JANUARY 1977 $1.00*
NZ $1.15

electronics TODAY INTERNATIONAL

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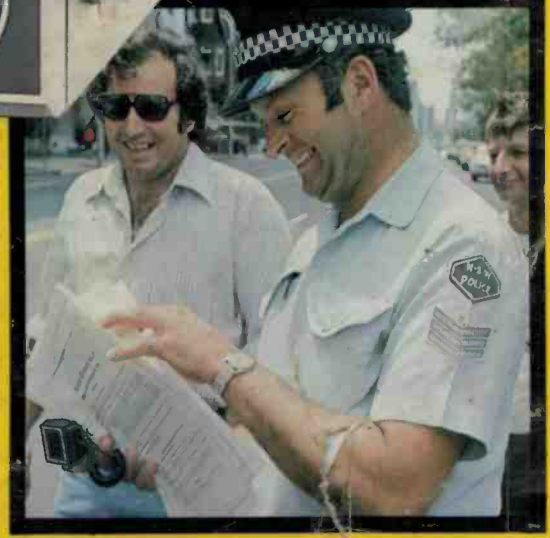
CB IN AUSTRALIA



SCOOP REPORT

Revolutionary new IC

50W stereo amplifier

ETI terminal - the VDU

1976 Index & Errata

...d for posting as a publication — Category C.

Well stacked in front

The new range of JVC front-loading cassettes is here. And if you think that's the only change, you're highly mistaken. Because, as usual, JVC brings in the range with a few unique additions which are going to make you think twice about any other brand.

For a start, the JVC ANRS sound reduction system is incorporated throughout, to make hi fi recording and playback as free of hiss as possible. And in some cases, even improving the dynamic range of normal cassettes.

Another exclusive is the JVC Sen-alloy head, and believe it or not, it offers you the clearest sound and longest wearing lifespan of any head available; originally designed solely for professional use, this head is now incorporated in JVC cassette decks CD-S200 and CD-1970.

And yet another first: JVC is the only manufacturer to provide decks with 5 LED peak-level indