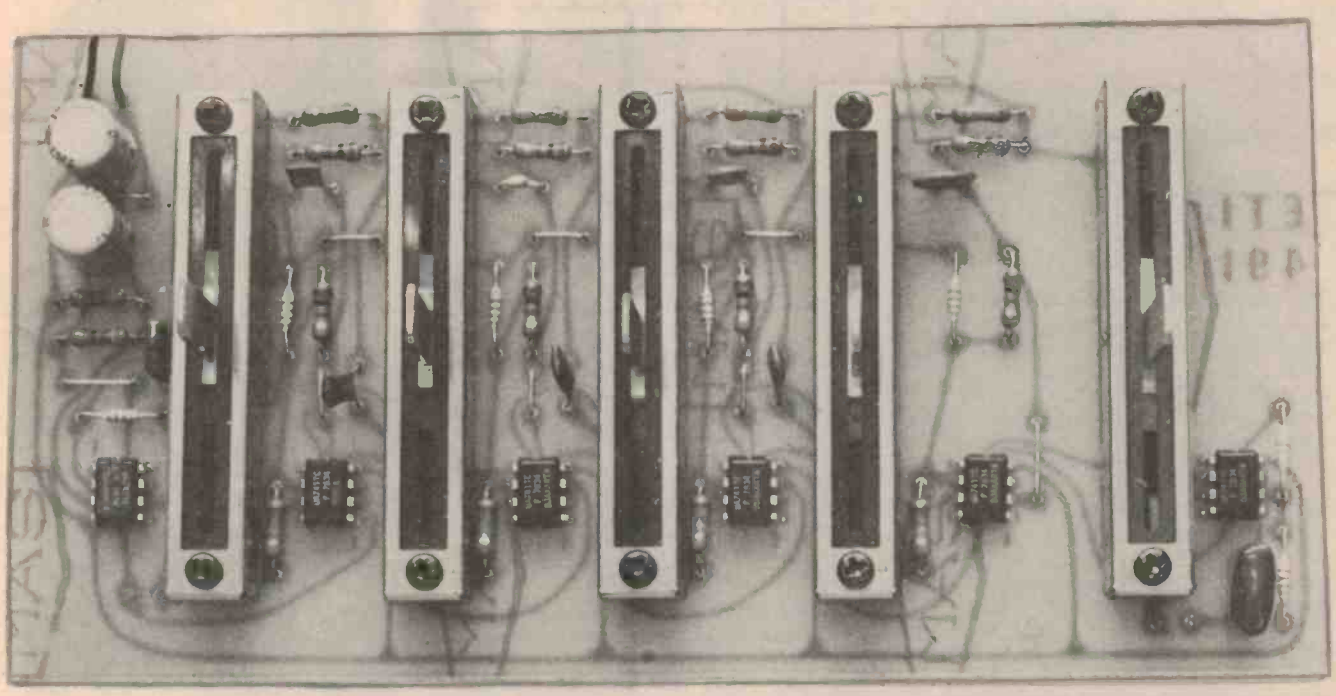


In this way we can take any system, be it a microphone, a telephone line or a hi-fi system, and iron out the variations in its response.

There are two ways of finding the correct equaliser settings. One is to measure the system response curve and design a custom equaliser to correct it. This is fine if you are prepared to do all the sums and build a complete new unit for each different application. The other is to build a device which has a variable response which can be adjusted to give the desired effect.

The way this is usually done is to build a unit which will split the incoming signal into a number of frequency bands and then remix these in the desired ratios. This will give the device a number of plateaux on its response curve, all of which can be moved up or down independently of each other to give an approximation to the desired shape.

An equaliser of this type is called a graphic equaliser if the controls which determine the positions of the plateaux are of the 'slider' type. The positions of the control knobs will then look like the frequency response graph of the equaliser.



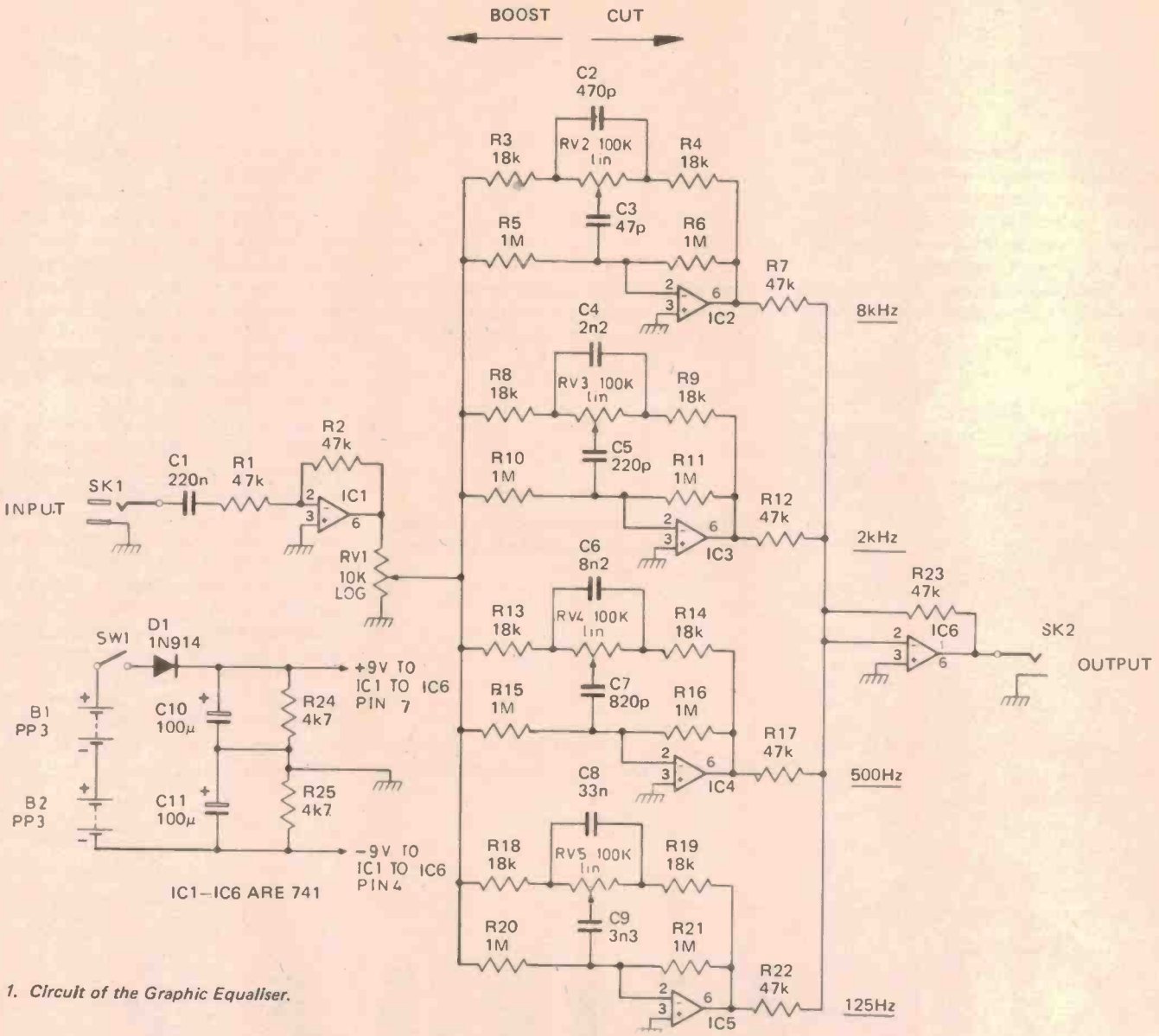


Fig. 1. Circuit of the Graphic Equaliser.

How It Works - ETI 491

The input to the unit is decoupled (to remove DC) by C1 and fed into IC1, which acts as a 'buffer' - it can be driven from a source with a very small current capability, which would be incapable of providing enough input otherwise. The output of IC1 is sufficiently powerful, however, to drive the rest of the circuit.

The output from IC1 is fed (via RV1, which controls the overall volume) to the four filter stages (ICs 2, 3, 4 and 5). These each respond to a particular frequency band and their output levels are adjustable by means of RVs 2, 3, 4 and 5. The outputs from these filters are summed by IC6, which acts as a virtual earth mixer. The "-" input is held at zero volts by virtue of the feedback through R23 and so the output of the unit is the inverted sum of the voltages at the outputs of the filter ICs.

The individual filters work as follows: the feedback will cause the output to be equal to the input times $(-Z_f/Z_{in})$, where Z_f is the impedance from the output to the "-" input and Z_{in} is the impedance from RV1 to the "-" input.

This is the same situation as in the buffer - IC1. In its case, Z_{in} = 47k and Z_f = 47k. Thus the output is -1 times the input (i.e. the signal will be 'inverted' - it will *sound* the same, though).

In the filters, if the variable resistor is at mid-position, with an equal resistance between the wiper and either end, then $Z_{in} = Z_f$. Thus each filter will pass all frequencies with output = -1 x input when the slider is in mid-position.

When the slider is at the left-hand end on the circuit diagram, however, the impedance of the capacitors will cause the gain of the filter (gain = output/input) to vary with frequency in such a way as to increase the gain in a particular frequency band.

Similarly, moving the slider to the other end of the potentiometer will cause the same band of frequencies to be attenuated.

Thus, by moving the slider from one end to the other, the response of the filter to its particular frequency band can be changed. As the output is the sum of all the filters' outputs, the overall frequency response of the unit will follow the shape the sliders make on the front panel - pushing one of them up will boost that particular frequency band.

Construction

All components, except the power switch, are mounted on the pcb. Take care to insert the electrolytic capacitors and ICs the right way round.

Use the front panel drawing to mark out the cutouts for the slide potentiometers. The cutouts can then be made by drilling small holes, as close as possible to each other, down the marked line. A small rat-tail file can then be used to file down the length of the cutout and a thin wide file to smooth the edges. They can be fairly sloppy as the front plate will hide any roughness.

The pcb can then be mounted off the front panel with four screws and 20 mm spaces. The positions for these screws are shown as black dots on the front panel and pcb artwork.

We used phono sockets for the input and output connections, however any other connector is suitable.

All components are easily obtainable except the slide potentiometers which we obtained from Radio Despatch Service in Sydney.

Operation

The input to the equaliser should be of a fairly high level, say between the pre-amp output and the main amplifier input. The output from a microphone or guitar would be too low for acceptable performance.

The sort of effects you can get from this unit are a telephone line (with the 500 Hz slider up and the rest down), a shout from a long way off (with the 8 kHz slider up and the rest down), or just a simple bass boost (with the sliders forming a diagonal up at the left).

Of course, by trying the unit yourself, you can adapt it to new applications or use it in conjunction with other effects units to provide a versatile addition to your effects equipment.

Hi-Fi

Naturally, if your hi-fi is stereo, you'll need two of these units. The ETI 485 Graphic Equaliser (June 77, Top Projects Vol 5), can be used for this application, however is more complex.

The unit should go between your pre-amplifier and power amplifier. The simplest way to adjust it is by ear, although it's not the most accurate method. You can reduce that annoying 'boominess' your speakers have always had, or boost the bass and treble and cut the middle from the signal from your tape recorder.

If you want to do it properly, however, you will need an Audio Spectrum Analyser such as the ETI 487 (Feb 78, Top Projects Vol 5). The equaliser is adjusted until the system's response to all frequencies is the same. Make sure the amplifier's tone controls are in mid-position.

This sounds simple enough — but remember that the room's response will change if you move the sofa or open the curtains — so first adjust these to their normal position. Also remember the neighbours!

PARTS LIST - ETI 491

Resistors all ¼W, 5%

R1, R2	47k
R3, R4	18k
R5, R6	1M
R7	47k
R8, R9	18k
R10, R11	1M
R12	47k
R13, R14	18k
R15, R16	1M
R17	47k
R18, R19	18k
R20, R21	1M
R22, 23	47k
R24, R25	4k7

Potentiometers

RV1	10k log Soanar slider pot
RV2, 3, 4, 5	100k linear Soanar slider pot

Capacitors

C1	220n greencap
C2	470p ceramic
C3	47p ceramic
C4	2n2 greencap
C5	220p ceramic
C6	8n2 greencap
C7	820p ceramic
C8	33n greencap
C9	3n3 greencap
C10, 11	100µ 25V electros

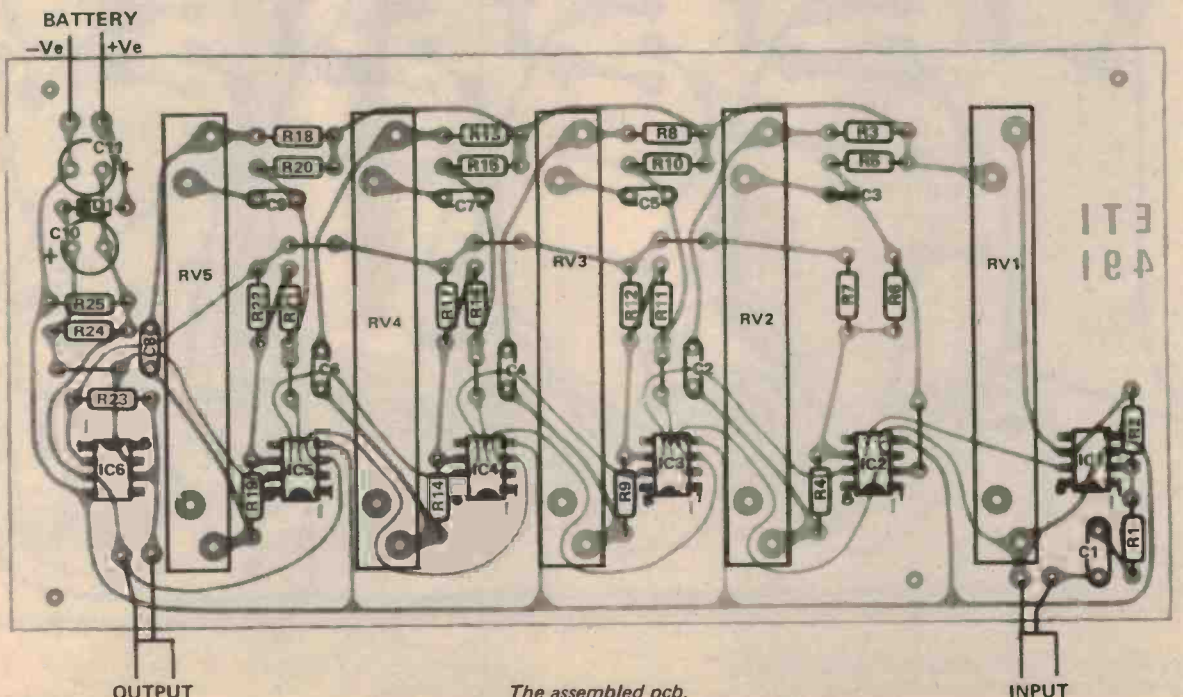
Semiconductors

IC1-IC6	741 8 pin DIL
D1	IN914

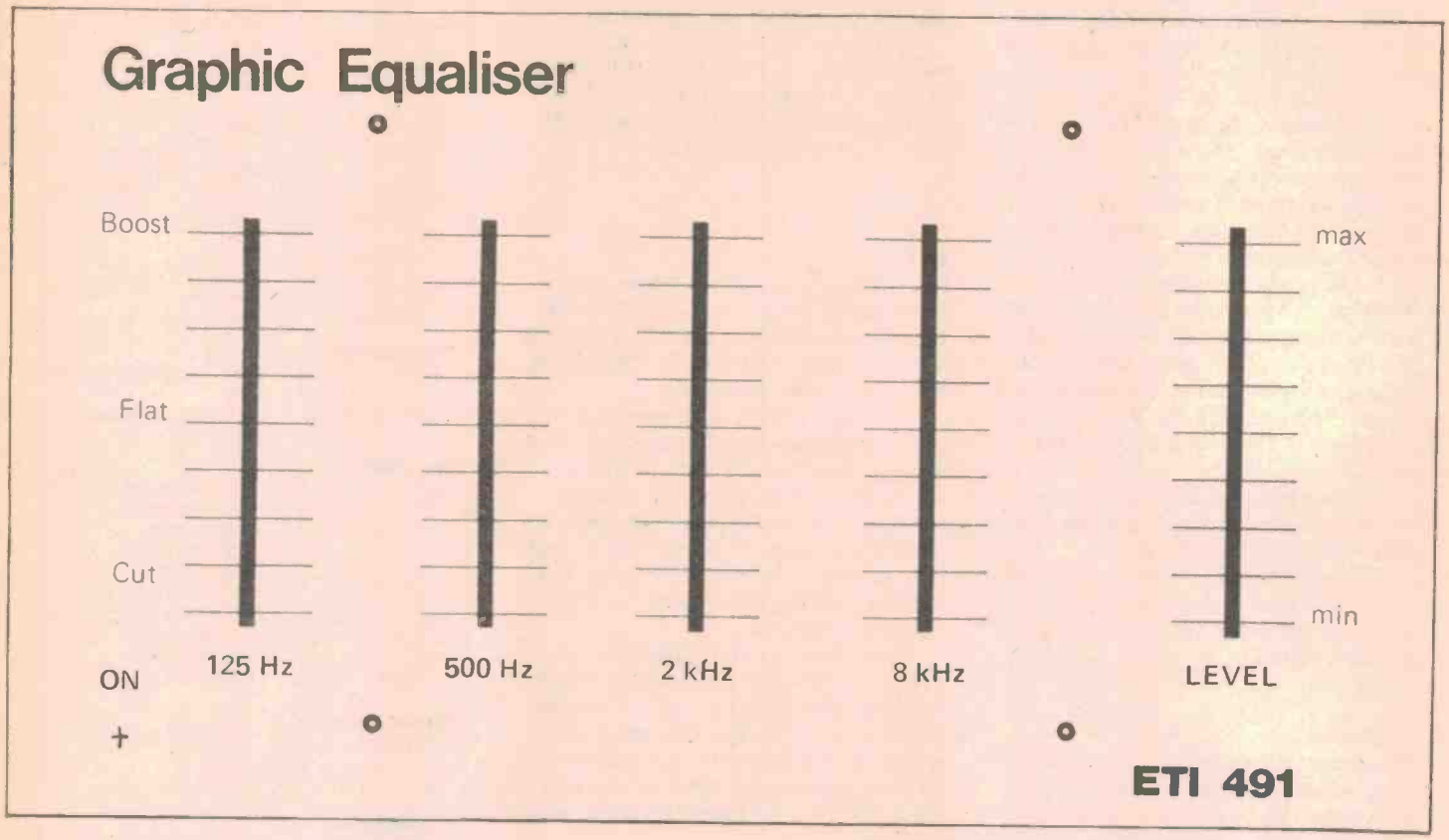
Miscellaneous

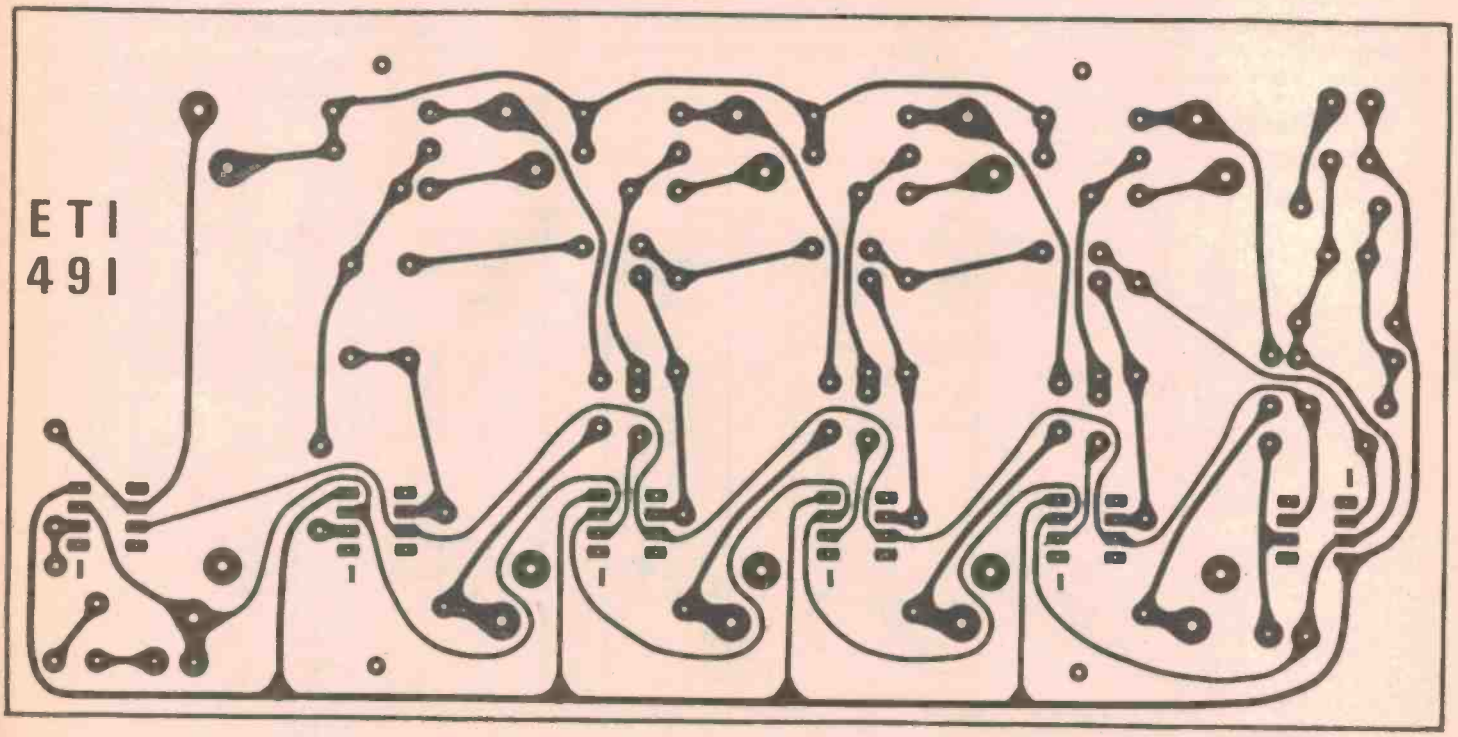
SW1	spst miniature toggle switch
SK1, 2	mono jack sockets
B1, 2	9V 216 batteries

Battery clips, box to suit (195 x 110 x 60 mm)
pcb - ETI 491, 20 mm spacers, slider caps



The assembled pcb.





Front panel and pcb layouts for the Equaliser, shown full size. Note the black pads on each for drilling the mounting holes.

SUPER SPECIALS

BD 139 — 50c ea.
BD 140 — 50c ea.
BC 547/8/9 — 15c ea.
10 555 Timers for $2.80
MJ2955 — 80c
2N3055 — 75c
BC 557/8/9 — 20c ea.
10 741's for $2.80.

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	.40
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
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741	.35
747	1.25
3900	.90
3909	1.25
CA3130	1.95

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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

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FND507 C/A	1.70
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FND 500C/C	1.40
Red LED	.22
Green LED	.35
Yellow LED	.35

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IN5625 5A 400V	45c

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18 PIN DIL	.55
24 PIN DIL	.70
28 PIN DIL	1.20
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Superboard II – a complete system on a board requires a 5 volt supply to be up and running.
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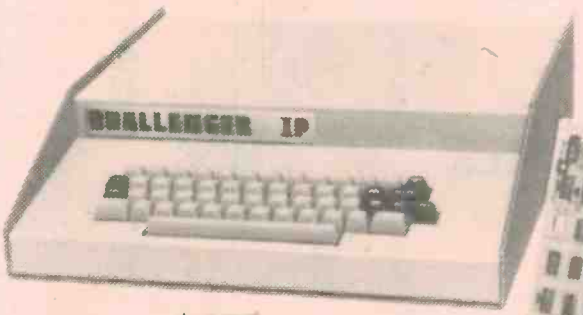
Both systems feature a 32 x 32 character display, 4K RAM on the board, Keyboard and ready-to-run BASIC-in-ROM.
Challenger I's are expandable with up to 32K of RAM, dual mini-floppies, and printer.



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TV set and cassette recorder not included.

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All systems include 4K RAM, a typewriter style keyboard, video output suitable for use with an RF convertor (not supplied) to a standard TV set, and the reliable Kansas City standard cassette system. Microsoft's 8K BASIC-in-ROM avoids lengthy loading from cassette and features full string manipulation, floating point and trigonometric capabilities. A machine code monitor in ROM, plus an Assembler allow access to machine code programming. A large range of programs are a available for education and entertainment. Contact us for further details.

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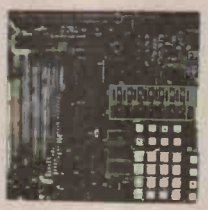

The ideal choice for the beginner, this is a complete Z80 system on a board. Includes 1k static RAM with sockets for another 1k, powerful 2k ZBUG monitor, extra PROM socket PLUS on-board PROM programmer. There's also a Kansas City standard cassette interface, hex keyboard and six digit display, twelve 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).

ALL THESE FEATURES FOR ONLY $249

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/O (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!

PRICES REDUCED: KIT $239

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VERSAFLOPPY FLOPPY DISC CONTROLLER — Controls both 8" standard and 5" minifloppies. Directly controls Shugart SA-400, SA-800; Persci 70 and 277; MFE 700/750 and CDC 9404/9406. Listings of control software are included in the price.

THE BEST VALUE IN FLOPPY DISC CONTROLLERS $159

assembled and tested 239

SHUGART FLOPPY DISC DRIVES

SA-400 5" minifloppy	$379	SA-400 cable	35
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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 on 2758 50

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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.

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

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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

(Power supplies shipped freight collect)

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.

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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.

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WAMECO, INC: CMB-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

Add 15 percent sales tax where applicable — we pay postage on pre-paid orders — orders accepted pre-paid or COD. Dealer enquiries invited.

SPECIAL OFFER!

16K S-100 RAM Card

S M Electronics are offering the 16K S100 RAM card featured in our last issue at a specially low price, to ETI readers.

The board is fully compatible with all other S100 projects which we have published and is well matched to our future S100 material - so it's a good idea to invest now in a bargain piece of equipment which will be compatible with many systems for a long time to come.

Some of the outstanding features of the S M Electronics kit are:

Fully S100 compatible — not 'pretend' compatible, as are many commercial units today
Independently addressable 4K blocks for system flexibility
Each 4K block is write-protectable
Standard Cromemco bank select
Selectable wait states for flexibility
450 ns access time (*300 ns* optional)
Gold plated edge connector
All holes *through-plated*
Fully buffered address and data busses
Phantom option
Reliable operation assured by the use of PDBIN strobe
Low power requirements - 1.2A (typ)
Kit assembled and sold only in *Australia*

The entire kit for a complete 16K S100 RAM board is available for $299 (plus 15% sales tax plus $5 registered postage). Other optional extras include 32 18-pin sockets (i.e. for the RAM chips only) - $13.80 inc. tax, a full set of sockets for every DIL chip on the board - $23.00 inc. tax, or faster (300 ns) memory chips - $36.80 inc. tax.

If you are seeking exemption from sales tax, please insert the tax free prices on the order form (RAM Card kit $299 + $5 p & p, 32 sockets $12, full socket set $20) and either a) enter a Tax Exemption Number and sign the order or b) attach a company order form giving details of your exemption claim or c) if you are a full-time student, attach the appropriate certificate, signed by your tutor.

NOTE: This offer is made by S M Electronics and ETI is acting as a clearing house for orders only. Cheques should be made payable to 'RAM Card Offer' and sent, together with the order form or a copy thereof, to 'RAM Card Offer', Electronics Today International, 15 Boundary Street, Rushcutters Bay, NSW 2011. We will then process the orders and send them on to the sponsor who will send out the goods by registered mail. Please allow four weeks for delivery — there could be a longer delay if you have ordered 300 ns memories. The offer closes on Friday, 20 April 1979 and is open to Australian readers only.

ORDER FORM

Electronics Today International, 15 Boundary Street, Rushcutters Bay, NSW 2011.

Please make cheques/money orders payable to 'RAM Card Offer'. Offer closes 20 April 1979.

Name: .....

Address: .....

..... Postcode .....

Please supply (state quantities):

..... RAM Card kits at $348.85 inc tax and registered p & p .....

..... 300 ns memory option, add $36.80 inc tax each .....

..... Sets of 32 sockets at $13.80 inc tax each .....

..... Full socket sets at $23.00 inc tax each .....

TOTAL: .....

I wish to claim sales tax exemption. My Sales Tax Number is .....

Signature: .....

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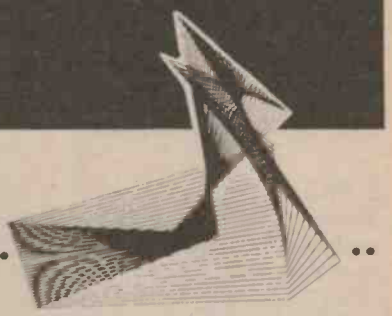
ETI's COMPUTER SECTION



NEWS

Speak and Spell Expanded

Texas Instruments has announced the first of several expansion modules for the Speak and Spell 'calculator'. The Vowel Power module stores 140 words in a 128 K ROM, divided up into short vowel sounds, long vowel sounds, two-letter 'blends' of vowel sounds and vowel-R sounds. The module will sell in the US for $15 and should be available here soon.

Looking for a Good Assembler

If you are looking for a really powerful assembler for the Z-80 or 8080 microprocessors, at last there is one that's got all the bells and whistles. The 14-Kbyte assembler includes a linking loader, library manager and cross-reference facility. Macro-80, from Microsoft, supports a complete Intel standard macro facility with nesting of macros limited only by available memory. Also included is a set of conditional pseudo-operations. Macro-80 is available as part of the Microsoft Fortran-80 package or is available separately. Microsoft software is available from several computer stores in Australia.

Oh, for an Aussie Ma Bell!

Those computer hobbyists in the States really do have it lucky! There's lots of lovely gear available for telecommunications applications, particularly for the S-100 bus. For example there are at least a couple of modems available (the Pennywhistle and D C Hayes designs); these are boards which let your computer talk to another for the exchange of programs, data or other messages. The latest gadget to come on the market over there is an S-100 board which interfaces a computer to a Touch-Tone telephone, letting it dial outgoing calls as well as answering the phone.

Once the computer has answered the phone, the person at the other end (assuming it is a person at the other end) can enter numbers into the computer by dialling them on the keypad of his phone. Couple this board with an S-100 speech synthesizer, and the applications are (to coin a phrase) limited by your imagination.

The question is, when will Telecom allow such beaut gadgets in Australia? I hope it isn't too long, or we'll all set solid from fossilisation ...

CMOS 6805

Motorola will soon release a scaled-down version of the 6801 single chip microcomputer, the 6805. The 28-pin package crams in 1 Kbyte of ROM, 64 bytes of RAM, 20 I/O lines, clock, timer and A/D converter.

Shortly after the release of the 6805 will come a CMOS version of the IC which will be pin-for-pin compatible. Look for processors like this to appear in low-cost portable equipment with some degree of intelligence.

32K Static RAM Card

A 32 Kbyte static RAM card for the Motorola bus is now available from *Semcon Microcomputers* of *1 Chilvers Road, Thornleigh, NSW 2120.* The Semcon 7932 uses 2114 memories to give a typical power consumption for the fully populated board of only 2.5A at 5V. The access time is 300 ns.

The board includes provision for decoding an extra four bits of address for page select logic, allowing expansion of memory beyond 64K. The board also allows disabling of the RAM during address changes, to avoid conflicts with dual processor systems or direct memory accesses during the 6800 phase one. Prices start at $245 for the kit with 8K of RAM up to $599 for a fully populated, assembled board.

MDS Loses Title

Microcomputer Development Systems such as the Motorola Exorcisor and Intel's Intellec have become known throughout the industry by the generic term MDS. Now however, Mohawk Data Sciences has decided to enforce its

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.

ownership of the MDS trademark, and Intel has agreed to withdraw a trademark application for the symbol.

S100 Card Cage

A new S100 microcomputer cabinet, model CMS-01, is available from *Acoustic Electronic Developments, of 179 Military Road, Guildford, NSW 2161.* The case, which measures 435 mm x 230 mm x 578 mm, is of extremely strong construction, using aluminium alloy castings for the front and rear covers and top and sides of vinyl covered galvanised mild steel. The internal construction is of nickel-plated mild steel and gold-anodised aluminium, designed to accept virtually any of the currently available mother boards, whether of 3/4 or one inch card spacing.

The case was designed to accommodate any extender card in the case; most are too tall to allow replacement of the cover. In addition, the card guides can be moved upwards in the frame to support the card under test. The CMS-01 will sell for approximately $160 and a matching power supply, model MPS-01, will be available soon.

Low-power TMS1000

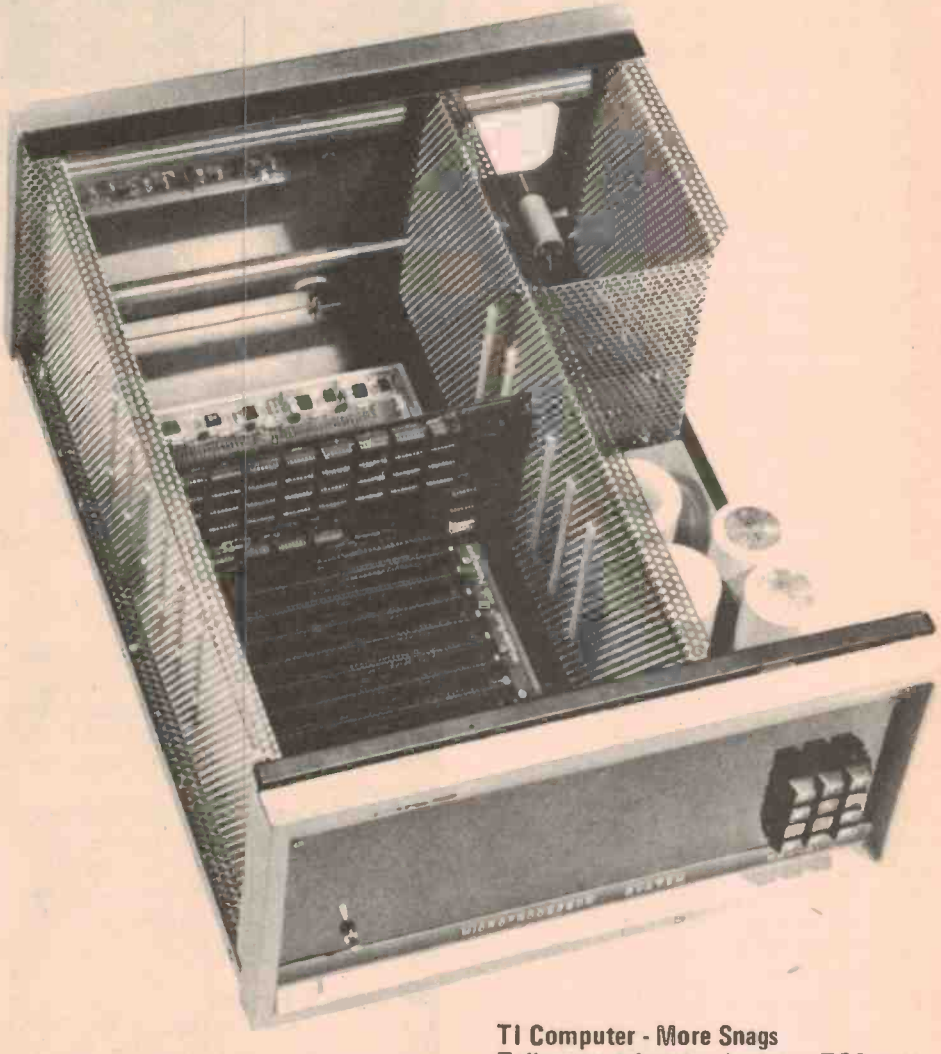
Texas Instruments have introduced the TMS1000C, a CMOS version of the popular TMS1000 mask-programmed microprocessor, for use in applications where low power consumption is important. As the TMS1000 was primarily designed for dedicated applications, this new device could prove a boon for those who wish to use it running on batteries, for instance.

The new version has a flexible supply voltage range (3–6 V) with 5mW operation at 5 V (typ). It also has a 1 MHz clock rate and the 40-pin package version, the TMS12000C, has 8 data inputs.

The CMOS versions also provide a unique power-down mode, controlled by the HALT pin, which drops typical power consumption to 5 microwatts while preserving memory and machine state.

Each TMS1000 has ALU, clock, I/O and memory on a single silicon chip. The RAM is organised as 64 x 4 and the mask-programmed ROM as 1024 x 8. Volume prices will be $5 and prototype delivery is eight weeks after receipt of program documentation.

Enquiries to: *Texas Instruments, 9 Byfield St., North Ryde, NSW 2113.* Tel. (02) 887 1122.



Copier-cum-printer

It has recently seemed to us that the technology being used by some computer companies to build high speed non-impact printers was very similar to that used in some office copiers and we began to suspect that a 'technology marriage' was in the offing. Indeed it was.

Wang Laboratories, Inc. of Lowell, Mass. have combined a photocopier with a CRT to produce a 4500 character per second printer. The Wang Image Printer uses a fibre-optic array to transfer the image of from the face of a CRT to the xerographic photomaster with a resolution of 90 000 dots per square inch. Z-80 microprocessor based electronics controls interfacing with a word processing system and also allows software selection of four fonts and six type styles. The printer has a two-page buffer and prints documents in collated order.

TI Computer - More Snags

Following delays in obtaining FCC type approval, Texas Instruments is reported to be having further difficulties with its home computer.

The problem is said to be development of the 9985 microprocessor - the heart of the unit. The 9985 is reportedly similar to the 9940, a 16-bit single-chip microcomputer with RAM, ROM, I/O and a counter/timer on the chip. This device is now a year late, and the development of the 9985, which is a 'stripped down' version of the 9940, is held up while bugs are ironed out of the earlier chip.

Earlier reports claimed that TI had submitted its home computer to the Federal Communications Commission for type approval testing, requesting that the RF modulator be approved independently. This would allow its use with other computer products without submission for FCC type approval. The FCC would not allow this and shipped back the home computer.

Hardware & Software for the Business System

The MT video terminal

- 16 x 64 display
- 7 x 9 matrix
- Optional 24 x 80
- 8 x 10 matrix
- U/L case
- Reverse Video
- Paging & Scrolling
- H/V line graphics
- Cursor addressing
- Print control sequences In BASIC
- Block graphics (48 x 128)
- $1275 plus Sales Tax

The MZ microcomputer

- Powerful Z-80 CPU
- 4 MHz clock
- Two quad-density floppies
- 630K bytes storage
- 1 serial port,
- 2 parallel ports
- 32K RAM standard
- expandable 64K
- extended monitor on PROM
- extended disk BASIC
- designed to interface with MT
- $3950 plus Sales Tax

The **VECTOR GRAPHIC MT** terminal interfaced with the **VECTOR MZ** microcomputer becomes a totally integrated video system. For the small business, we have developed suitable software including accounts payable and receivable, wages and general ledger. The VECTOR System priced at $5225 plus Software becomes very flexible. A wide range of printers are available. For further information please don't hesitate to contact us.

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Australian Distributor
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5245639

PRINTOUT

Thermal Graphics Printer

The new Hewlett-Packard Model 9876A printer prints at speeds up to 480 full lines per minute with high resolution (77 dots per inch) characters upon high contrast, fade resistant paper. It is a stand-alone version of the proven, built-in printer of the popular HP System 45 Desktop Computer, and is expected to be the primary external printer used with HP's 9825 and new System 35 desktop units. Additionally, the 9876A was designed for use with other computers in the Hewlett Packard line, and those manufactured by other companies. This flexibility is made possible by two interfacing modes, 8-bit parallel and IEEE-488-1975 (HP-IB).

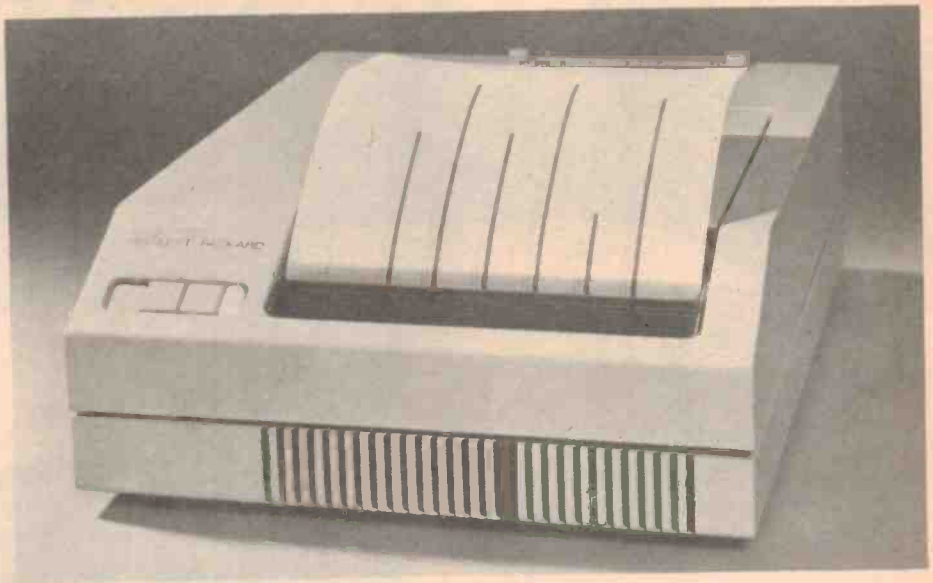
The HP 9876A is capable of printing as many as 80 characters per line at up to 480 lines per minute. Each character is composed of a 5x7 dot matrix of 300-micron square dots. Two row positions above and below each character allow for special marks or ascending and descending characters.

The full HP 9876A character set contains 128 standard ASC11 characters, both upper and lower case, and control characters. Seven additional character sets, which exist in the printer at all times, can be accessed through software. These additional include: French, German, Katakana, British, Spanish, Danish/Norwegian, and Swedish/Finish. Also, the user can create up to seven new characters at a time by defining special dot patterns which are then stored in the printer's memory.

Graphics on the HP 9876A can be printed in two forms, strip chart and CRT dump. The graphics field is 560 dots within a plot 185 - cm wide. Plotting speeds range from .38 to 2.5 cm/sec., or about .15 to 1.0 in/second.

Although the HP 9876A is based on the thermal printer from the System 45, several features have been added to increase its effectiveness and reliability as a stand-alone unit. These include a separate power supply, built-in precautions to assure that improper power levels do not damage the print head, and high-temperature protection. Much of this has been made possible by the use of a microprocessor to facilitate self-checking.

Price of the HP 9876A Thermal Printer is $3,500 excluding sales. Further information is available from local Hewlett-Packard offices.



Clubs, Societies, User Groups

We receive quite a few letters every month announcing the formation of new clubs and societies, or from people who want to start clubs. Of course, we're only too happy to pass the information on.

Some clubs are formed to serve a particular geographical area; for example the Microcomputer Enthusiasts' Group serves the Sydney area. Others are formed to serve the interests of users of a particular machine such as the TRS-80. If you can, you would be well advised to join such a club.

Monash University

Monash Personal Computer Club can be contacted via The Union Building, Monash University, Clayton, Vic., but membership is open to members of the public. The club owns a 6800.

Western Australia

If you live in or near Perth, you should be in the Western Australian Computer Enthusiasts Group (WACEG). The Club meets on the last Monday of each month at 7.30 pm, and the venue is the premises of Taimac Video Corporation, 1st floor, cnr. Newcastle and William Streets, Perth. Correspondence can be directed to the Secretary, R. Langlois, at Memorex Pty. Ltd., 49 Hay St., Aubiaco, WA 6008. You can phone him on 381 2444.

TRS-80

Les Kinch, VK2BBD, of 128A Booralie Road, Duffys Forest, NSW 2084, is attempting to organise a TRS-80 User Group, in order to provide a central clearing house for soft- and hardware problems/discoveries. Additionally, it is hoped to start populating a spot on both the ten and two meter amateur bands for round-table discussions. A monthly meeting may also be possible. Les can be contacted on (02) 450 2026.

Canberra MICSIG

In Canberra, the Microprocessor Special Interest Group of the Australian Computer Society (ACS) continues to go from strength to strength. Membership is not confined to ACS members – anyone can join for an annual subscription of $10. MICSIG publishes the excellent *Microcomputer Journal*, and can be contacted via The Registrar, MICSIG, c/- P.O. Box 446, Canberra City, ACT 2601.

Exidy Sorcerer

Attention, owners of the Exidy Sorcerer! Frank Schuffelen, of 66 Porter Street, Templestone, Vic 3106 is attempting to start up a User Group for present and future owners of this machine. Close liaison will be maintained with Dick Smith Electronics who import the machine, in order to keep members posted on up-coming developments.

TI59

Another group trying to get off the ground – this time for users of the Texas Instruments 59 programmable calulator and its accessory printer.

Serge Petelin is interested in forming a non-profit user exchange service to air technical problems as well as promoting software interchange. Contact Serge at 95 Gerler St., Bardon, Qld., or phone him on (07) 36 4197.

Micro Report

A report on the personal computer industry prepared by Dataquest Inc. of Menlo Park, California, estimates that 1978 sales reached about US$500 million and that sales will grow to more than US$2.4 billion by 1982. The report also predicts dramatic changes as large semiconductor and consumer electronics suppliers enter the marketplace.

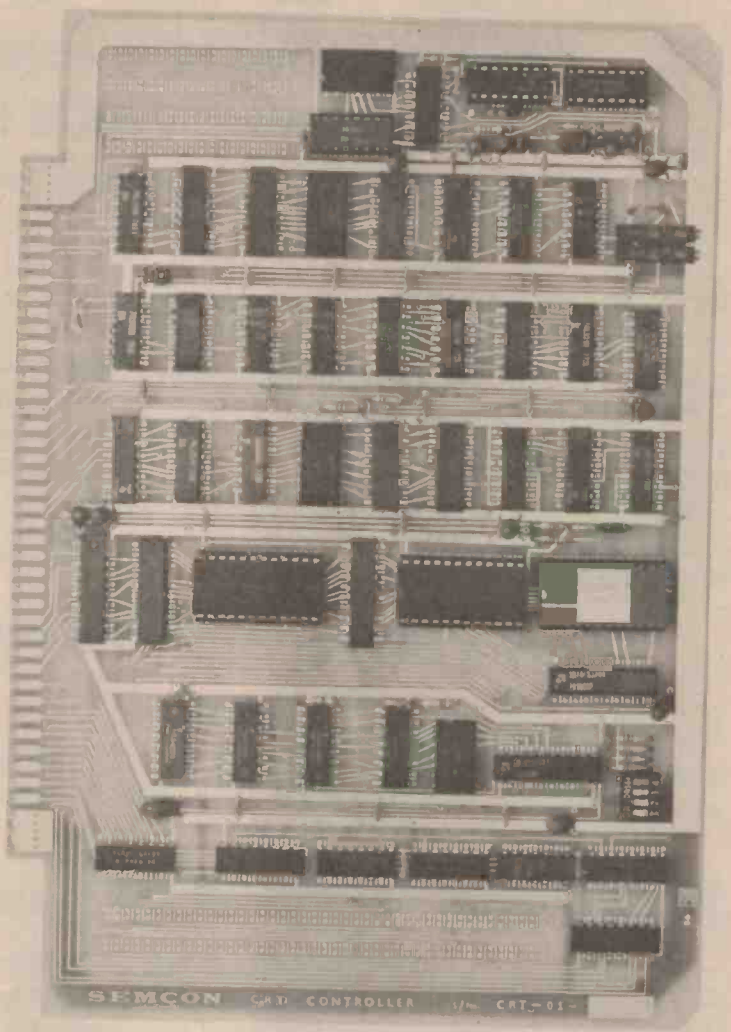
SEMCON Video Interface Card

Semcon Microcomputers has recently announced the availability of their locally designed and built CRT-01 Video Interface Card. The module has been designed to efficiently interface the memory of systems based on the Motorola bus (eg. MEK D2 Evaluation module) with an external video monitor. The manufacturers claim the following features:

Flexible display format –
48,64 or 80 characters/row.
20,22 or 24 rows/page.
Additional line at bottom of page for status information, which is unaffected by scrolling.
Displays up to 64K of CPU memory in 2k pages.
Low processor overheads in updating pages – to display a new page only requires the CPU to perform a single write operation to the CRT-01's page register.
All operations performed on a DMA basis that is completely transparent to the processor, resulting in a stable, flicker free display.
Displays 128 ASCII characters in both standard and inverse video.
Coarse graphics capability.
Video rate controlled by a Phase Locked Loop.
On Board divider generates a stable 50 Hz reference frequency from a wide variety of processor clock speeds.
Motorola Bus Compatible.

The CRT-01 has its own data and address buffers and plugs into a 43 x 2 0.156" bus. It outputs its own addresses onto the bus.

At any time, two on board 6810's acting as line buffers store the current character row being displayed and the next character row for display. As each displayed character row is made up from 13 scan lines and each scan line lasts 65μsec, a new character row must be loaded every 845 μsecs. Assuming a 1 MHz CPU clock and a display of 80 characters/row, the video card needs to access processor memory 80 cycles in every 845 to keep its buffers filled with valid characters.



Although the CRT-01 is accessing the bus 10% of the time, there is no conflict with the processor, resulting in a flicker free display. These accesses are also completely transparent to the processor i.e. they do not result in halting or slowing of the processor. They are also independent of the processor clock. This is achieved using two alternative methods: a) The CRT-01 tristates the processor bus during phase one and loads its memory during this period, or b) the CRT-01 monitors the CPU VMA line. This is checked during the latter part of phase one. If it is low it indicates that the CPU does not require the bus during that cycle, leaving the video card free to access memory during phase two.

Price of the module is $285 + tax for small quantities. Further information may be obtained from *Semcon Microcomputers, 1 Chilvers Rd., Thornleigh 2120.*

Sydney Computer Show

Following the success of the first Home Computer Show held at Box Hill Town Hall in Melbourne (see last issue), Australian Seminar Services have announced that a show will be held at Sydney Town Hall on 17 - 20 May. The first two days (Thursday and Friday) of the Show will be open to the trade and schools, and at the weekend it will be open to the public.

TMS9900 Group

The Texas Instruments TMS9900 is a very nice 16-bit microprocessor. The only problem with it is that it doesn't have the kind of software that supports earlier processors like the 8080. An attempt to put this right is being made by Barry Day, of 43A Osborne Road, Lane Cove, NSW 2066. He is attempting to form a 9900 User Group to exchange all kinds of information.

COMPUTER BITS

S-100 HARDWARE & 8080 SOFTWARE
RETAIL PRICE LIST

(Sales tax in brackets to be added if no certificate given)

Thinker Toys *products*

- 8K Synchrofresh RAM (A&T) **$149(** ($16.50)
- 16K Static RAM (Kit) **$299** ($4.35).
- Disk Jockey Disk I/F (Kit) **$179** ($20.55) Assembled **$213** ($24.45).
- Discus I 8" Disk System (240v/50 Hz) Assembled **$995** ($114.60); Add-on Drives (Incl. power supply) Assembled **$795** ($91.50).
- Keyed-up 8080 CPU (Kit) **$250** ($28.80).
- Speakeasy I/0 (Kit) **$130** ($15).
- Wunderbuss 20 slot terminated & shielded Motherboards: Kit with 20 edge connectors **$154** ($17.70); with 10 E/C **$120** ($13.80); Kit with no edge connectors **$76** ($8.70); A&T with 20 E/C **$199** ($22.95).

DEALERS THROUGHOUT AUSTRALIA WANTED FOR THE ABOVE PRODUCTS

SOFTWARE FOR DISK SYSTEMS:-

- CP/M by Digital Research **$100** ($13.50).
- Microsoft Disk Basic **$268** ($36.18).
- Microsoft Fortran IV **$350** ($47.25).
- CP/M Users Group Library (per disk) **$10** ($1.35)

Processor Technology *systems and software systems*

SOL 20	**$1895** ($227.55)
SOL 20/16	**$2095** ($251.55)
SOL 20/32	**$2395** ($287.55)
HELIOS II/2	**$3195** ($404.70)
HELIOS II/4	**$5395** ($683.25)
SOL SYST. IIIb	**$6295** ($724.80)
SOL SYST. IVb	**$8550** ($984.45)

16K RA-1	**$429** ($50.10)
32K RA-1	**$750** ($87.60)
48K RA-1	**$1095** ($127.80)
64K RA-1	**$1350** ($157.65)

ALL ASSEMBLED AND TESTED

SOFTWARE: FOCAL (THE DEC LANGUAGE), BASIC/5, TREK 80, GAMEPAC-1, GAMEPAC-2, CHESS, ASSM, EDIT, DEBUG ON CASSETTE (1200 BAUD), ALL **$19.50** ($1.95). EXTENDED BASIC AND ALS-8, EACH **$45.00** ($4.50). PILOT (CAI LANGUAGE), **$24.50** ($2.40). DISK FORTRAN FOR HELIOS SYSTEMS, **$96.00** ($7.95).

ALL AVAILABLE FROM:

AUTOMATION STATHAM
PTY. LTD.

47 Birch St, BANKSTOWN. 2200. Phone: 709-4144. Telex: AA 26770.

CB News

Queensland CREST

CREST QLD had its inaugural meeting on 27 and 28 May 1978 and now has 16 regions established throughout the State. There are new Divisions forming within these regions quite frequently, increasing the number of monitors all the time.

The next State meeting will be held in Townsville on Saturday, 3 March, 1979. The annual general meeting is to be held in Brisbane on 14-15 July.

A metallic badge (broach or key ring) has been produced by the State organisation. It costs only $2 and any monitor wishing to purchase these should send their order with money to:

The Treasurer,
CREST Queensland,
11 McBride Street,
Heatley,
TOWNSVILLE 4814 QLD.

Queensland CBers and others wishing to enquire about Crest in this State should write to:

The Secretary,
CREST Queensland,
Box 74,
MALENY 4552 QLD.

The Queensland Crest organisation does not have a State headquarters as the State is so large and the executive is spread throughout the State to give a better coverage to monitors.

Marine And CB Crystals

Pairs of transceiver crystals to suit 27 MHz marine and CB equipment have been released by Jackson. Attractively presented in small blister packs for convenience, they are expected to sell at a recommended retail price of $4.85 the pair.

Crystals for the 27 MHz CB channels, from 27.015 to 27.115 and the walkie-talkie channel on 27.240, have the receiver crystal *below* the channel frequency ("low side") while those for the marine channels are *above* the channel frequency ("high side"). This is to prevent 'image' interference problems on reception.

The following channel sets are available:

CB	27.015 MHz	ch.1.	Cat. No:12-305
	27.035 MHz	ch.3.	Cat. No:12-307
	27.065 MHz	ch.5.	Cat. No:12-309
	27.085 MHz	ch.6.	Cat. No:12-311
	27.115 MHz	ch.9.	Cat. No:12-313
		Hand	
	27.240 MHz	held	Cat. No:12-250
Marine			
	27.880 MHz		
	27.890 MHz		
	27.900 MHz		
	27.910 MHz		

The Jackson crystals are distributed by *IFTA, 1 Greville St., Randwick, NSW 2031*, phone (02) 665-8211.

Rig Tester

For the real enthusiast, or the technician, a handy gadget to have around the shack or the workshop is a test rig that will test just about any function of CB transceiver.

Peter Shalley Communications has a neat little device under his 'Contact' label that includes nine functions which will allow you to test just about everything you need to know about a rig. The Contact model FS-117 transceiver tester combines the following instruments in one neat package:

Wattmeter, SWR meter, Modulation meter, Field strength meter, RF signal generator, crystal checker, audio signal generator, low frequency oscillator and a 5 W dummy load.

These, and similar models, have been selling for around the $60 mark in the past and about $50 on special. Peter Shalley is offering the FS-117 for a mere $39.50 – which certainly seems good value for money.

If you're after a neat-n-nifty, handy-andy, little-jim-dandy rig test set then contact your Contact at 554 Pacific Highway, Killara NSW 2071; (02) 498-2611.

Tram D62 Released

Released in February by Mobile One, the Australian Tram agents, the D62 SSB/AM rig will no doubt put a ripple of excitement through the ranks of 'top line' CB'ers who appreciate quality equipment.

Built in the familiar Tram style, the D62 transmitter features a rugged solid-state transmitter (fully protected from antenna problems) AM compression and automatic level control on SSB to maintain good average power output for a 'punchy' signal. A mic gain control is provided so that the operator can adjust for varying voice levels and conditions.

On the receiver side, the D62 uses a highly-selective crystal filter to give good adjacent channel rejection and reduce 'harsh' pickup. A noise blanker is provided which Tram claim to be very effective.

A unique 'snap bracket' mount comes with the rig that allows the rig to be slipped in or out of the mount in a few seconds – no knobs or nuts to undo and no need for slide mount. There are two positions in which the rig may be inserted in the bracket, one so that the rig projects about 150 mm from the bracket and another that allows the rig to project only about 50 mm.

The D62 has a digital LED channel display and a full complement of controls – arranged in piggyback fashion, something Tram have been incorporating on their rigs for many years.

To avoid possible damage to the transmitter output transistors Tram have included a unique protection and indication scheme should a high SWR appear on the antenna line. The decimal point between the two digits of the channel display will light when a high SWR occurs and the transmitter shuts down.

The Tram is distributed by *Mobile One, 17 Sloane St., Marrickville, NSW 2044*, (02) 576-4500.

New Regulations – Licences

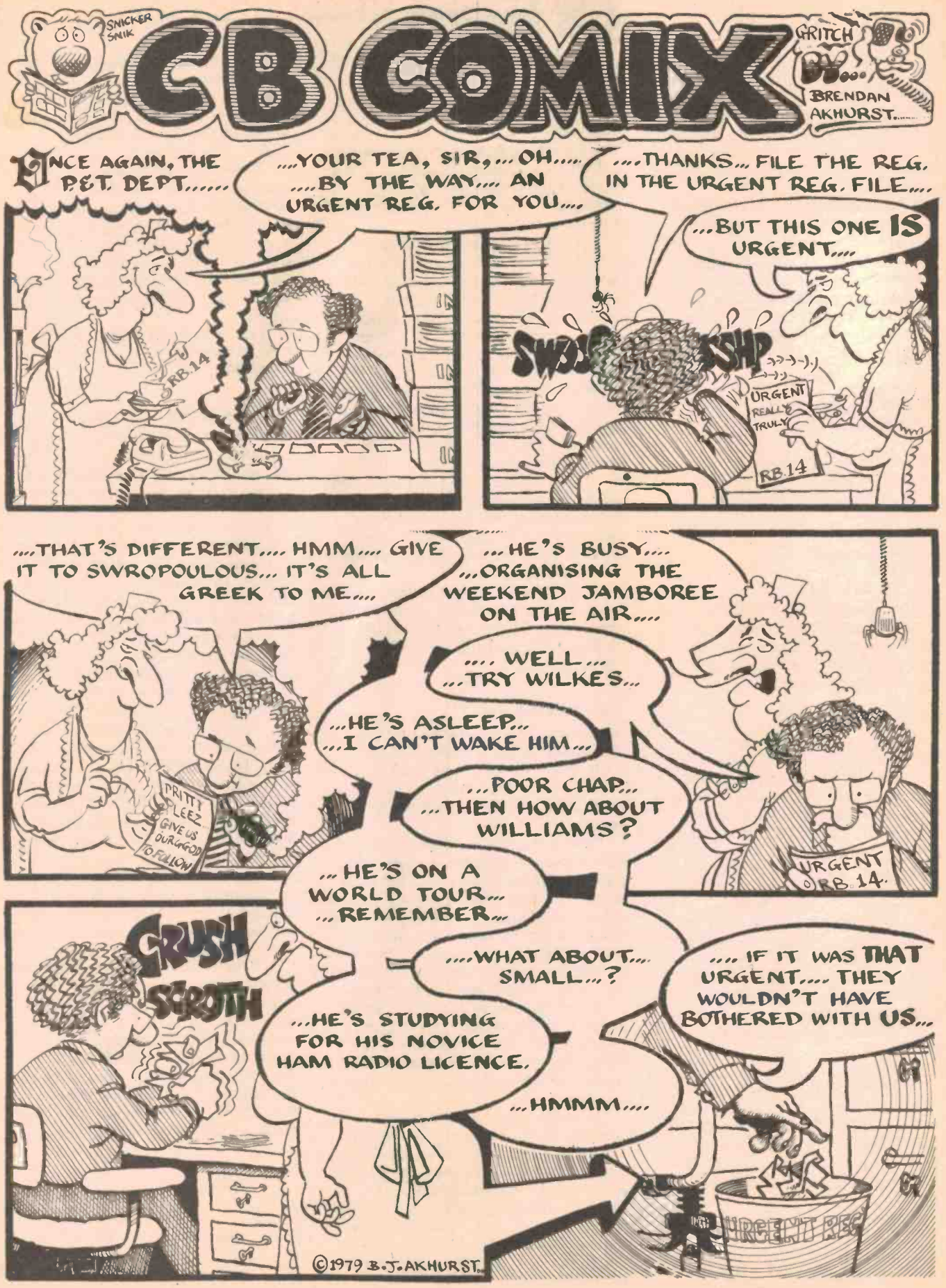
Due for release in mid-February, the "all new, singing-dancing . . ." RB14 was undergoing the final touches and passing through the last few metres of red tape at time of going to press.

As we heard it, the Government will add a minute to the Wireless Telegraphy Act to allow for five sets under one licence. There will be a change to the licences – currently CBers are licensed under the Land Mobile Service. A new service will be created – well, a name for what already exists. The Regulations governing the (new) service, RB14 (funny . . . seen that somewhare's afore), will be couched in "legalese" and another document, to be known as RB14a, will be issued to explain RB14 – operating guidelines in plain language. A new licence form will be issued which will include the authorised operating frequencies. Those with existing old licences (Land Mobile – Class C) will not be disadvantaged we understand, and 'transitional' licences may be issued.

It appears you will be able to add or delete sets, up to the maximum of five sets, at any time under the new system, without charge.

CB Australia's Crystal Ball Calendar (in the January issue) for 1979 once again made a curiously accurate prediction (self-fulfilling ?). The January item predicted that typesetting errors would be inserted in the RB14. It really happened! Some delay in getting the final draft together and approved was caused by last-minute typesetting errors, so our Canberra spies tell us.

Turn over for the Wombat's comment . . .


SNICKER SNIK
CB COMIX
GRITCH
BRENDAN AKHURST
ONCE AGAIN, THE P.E.T. DEPT.....
....YOUR TEA, SIR,... OH..... ....BY THE WAY.... AN URGENT REG. FOR YOU....
....THANKS... FILE THE REG. IN THE URGENT REG. FILE....
...BUT THIS ONE IS URGENT....
RB.14
URGENT REALLY TRULY
RB.14
....THAT'S DIFFERENT.... HMM.... GIVE IT TO SWROPOULOUS... IT'S ALL GREEK TO ME....
...HE'S BUSY.... ...ORGANISING THE WEEKEND JAMBOREE ON THE AIR....
..... WELL... ...TRY WILKES...
...HE'S ASLEEP... ...I CAN'T WAKE HIM...
...POOR CHAP... ...THEN HOW ABOUT WILLIAMS?
...HE'S ON A WORLD TOUR... ...REMEMBER...
....WHAT ABOUT.... SMALL...?
...HE'S STUDYING FOR HIS NOVICE HAM RADIO LICENCE.
...HMMM.....
.... IF IT WAS THAT URGENT.... THEY WOULDN'T HAVE BOTHERED WITH US...
PRITTY PLEEZ GIVE US OUR GOOD TO FULLOW
URGENT RB.14
CRUSH SCROTH
URGENT REG
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2SA 683R	.95
2SA 719Q	.80
2SA 733Q	.75
2SB 555	8.30
2SC 372	.65
2SC 380	.70
2SC 287	1.30
2SC 388	1.30
2SC 460A	.70
2SC 495	2.40
2SC 710	.60
2SC 710C	.70
2SC 710D	.70
2SC 712	.55
2SC 732	.80
2SC 735	.80
2SC 763D	.75
2SC 784	.55
2SC 815	.75
2SC 828	.75
2SC 829	.75
2SC 839	.65
2SC 900	.55
2SC 900F	.60
2SC 900U	.60
2SC 945	.75
2SC 1018	2.90
2SC 1047	.60
2SC 1061	2.35
2SC 1096	1.40
2SC 1239	7.35
2SC 1306	2.65
2SC 1307	6.85
2SC 1318R	.65
2SC 1327T	.60
2SC 1359C	.55
2SC 1383R	.85
2SC 1398	1.95
2SC 1687	.75
2SC 1846R	1.10
2SC 1969	4.35
2SC 2086	3.75
2SC 2166	2.65
2SD 180	4.15
2SD 235	1.95
2SD 288	2.45
2SD 525	2.00
2SK 19GR	1.25
2SK 34E	.85
CS 9013	.60

DIODES

GP 25G	.95
BZ 162	.70
1N 34A	.25
1N 60AM	.20
1N 60FM	.25
1N 4148	.07
1S 32	.35
1S 188AM	.25
1S 953	.40
1S 1555	.35
1S 1588	.35
1S 1885	.25
1S 2473	.25
1S 2689	2.45
ITT 310	.20
ITT 410	.40
ITT WG713	.20
MA 150	.27
MZ 205	.58
MZ 310	.46
M 8513	.85
OA 90	.25
02Z 5.6A	1.10
RD 6A	1.10
RD 91E	.40
S3016R	1.45
V06C	.30
WZ100	.65

INTEGRATED CIRCUITS

AN612	2.95
HA1322	4.95
HA1339	4.75
HA1342	4.50
MM5369AA/N	3.40
MM5387AA/N	9.15
M51202	2.95
NIS7261A	9.60
PLL02A	6.30
TA7045M	4.25
TA7061AP	2.60
TA7062P	2.60
TA7069P	2.60
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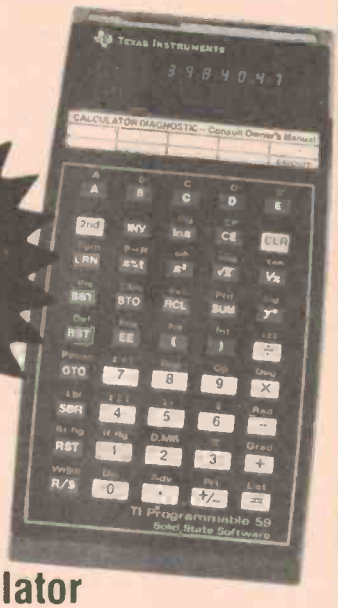

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SWL News

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

All times are in Greenwich Mean Time (GMT); all frequencies are in kilo-Hertz.

Signals from Brazil at Peak

As we move into Autumn, DXers will note a change in the reception patterns on the bands. Signals from Europe will fade out earlier in our evenings on 49, 41, 31 and 25 metre bands. During summer it is common to hear signals on 49 metres until as late as 1000 via the longer reception path over the Americas and the Pacific, due to the late sunrise in Europe during December and January. However, as we enter March, these European signals will fade out by about 0800 on 49 metres, and just slightly later on frequencies up to 12000 kHz.

The European signals begin to be replaced by signals from the Americas in the period 0800-1000. We are now entering a peak period for receiving signals from Brazil, which sould be in evidence during these hours on 49, 31 and 25 metres. The best signal on 49 metres should be Radio Guaiba on 5965, which signs on at 0900 to keep the people of Porto Alegre in southern Brazil entertained in the early morning.

Signals on the 31 and 25 metre bands are slightly more difficult to find, as they have to compete with interference from signals from Asia which fade in at about 0900 most nights. However, try for Radio Bandeirantes on 9645, or Radio Excelsior on 9585.

The 25 metre band signals must also compete for channels on this crowded band, but some of the most consistent signals you should be able to pick up between 0800 and 1000 are Radio Globo on 11805, and the additional channels for two stations already mentioned, Radio Guaiba 11785, and Radio Bandeirantes on 11925.

Brazilian stations broadcast in Portuguese. All stations mentioned here are commercial, so expect to hear many fast-talking disc-jockeys and advertising jingles!

During March, signals from Brazil should also be audible in our mornings from about 2100 until the time when most Brazil stations close down for the evening (usually at about 0300) on the 25 metre band. During these hours, depending on channel usage by higher-powered international stations, you may expect to hear the stations on 11785, 11805 and 11925, as well as Radio Nacional Brasilia which operates on 11780.

Africa

Another part of the changing reception pattern during March is the way signals from Africa on the 90 and 60 metre tropical bands are able to be heard gradually later in our mornings.

In midsummer, signals from Africa on these bands would seldom be audible past about 2030, yet by June the 60 metre band will support signals until 2300 and even later. The 90 metre band should also be active much later, with one of the later signals being Malawi on 3380, which signs off for the evening at 2210.

Central America

This month will also see improvement in reception of signals from Central America and northern South America. Signals from this area are most prevalent on 60 and 49 metres between about 0600 and 1200. This is when darkness covers the southern Pacific, providing optimum reception conditions for eastern Australian listeners.

From about 1130, signals begin to fade as early morning daylight approaches the Americas from the east. Thus most of the Venezuelan signals, being located further to the east, will fade by 1130 (7.30 am in Venezuela) while signals from Colombia fade by about 1200 on 60 metres and by 1230 on 49 metres.

Signals to watch for are Radio Reloj, Costa Rica on 6005, Emisora Nueva Granada, Colombia on 6160, and Radiofusora Nacional de Nicaragua on 5950. On the 60 metre band, best signals are Radio Colasal, Colombia 4945, Radio Continente, Venezuela 5030 (from sign on at 0930), and Ecos del Torbes, Venezuela, which opens at 1000 on 4980.

As you see, there is plenty to hear at this time of year! If you are interested in monitoring the Latin American or African stations, then a necessary reference is the complete survey of these stations made by ARDXC during 1978, called the 'Shortwave Radio Log'. This will assist you in identifying many of these stations. Write to ARDXC for information on how to obtain a copy.

New Malta Service

The program "Malta Calling" has been completely revamped and retimed. The English service is still heard every Saturday, but is now a full one hour program between 0700 and 0800, on 9670 kHz. The program previously lasted only 30 minutes and was aired from 2045-2115 on 5980 kHz.

The new 0700-0800 service includes news and interviews about current events in Malta, and invites listeners to send their reports on reception and program suggestions to: Malta Calling, Box 82, Gwardamangia, Malta.

Pakistan

As well as operating an overseas service, the Pakistan Broadcasting Corporation also operates many shortwave outlets which carry Home Service programs for those remote parts of the country where mediumwave signals do not give reliable reception.

These shortwave Home Service programs are transmitted from four sites, Islamabad, Peshawar, Quetta and Rawalpindi. Islamabad programs likely to be received here in Australia are on 5060 1435-1600; on 5110 1300-1600; and on 3915 1615-1700.

Peshawar transmits on 3155 from 1430-1800. Quetta may be heard on 5980 between 1400 and 1600, while transmissions from Rwaalpindi are available on 3335 between 1500 and 1800. The address for reception reports is: Pakistan Broadcasting Corporation 35-A Satellite Town, Rawalpindi.

Nepal

Remaining in south Asia, Radio Nepal has an English service every day between 1435 and 1520 on frequencies of 5005 and 3425. A news bulletin in English is included at 1450, with news comment at 1500.

Bhutan

The Radio National Youth Association of Bhutan (Radio NYAB) at Thimphu, with a shortwave transmitter of somewhat less than 300 watts, promotes itself as the smallest shortwave station in the world.

Broadcasts from Radio NYAB are on the air for just two hours on Sundays and for one hour each Wednesday, in Bhutani, Nepali and English. The only opportunity listeners in Australia have for hearing Bhutan is on Wednesdays, when Radio NYAB is on the air from 1230-1330, with an English segment between 1315 and 1330, on the frequency of 4690.

For the first time, reception has been reported of this broadcast by Robert Yeo and Matthew Wilson of Melbourne, who both observe very weak signals during the last half-hour of the Wednesday service.

For further information on shortwave radio and the activities of the Australian Radio DX Club (ARDXC), write to either PO Box 67 Highett, Vic 3190, or to PO Box 79 Narrabeen NSW 2101, enclosing a 30c stamp for return postage of literature.

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Amateur News

Old timers' annual

Bob Cunningham, VK3ML, advises that the annual dinner for the Radio Amateurs Old Timers Club will be held in 1979 at the usual venue, Science House, Clunies Ross Building, Parkdale, Melbourne on Thursday, 8 March. The Guest Speaker on this occasion will be Ray Naughton, VK3ATN, who will speak on Radio Astronomy. Ray is well known for his work on moonbounce techniques. It is expected that more than 100 members will attend this year.

Membership of RAOTC is now some 250 from all states of Australia and overseas.

Membership of the club is open to amateurs world wide who have held an amateur licence (or equivalent) for at least 25 years. There is no subscription to the Club but a charge of $2 is made for the attractive certificate of membership plus postage.

Application to join the club can be made by writing to Harry Cliff, VK3HC, P.O. Box 50, Point Lonsdale, Victoria, 3225 accompanied by a SAE envelope.

Museum Station

The Museum of Applied Arts and Sciences has commenced regular weekend transmissions from their amateur station VK2BQK. These transmissions have been designed to acquaint the Museum visitor with the exciting and increasingly popular leisure time activity of amateur radio.

The latest in commercial amateur radio equipment is used, generously donated by Dick Smith.

The station is manned on Saturdays and Sundays by volunteers from the Wireless Institute of Australia NSW Division. Initial test transmissions to all states of Australia, New Zealand and Japan have been very successful.

A VHF aircraft communications scanning receiver has also been installed in the Museum. This scans the radio channels used to control the flow of aircraft into and out of our airports. Visitors can hear the aircraft controller instructing the pilot and the pilot's reply for the Sydney Approach and Departure channels at Mascot and Bankstown aerodromes. (Also have a look at our project ETI 721 in this issue).

During school term, special classes may be arranged for secondary school students by contacting the Senior Education Officer on 211 3911.

Ham Radio Taking to MPUs

Microprocessors are being increasingly adopted in amateur radio equipment. New products have been released by specialist amateur radio manufacturers such as Icom and Yaesu. Trio-Kenwood which has the largest world market share of ham gear is known to be working in the microprocessor area and release of their new equipment is only a matter of time. (Note in Vicom Ham News for January 1979).

Radio Clubs in Tasmania

Southern Branch of WIA:
PO Box 123, Sandy Bay, 7005. Meetings, first Wednesday of each month at State Emergency Services, Melville St., Hobart. Enquiries: Harvey Skegg, phone 43 6337 (VK7HK).

Northern Branch of WIA:
PO Box 275, Launceston 7250. Meetings, second Friday of each month at the Clubrooms, 34 Bourke St., Launceston. Enquiries: Joe Gelston, phone 44 3882 (VK7JG).

North West Branch of WIA
Meetings, second Tuesday of each month at Lakins Hall, Ulverstone. Enquiries: Brian Lord, phone 42 2545 (VK7ZBL).

Any general enquiries should be directed to the WIA at PO Box 1010, Launceston 7250.

Brisbane Club

The Brisbane Amateur Radio Club, call-sign VK4BA, meets every second and fourth Friday of each month at 0930z at the Holland Park State High School, Baupaume Road, Holland Park. The club conducts on-air nets on Sundays, following the local WIA news broadcast; frequency – 21 117.5 kHz at about 2330z. Also on Mondays at 9030z on 28 450 kHz.

The club issues an award to any station applying who has worked seven members or the club station plus four members.

The club's address is: *PO Box 310, Mt Gravatt, Qld 4122.*

Darling Downs Repeater Change

The two metre repeater operated by the Darling Downs Radio Club at Toowoomba, VK4RDD, changed frequency on 2 December 1978, from channel 44 to channel 74 (input 147.7 MHz, output 147.1 MHz). The change has been approved by the Post and Telecommunications Department.

The reason for the change is to eliminate interference problems caused by the allocation of the same repeater channel (44) in adjacent areas; viz: Bundaberg, Toowoomba and Lismore where operators in some locations can access two and sometimes three repeaters at the same time.

The Club meets at the Toowoomba Education Centre, Baker Street, Toowoomba at 7.30 pm on the last Friday of every month except December. Visitors are welcome. A club net on the repeater, channel 74 is held every Thursday night at 8.00 pm local time.

The Secretary's address is *38 Wentworth Street, Toowoomba.*

Self-raising Sunspots

No doubt those of you keen on working DX have been taking advantage of the improved conditions of late, what with Sunspot Cycle 21 steaming its way up towards an optimistically large peak. Well, just how is it going?

M. Waldmeier of the Swiss Federal Observatory at Zurich, the establishment that compiles the Sunspot numbers, in Sunspot Bulletin, 1979, No. 1., lists the Smoothed Mean for July 1978 as 95.0 and the Mean Provisional Sunspot Number for January this year as 165.8. The December 1978 bulletin listed the Predicted Smoothed Monthly Sunspot Number for January as 129. The Provisional daily Sunspot Numbers for January ranged from a low of 130 (on the 31st) to a high of 209 (on the 24th and 25th).

The retrospective smoothed means for April, May, June and July last year were, respectively: 74.9, 81.0, 87.0 and 95.0. The predicted Smoothed Monthly Sunspot Numbers for the same period this year are as follows:

March	136
April	141
May	145
June	148
July	150

The last time a value for the Smoothed Mean reached 95 on the rising part of a sunspot cycle was in 1968. It was not predicted to reach that value on the present cycle until mid-1979 (according to Hill – see the curves in our Kenwood-ETI poster from the December '78 issue).

150th Anniversary Contest

This year marks the 150th anniversary of the founding of Western Australia (what happened about Dirk Hartog nailing his pewter plate to a tree on an island off the WA coast in the early 17th century?, ooops – embarrassing).

So that amateurs from all over the world may be aware of West Australia's anniversary, the state's Division of the Wireless Institute of Australia has mounted a year-long contest. Perhaps some of you have already noticed from activity on the bands.

Cliff Waterman, VK6NK, is the contest manager and full details on the rules are available from him at *PO Box 6250, Hay Street East, Perth, WA 6000.*

Continued on p. 91.

We don't have to blow our own trumpet ...

(WE GET LETTERS!)

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Amateur News

TEP or Not TEP?

Amateur contacts on the 50 MHz band over distances of 4000 - 10 000 km spanning the geomagnetic equator have been reported consistently since 1947. A variety of research projects carried out between the early 1950s and early 1970s has seen greatly increased understanding of what is termed 'Trans-equatorial Propagation", or TEP, that supports signals over considerable distances at frequencies well into the VHF spectrum. This research has brought to light two modes of TEP – Class I, or afternoon-type, and Class II, or eveining type. They are so designated because Class I has a predominant occurrence between 1400 and 1900 local mean time (LMT) whereas Class II has a peak occurrence around 2000 to 2300 hours local mean time.

The upper frequency limit for Class I TEP seems to be around 60 - 70 MHz, hence the frequently reported afternoon contacts on the six metre band, along with reception of television and other signals in the 40 - 60 MHz region from areas across the opposite side of the geomagnetic equator.

No upper frequency limit has been proposed for Class II transequatorial propagation. The highest fequency observed until the mid-1970s was 102 MHz, from a 1 kW beacon in Darwin received in Yamagawa in Southern Japan (distance 4850 km). This beacon was operated as part of a cooperative propagation study between Australian and Japanese ionospheric research establishments since the mid-1960s.

On the evening of October 29 1977 YV5ZZ, Venezuela, contacted LU1DAU in Argentina on 144 MHz, a distance of 5044 km., then a world record. This appears to be the first reported instance of 144 MHz propagation across the geomagnetic equator – I won't call it TEP, yet.

Subsequently, the world terrestrial distance record for 144 MHz was established by a contact between KP4EOR, Puerto Rico, and LU5DJZ at Mar Del Plata in Argentina, on 12 February 1978. The distance – 6400 km. The time – 0015 GMT (2015 local mean time).

The first Australia-Japan contact on 144 MHz was between VK8GB, Darwin and JH6TEW on the island of Kyushu, southern Japan, at 1200 hrs GMT (2130 LMT) on 24 February 1978, a distance close to 5000 km.

On April 10, 1978, at 2000 hrs LMT ZE2JV, Rhodesia, contacted 5B4WR on Cyprus on 144 MHz.

Since then, many occasions of 144 MHz 'openings' between these areas have been reported, particularly for the Venezuela/Peurto Rico to Argentina and the Darwin to Southern Japan paths.

Then, on February 13 last year, YV5ZZ (Venezuela), heard signals on 432 MHz from KP4EOR between 2000 and 2110 hrs LMT and again, on the 16th of the month, LU3AAT was heard on 432 MHz by YV5ASU at around midnight local time.

Speculation

The mode of propagation supporting these phenomenal contacts and reports has recently been a subject of some speculation and hypothesis in the amateur journals.

The October 1978 issue of QST carried an article by Joseph Reisert W1JR (ex-W6FZJ) and Gene Pfeffer K0JHH titled "A Newly Discovered Mode of VHF Propagation". They examine the reported instances of unusual 144 and 432 MHz propagation as detailed above, review the characteristics of transequatorial propagation, and attempt to explain the contacts as being by 'previously unobserved and unexplained" propagation modes. Reisert and Pfeffer " . . . conclude that this fantastic porpagation was not TE, but possibly a result of *magnetic-field-aligned irregularities* (FAI) in the equatorial ionosphere".

What they are considering, I believe, is actually Class II or evening-type, TEP – extending well beyond the previously observed frequency limits.

No *new* mode of propagation need be invoked to explain the contacts. But why?

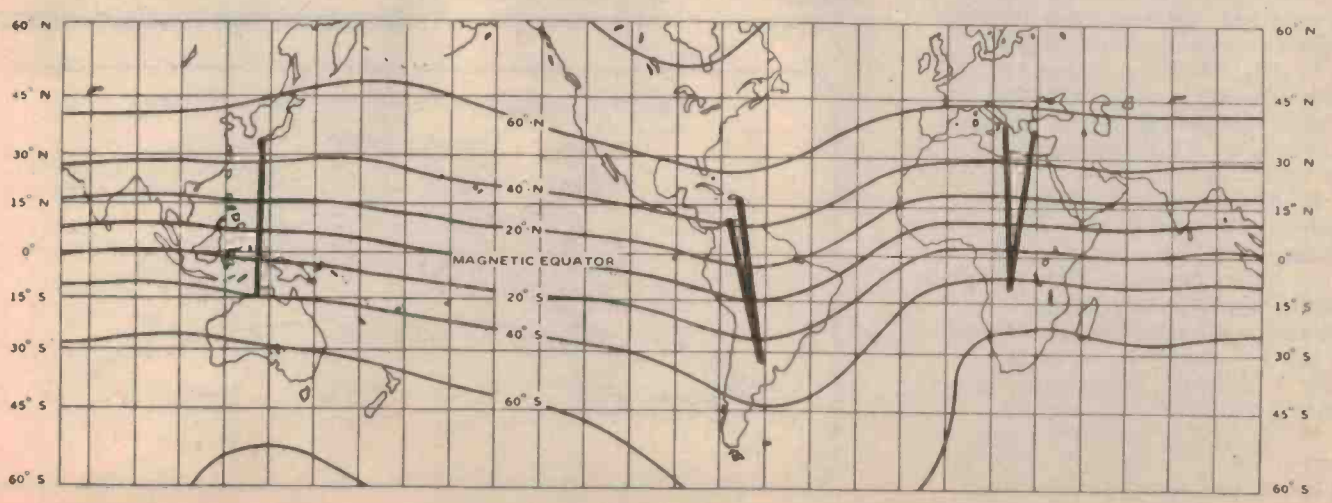
First up, let's take a look at the known characteristics of evening-type TEP, the suggested propagation mode (now generally accepted) and the criteria involved for propagating signals via Class II TEP.

High Signal Strengths

Evening-type TEP has a peak diurnal occurrence around 2000 - 2300 hrs local mean time (measured at the point where the path crosses the geomagnetic equator). High signal strengths are often observed, occasionally above values equal to free-space path loss for the same distance, but generally varying from 70 dB to 20 dB below free-space path loss figures. Signals have a characteristic 'flutter' fade at rates up to 15 Hz, often deep, and a Doppler spread up to 15 Hz (giving rise to comments such as "sounds like moonbounce signals"). Path lengths are generally about 3000 - 6000 km, path terminals (ie: station location) are generally situated between geomagnetic latitudes of 10° and 20° north and south of

Continued overleaf.

Fig. 1. Paths of the reported 144 MHz and 432 MHz transequatorial contacts. The geomagnetic dip contour lines are superimposed on a Mercator projection. Note that the ends of the paths are nearly conjugates.



the geomagnetic equator. 'Openings' are most often reported around the equinoxes, although they can occur at any time under suitable conditions, Paths generally cross the geomagnetic equator at a right angle – or very close to it. Paths having an obliquity with the equator of more than 15° are rare, particularly at the higher frequencies.

The propagation mode supporting Class II TEP was suggested some ten years ago by Bowen, Fay and Heritage (ref. 2.) and Nielson (ref.3.). Research work on this mode of TEP was conducted during the early 1970s by Dr. L.F. MacNamara of the Australian Ionospheric Prediction Service and resulted in a number of papers which fairly conclusively showed the correctness of the model proposed earlier by Bowen and Nielson et al. The most detailed paper on the subject is by McNamara and was published in The Australian Journal of Physics, in 1973, entitled "Evening-type Trans-equatorial Propagation on Japan-Australia Circuits". It details the general characteristics of Class II TEP and the various conditions necessary to support this mode of propagation.

The suggested mode of propagation involves *guidance* of the radio waves along the earth's magnetic field lines across the geomagnetic equator. Small-scale, field-aligned irregularities in the ionosphere in this region are believed to account for the wave guiding. There is considerable evidence, apart from observational evidence that accords with the characteristics of these irregularities, to support the proposal that Class II TEP is a *field-guided* mode. See figure 2.

For a wave to experience guidance from these irregularities, following the earth's magnetic field in the equatorial region, the signal would have to be tangential, or very close to, the angle of dip of the earth's magnetic field at the point where it enters the ionosphere (around 300 - 400 km) where the field-aligned irregularities exist. Nielson (ref.3) has shown that guidance at frequencies up to about 90 MHz is possible if reasonable density gradients exist in areas of high density within the equatorial ionosphere.

Both Nielson and MacNamara's analysis of the geometry involved to obtain guidance of a wave indicate that a station located at a latitude where the dip angle is about 40° needs to fire a ray at an angle of elevation between 6° and 11°, depending on the longitude – the earth's magnetic field is not centred, and somewhat distorted.

For example, a transmitter located at Darwin, being at a dip angle of 40°S, to launch a wave such that it obtains tangency with a field line at 300 km to the north, must have an angle of elevation of about 7°. Similarly, for Yamagawa, MacNamara shows that the required angle of elevation of the wave is 11°.

144 MHz and 432 MHz Reports

Taking the many reports of 144 MHz contacts over transequatorial paths, the equinoctial dependance is quite apparent. There are some scattered contacts, but that is a feature of previous long-term observations at lower frequencies as well. The diurnal peak lies between 2000 - 2400 hrs LMT, as reported.

Secondly, Reisert and Pfeffer report some angle-of-arrival measurements carried out by YV5ZZ and KV4FZ that indicated signals received on 144 MHz (VK4FZ - LU3AAT) and 432 MHz peaked at elevations of 8-10° which accords very well with the arguments presented by both Nielson and MacNamara.

Thirdly, reported signal strengths are very strong under 'good' conditions, well over strength nine, many occasions averaging strength seven or more. Even though these are 'guesstimates' a reasonable estimate of signal levels can be made, going by modern receiver performance measurements.

Now, a signal of 50 uV at the antenna of a receiver roughly represents an S9 signal. A 'scotch' S-meter will indicate S9 at around 150 uV. Now, 50 uV in 50 ohms is a signal level of -73 dBm. Remember that.

Now, let's consider the free space path loss at 144 MHz over a distance of 6400 km. Remember the world record – LU5DJZ to KP4EOR? Using the good books, a figure of 152 dB is obtained. Knowing the powers used by these two stations, their antenna systems etc, I estimated the signal, over a free space path, from LU5DJZ, received by KP4EOR would be at a level of -66 dBm.

This exceeds the 'guesstimate' S9 by 7 dB, i.e.: the S9 + report accords fairly well with a loss over the transequatorial path *equal to, or better than free-space path loss figures!*

A similar analysis for more modest stations, such as used by Australian and Japanese amateurs on 144 MHz gives received signals strengths, for a free-space path of the same length as the JA-VK TE path (5000 km), of around -85 dBm. This represents strength seven on the guesstimate signal strength scale (based on 6 dB per S-point). Reported signal strengths for many Australasian TEP contacts on 144 MHz are in this region.

I hardly think a *scatter mode* is responsible for the contacts.

Considering the evidence to date, it seems more likely that the 144 MHz contacts during the evening hours are supported by a *field-guided propagation mode*, or Class II TEP.

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2. E.D. Bowen, W.J. Fay and J.L. Heritage, Journal of Geophysical Research, 1968, 73, page 2469.
3. D.L. Nielson, "Long-Range VHF Propagation across the Geomagnetic Equator", March 1969 Stanford Research Institute Research Report.
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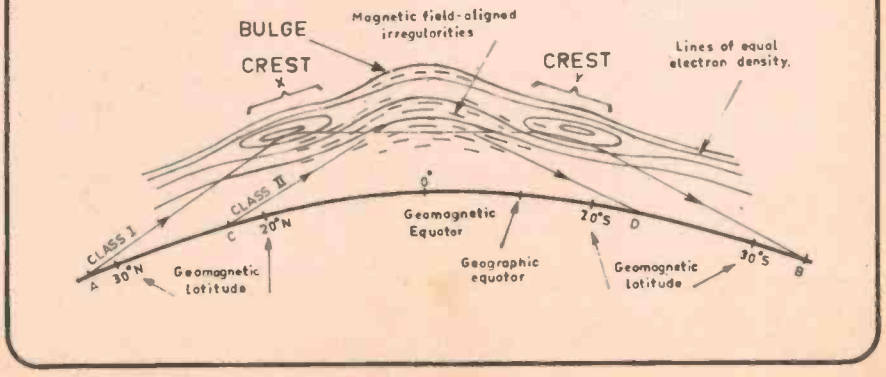
Fig. 2. The propagation modes of class I and class II TEP.



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- C J R Components, PO Box 128, Eastwood NSW 2122
- D Dick Smith Electronics P/L, PO Box 747, Crows Nest NSW 2065
- E All Electronic Components, 118 Lonsdale Street, Melbourne Vic 3000
- J Jaycar Pty Ltd, PO Box K39, Haymarket, NSW 2000
- K S M Electronics, 10 Stafford Court, Doncaster East, Vic 3109
- M Mode Electronics, PO Box 365, Mascot NSW 2020
- N Nebula Electronics Pty Ltd, 15 Boundary Street, Rushcutters Bay NSW 2011
- O Orbit Electronics, PO Box 7176, Auckland, New Zealand
- P Pre-Pac Electronics, 718 Parramatta Road, Croydon NSW 2132
- R Rod Irving, PO Box 135, Northcote Vic 3070
- T Townsville Electronic Centre, 281E Charters Towers Road, Rising Sun Arcade, Townsville Qld 4812
- V Silicon Valley, 23 Chandos Street, St Leonards NSW 2065

Project Electronics

041. . . . Continuity Tester . . . . . T, D
042. . . . Soil Moisture Indicator . . . . . T, D
043. . . . Heads or Tails Circuit . . . . Oct 76. . T, D, E, A
044. . . . Two Tone Door Bell . . . . . Oct 76. . T, D, E, O, A
045. . . . 500 Second Timer . . . . . T, D, O, A
047. . . . Morse Practice Set . . . . . T, D, O, A
048. . . . Buzz Board . . . . . T, D, A
061. . . . Simple Amplifier . . . . . Oct 76. . T, D, O, A
062. . . . Simple AM Tuner . . . . . Mar 77 . . D, E
063. . . . Electronic Bongos . . . . . D, A
064. . . . Simple Intercom . . . . . Nov 76 . . T, O, A
065. . . . Electronic Siren . . . . . D, O, A
066. . . . Temperature Alarm . . . . . Dec 76 . . T, D, E, A
067. . . . Singing Moisture Meter . . . . . D
068. . . . LED Dice Circuit . . . . . Oct 76. . T, D, E, A
070. . . . Electronic Tie Breaker . . . Jan 77
071. . . . Tape Noise Limiter . . . . . Jan 78. . . E
072. . . . Two-Octave Organ . . . . . Jun 78. . D
081. . . . Tachometer . . . . . Mar 77 . . T, E, O
082/528 . Intruder Alarm . . . . . T, E, A
083. . . . Train Controller
084. . . . Carl Arm . . . . . D, A
085. . . . Over-rev Alarm
086. . . . FM Antenna
087. . . . Over-LED
088. . . . Hi-Fi Speaker

Test Equipment

132. . . . Experimenter's Power Supply . . . . . Feb 77 . . E
133. . . . Phase Meter . . . . . Apr 77 . . E
134. . . . Ture RMS Voltmeter . . . . Aug 77 . . E
135. . . . Digital Panel Meter . . . . . Oct 77. . . E
136. . . . Linear Scale Capacitance Meter . . . . . Mar 78 . . E
137. . . . Audio Oscillator . . . . . May 78 . . E
138. . . . Audio Wattmeter. . . . . Nov 78
139. . . . SWR/Power Meter . . . . . May 78
140. . . . 1 GHz Frequency Meter-Timer . . . . . Mar 78 . . C

Simple Projects

243. . . . Bip Beacon. . . . . Apr 77
244. . . . Alarm Alarm . . . . . Feb 77
245. . . . White Line Follower . . . . Nov 77
246. . . . Rain Alarm . . . . . Apr 78
248. . . . Simple 12V to 22V Converter. . . . . Jul 78

Motorists' Projects

316. . . . Transistor Assisted Ignition . . . . . May 77 . . K, O, E
317. . . . Rev Monitor Counter . . . . Jul 77 . . . E
318. . . . Digital Car Tacho . . . . . Jul 78 . . . K, E
319. . . . Variwiper MK II . . . . . Sep 78. . . E

Audio Projects

448. . . . Disco Mixer . . . . . Nov 76
449. . . . Balanced Microphone Amp . . . . . Nov 76 . . J, E
450. . . . Bucket Brigade Audio Delay Line . . . . . Dec 77 . .
480. . . . 50-100 Watt Amp Modules. . . . . Dec 76 . . J,E,D,O,R,A
481. . . . 12 V 100 Watt Audio Amp . . . . . May 77 . . E
481. . . . High Power PA/ Guitar Amp . . . . . Jun 77. . O
482. . . . Stereo Amp . . . . . Jan 77. . . O, E
482. . . . Stereo Amp Part 2. . . . . Feb 77 . . O, E
483. . . . Sound Level Meter. . . . . Feb 78 . . E
484. . . . Simple Compressor Expander . . . . . Jul 77 . . E
485. . . . Graphic Equalizer . . . . . Jun 77. . J, E
486. . . . Howl-round Stabilizer . . . Nov 77 . . J
487. . . . Audio Spectrum Analyser . . . . . Feb 78 . . E
489. . . . Audio Spectrum Analyser 2 . . . . . Apr 78 . . J, E
495. . . . Transmission Line Speakers . . . . . Aug 77

Miscellaneous

546. . . . GSR Monitor . . . . . Mar 77 . . E
547. . . . Telephone Bell Extender . . . . . Jun 77. . . E
548. . . . Photographic Strobe . . . . May 77 . . E
549. . . . Induction Balance Metal Detector . . . . . May 77 . . E
550. . . . Digital Dial. . . . . Aug 78 . . E
551. . . . Light Chaser. . . . . Sep 78. . . E
552. . . . LED Pendant . . . . . Sep 78
553. . . . Tape/Slide Synchroniser . . Oct 78. . E
581. . . . Dual Power Supply . . . . . Jan 77. . . E
582. . . . House Alarm . . . . . Jul 77 . . T, O, E, A
House Alarm — Installation Instructions . . Aug 77
583. . . . Marine Gas Alarm . . . . . Aug 77 . . M, E
585. . . . Ultrasonic Switch . . . . . Sep 77. . . R, O, E, T
586. . . . Shutter Speed Timer . . . . Oct 77. . . E
587. . . . UFO Detector. . . . . May 78
588. . . . Theatrical Lighting Controller . . . . . Nov & Dec 77, Jan & Mar 78 . . N
589. . . . Digital Temperature Meter (PCB135) . . . . . Dec 77 . . E
590. . . . LCD Stopwatch . . . . . Oct 78. . N
591. . . . Up/DownPresettable Counter . . . . . Jul 78 . . E
592. . . . Light Show Controller . . . Aug 78 . . E

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603. . . . Sequencer . . . . . Aug 77
604. . . . Accentuated Beat Metronome. . . . . Sep 77. . . E
605. . . . Temp Stabilized Log-exponential Converter . . Sep 78

Computer Projects

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634. . . . 8080 Educational/ Prototyping Interface . . . Jul, Aug 78
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637. . . . Cuts Cassette Interface . . . . . Jan 78. . . V, O, E, A
638. . . . Eprom Porgrammer . . . . . Jul 78 . . . E, A
639. . . . Computerised Musical Doorbell . . . . . Mar 78 . . A
640. . . . S100 VDU . . . . . Apr-Jun 78 . . . V, O, A
641. . . . S100 Printer. . . . . Sep 78
650. . . . STAC Timer. . . . . Nov 78

Radio Projects

712. . . . CB Power Supply . . . . . Jun 77. . . O, E
713. . . . Add-on FM Tuner . . . . . Sep 77
714. . . . VHF-Log-Periodic Antenna. . . . . Feb 78, Mar 78
715. . . . VHF Power Amplifiers . . . Nov 77
716. . . . VHF Power Amplifiers . . . Jan 78, Feb 78
717. . . . Crosshatch Generator . . . . May 78 . . E
718. . . . SW Radio. . . . . Oct 78. . . E
719. . . . RF Field Strength Indicator . . . . . Nov 78

Electronic Games

804. . . . Selectagame . . . . . Nov 76 . . O
804. . . . Selectagame (Rifle Project) . . . . . Mar 77 . . O
805. . . . Puzzle fo the Drunken Sailor . . . . . Oct 77
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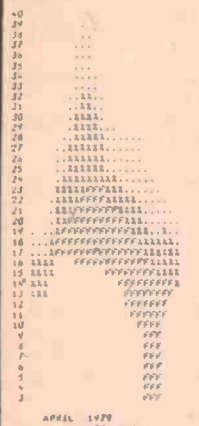
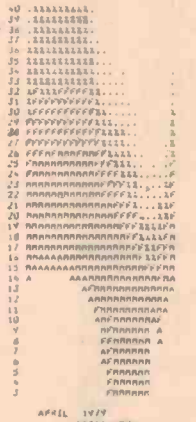
predictions for April 1979

These GRAFEX predictions show the various propagation modes possible on different frequencies at varying times for several paths. For full information on how to use the graphs, please see the ETI/Trio-Kenwood poster given free in the December 1978 issue.

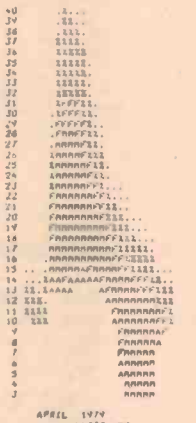
For reliable predictions follow the times and frequencies indicated by the F character on the printouts. (Time goes from 0000 UT to 2300 UT across the graph).



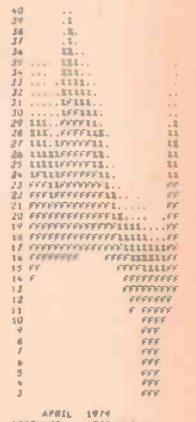
East Coast — Europe (Short Path)



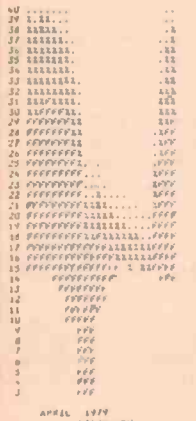
East Coast — Japan (also serves NE and South Central)



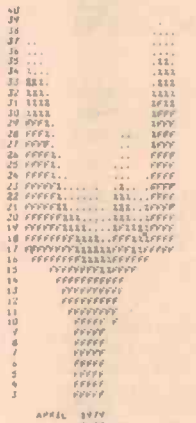
East Coast — South Africa (also serves South Central)



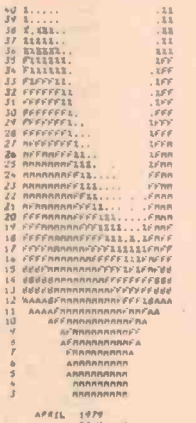
East Coast — North Africa (also serves South Central)



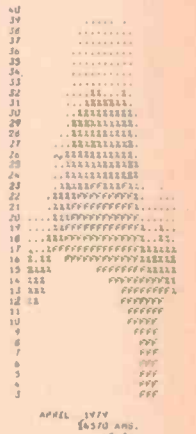
East Coast — South America (also serves South Central)



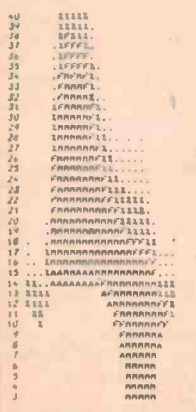
East Coast — North America (also NE and South Central)



East Coast — South Pacific

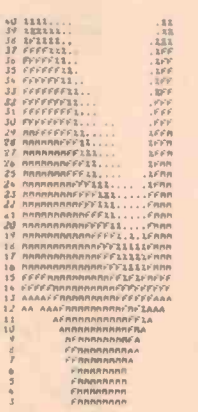


North East — Europe (Short Path)



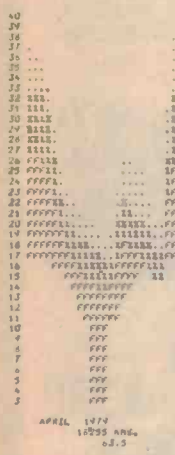
North East — South Africa

North East — North Africa

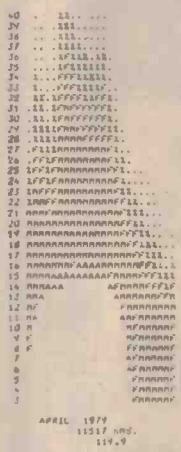


North East — South Pacific (also serves South Central)

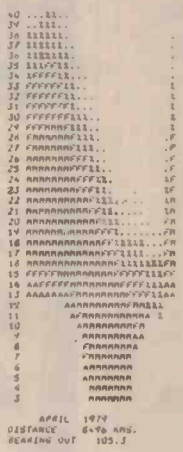
South Central — Europe (Short Path)(also West Coast)



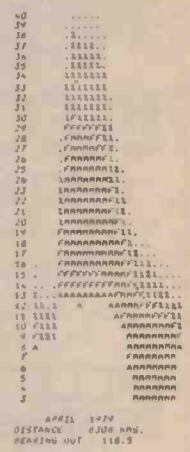
West Coast — North America



West Coast — North Africa



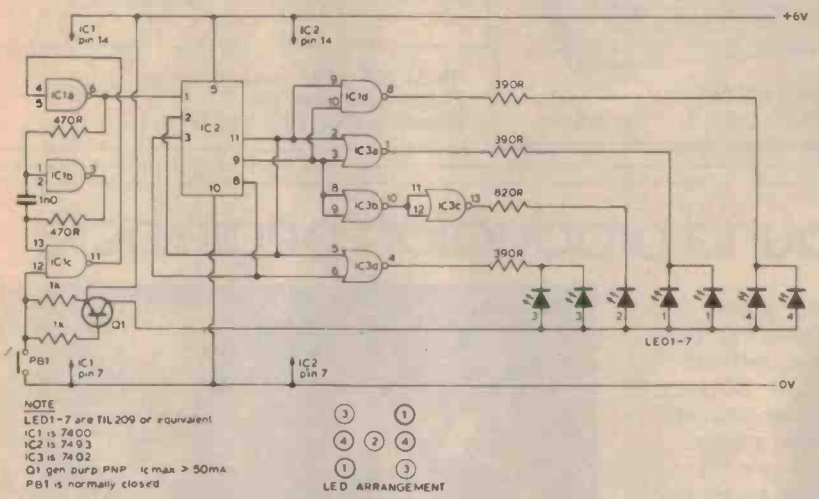
West Coast — Japan



West Coast — South Africa

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.
Electronics Today is always seeking material for these pages. All published material is paid for – generally at a rate of $5 to $7 per item.

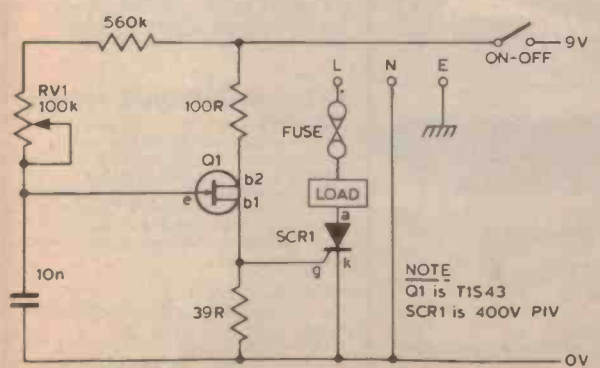


Electronic Dice

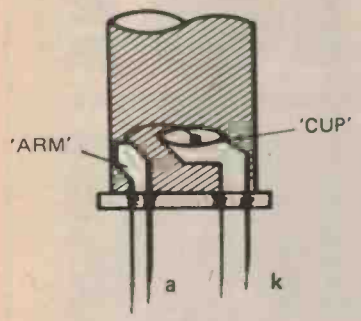
This dice circuit is interesting, as the six LEDs are arranged to produce a display the same as the dots on a dice. When PB1 is depressed, the display is blanked and the oscillator (IC1a, b, c) clocks IC2 at about 1 MHz. IC2 counts from zero and resets on seven. When PB1 is released, the display is enabled and a novel decoding system produces the correct output on the LEDs.

Lighting Effects

This circuit can be used to produce some interesting lighting effects. A unijunction relaxation oscillator is used to trigger the thyristor. The frequency of the oscillator is controlled by RV1. The load (a light bulb) will not be supplied at the same frequency as the unijunction oscillator, and some interesting effects can result. Care should be taken with this circuit as it is not isolated from the mains.



Ideas for experimenters



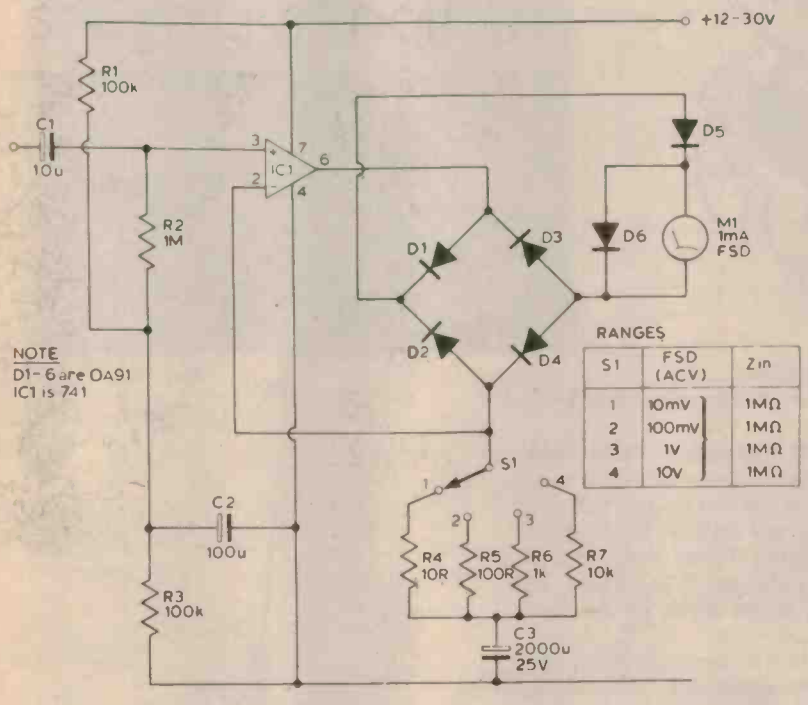
LED Spotting

Since the leadout on LEDs varies according to the manufacturer's preference, leadout diagrams are not always worthy of the trust placed in them. In some cases a reverse connection will destroy the device being used.

A simple way to avoid this is to use the following technique.

If the LED is held up to the light, the structure can be clearly seen. There is a "cup" and an "arm" carrying a fine wire to the LED itself, which is in the "basin" of the cup (see drawing).

The lead with the cup is the cathode, and the other is the anode (of course).



Audio Millivoltmeter

The circuit shown is of a very simple but effective and accurate millivoltmeter. The non inverting input is biased at half supply by the voltage divider R1/R3, decoupled by C2. The input impedance is defined by R3, whilst C1 isolates unwanted DC.

Due to normal op-amp action the inverting input follows any voltage present at the non inverting input. Because of this the current flowing through the meter, and the resistor selected by S1 is V_{RMS}/R. C3 prevents any DC flowing and hence makes offset nulling unnecessary.

With the component values shown the circuit has a flat response from 8 Hz-50 kHz (–3dB) on the 10 mV range. The upper limit remains the same on the less sensitive ranges but the lower frequency limit drops below 1 Hz.

D5 and D6 provide protection for the meter under reverse bias and overload conditions respectively. The circuit will work from supply rails between 12 and 30V, and in the quiescent state consumes only 2mA.

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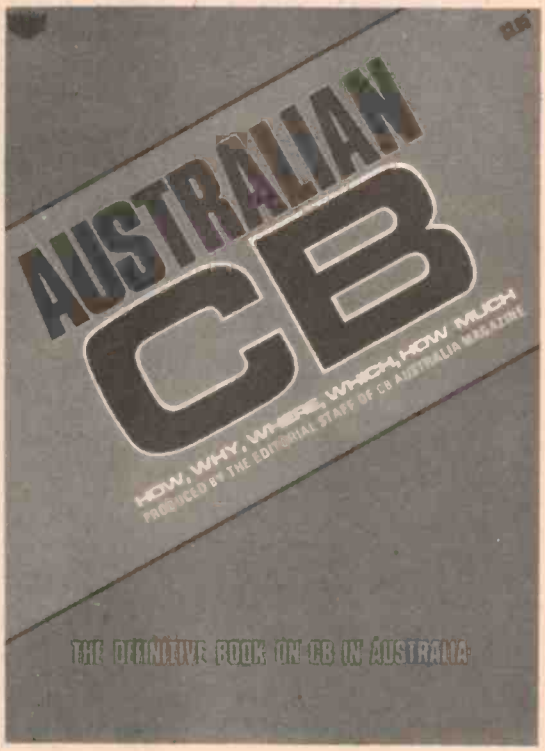

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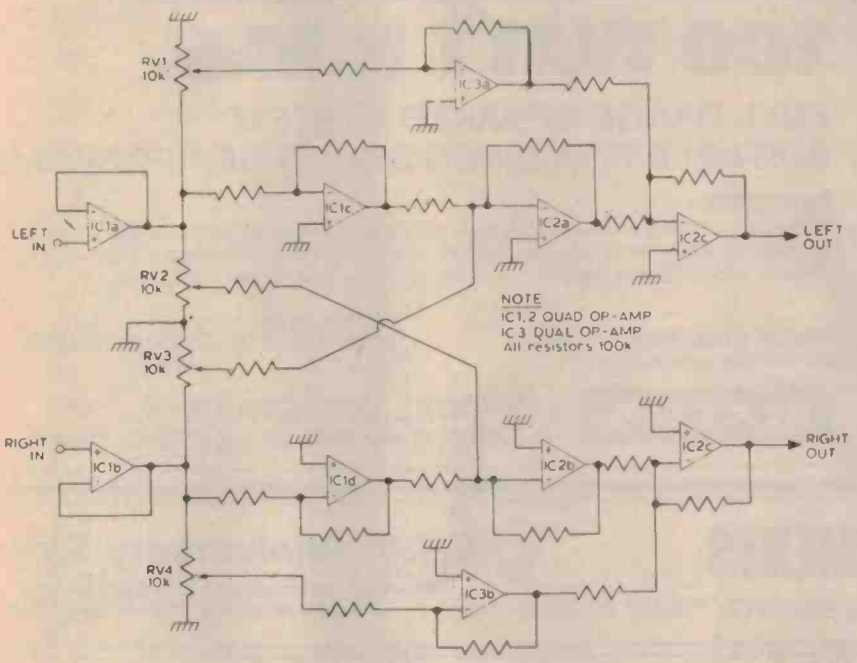
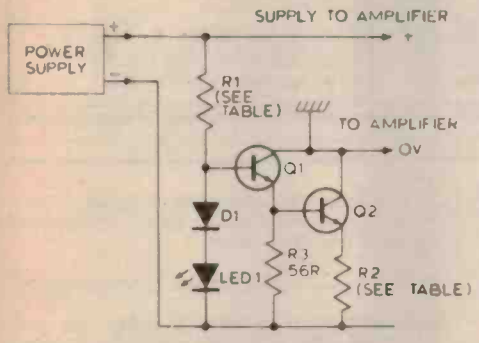
- CB mains power supply.
- SWR meter to build.
- CREST - CB for safety.
- Gulde to the NCRA.
- Two hundred unusual names for CB clubs.

Ideas for experimenters



4 Channel Synthesizer

This circuit will synthesize two rear channels for 'quadraphonic' sound when fed with a stereo signal. The rear output for the left channel is a combination of the left channel input 180 out of phase, added to a proportion of the right hand channel (also out of phase). The right hand rear output is obtained in a similar way.



NOTE
Q1 is BD131(up to 45V supply) or BD139(up to 90V supply)
Q2 is 2N3055
D1 is 1N914
LED1 is a RED LED

SUPPLY VOLTAGE	R1
10V to 22V	1k, ½W
22V to 40V	1.8k, 1W
40V to 70V	2.7k, 2W

AMPLIFIER POWER (RMS Watts)	R2
15W, 8R or 4W + 4W, 8R or 4W, 4R	0.5R
60W 8R or 15W +15W, 8R or 15W, 4R	0.2R
30W +30W, 8R or 30W, 4R	0.15R

Protection For Power Amplifiers

In many amplifiers, the only protection against overload is a single fuse. Experience has shown that output transistors can blow faster than fuses.

Normally, the current through R1 biases both the transistors fully on. The P.D. across the LED is less than 2V, and it will not light up. In the event of a fault or overload, the current consumption of the amplifier will increase. The forward bias on the transistors will decrease, and they will tend to turn off. This will cause the potential across R1 to decrease, which will increase the bias on the transistors, turning them on again. The overall effect is that current limiting takes place. Under these conditions, the LED will light up, indicating a fault condition. If the fault or overload persists, the main fuse in the amplifier will probably blow. The actual protection circuitry needs no resetting.

Under fault conditions, the dissipation in Q2 will be very high, and so it must be bolted onto the chassis or the heatsink.

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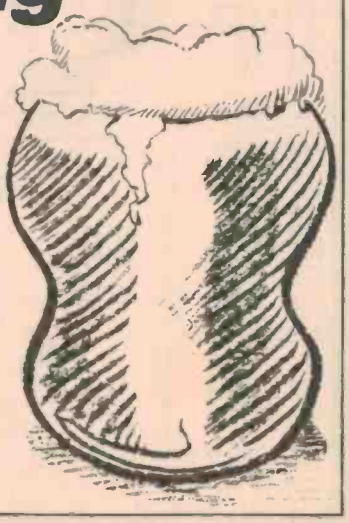

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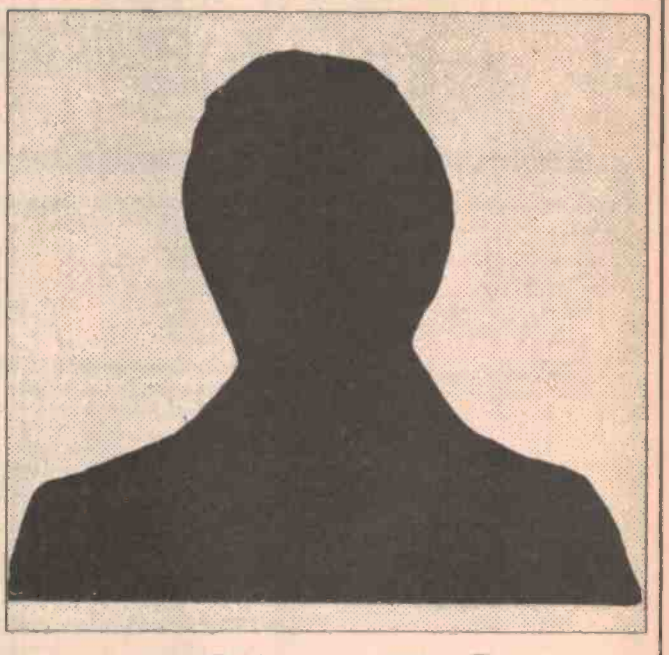

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	4046	1.25
	4048	.95
	4049	.45
	4050	.45
	4052	.75
	4053	.75
	4066	.55
	4069/74C04	.35
	4071	.25
	4081	.30
	4082	.30
	4507	.95
	4511	.95
	4512	1.10
	4515	2.95
	4519	.85
	4522	1.10
	4526	.95
	4528	1.10
	4529	.95
	MC 14409	14.50
	MC 14419	4.85
	74C151	1.50

LINEARS, REGULATORS, etc.

QTY.		QTY.		QTY.	
MCT2	.95	LM323K	5.95	LM380 (8-14 Pin)	1.19
8038	3.95	LM324	1.25	LM709 (8-14 Pin)	.35
LM201	.75	LM339	.75	LM711	.45
LM301	.45	7805 (340T5)	.95	LM723	.40
LM308	.65	LM340T12	.95	LM725	2.50
LM309H	.65	LM340T15	.95	LM739	1.50
LM309K (340K-5)	1.50	LM340T18	.95	LM741 (8-14)	.35
LM310	.85	LM340T24	.95	LM747	1.10
LM311D	.75	LM340K12	1.25	LM1307	1.25
LM318	1.75	LM340K15	1.25	LM1458	.65
LM320H6	.79	LM340K18	1.25	LM3900	.50
LM320H15	.79	LM340K24	1.25	LM75451	.65
LM320H24	.79	LM373	2.95	NE555	.45
7905 (LM320K5)	1.65	LM377	3.95	NE556	.85
LM320K12	1.65	78L05	.75	NE565	.95
LM320K24	1.65	78L12	.75	NE566	1.25
LM320T5	1.65	78L15	.75	NE567	.95
LM320T12	1.65	78M05	.75		
LM320T15	1.65				

– T T L –

QTY.		QTY.		QTY.		QTY.	
7400	.10	7482	.75	74221	1.00	74LS02	.30
7401	.15	7483	.75	74367	.95	74LS04	.30
7402	.15	7485	.55	75108A	.35	74LS05	.35
7403	.15	7486	.25	75491	.50	74LS08	.35
7404	.10	7489	1.05	75492	.50	74LS09	.35
7405	.25	7490	.45	74H00	.15	74LS10	.35
7406	.25	7491	.70	74H01	.20	74LS11	.35
7407	.55	7492	.45	74H04	.20	74LS20	.30
7408	.15	7493	.35	74H05	.20	74LS21	.35
7409	.15	7494	.75	74H08	.35	74LS22	.35
7410	.15	7495	.60	74H10	.35	74LS32	.35
7411	.25	7496	.80	74H11	.25	74LS37	.35
7412	.25	74100	1.15	74H15	.45	74LS38	.45
7413	.25	74107	.25	74H20	.25	74LS40	.40
7414	.75	74121	.35	74H21	.25	74LS42	.75
7416	.25	74122	.55	74H22	.40	74LS51	.45
7417	.40	74123	.35	74H30	.20	74LS74	.45
7420	.15	74125	.45	74H40	.25	74LS76	.50
7426	.25	74126	.35	74H50	.25	74LS86	.45
7427	.25	74132	.75	74H51	.25	74LS90	.65
7430	.15	74141	.90	74H52	.15	74LS93	.65
7432	.20	74150	.85	74H53	.25	74LS107	.50
7437	.20	74151	.65	74H55	.20	74LS123	1.20
7438	.20	74153	.75	74H72	.35	74LS151	.85
7440	.20	74154	.95	74H74	.35	74LS153	.85
7441	1.15	74156	.70	74H101	.75	74LS157	.85
7442	.45	74157	.65	74H103	.55	74LS160	.95
7443	.45	74161	.55	74H106	.95	74LS164	1.20
7444	.45	74163	.85	74L00	.25	74LS193	1.05
7445	.65	74164	.60	74L02	.20	74LS195	.95
7446	.70	74165	1.10	74L03	.25	74LS244	1.70
7447	.70	74166	1.25	74L04	.30	74LS367	.95
7448	.50	74175	.80	74L10	.20	74LS368	.95
7450	.25	74176	.85	74L20	.35	74S00	.35
7451	.25	74180	.55	74L30	.45	74S02	.35
7453	.20	74181	2.25	74L47	1.95	74S03	.25
7454	.25	74182	.75	74L51	.45	74S04	.25
7460	.40	74190	1.25	74L55	.65	74S05	.35
7470	.45	74191	1.25	74L72	.45	74S08	.35
7472	.40	74192	.75	74L73	.40	74S10	.35
7473	.25	74193	.85	74L74	.45	74S11	.35
7474	.30	74194	.95	74L75	.85	74S20	.25
7475	.35	74195	.95	74L93	.55	74S40	.20
7476	.40	74196	.95	74L123	.85	74S50	.20
7480	.55	74197	.95	74LS00	.30	74S51	.25
7481	.75	74198	1.45	74LS01	.30	74S64	.15
						74S74	.35
						74S112	.60
						74S114	.65
						74S133	.40
						74S140	.55
						74S151	.30
						74S153	.35
						74S157	.75
						74S158	.30
						74S194	1.05
						74S257 (8123)	1.05
						8131	2.75

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Left JR-S201 Right JR-S301

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WT87/78

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Technics hi-fi

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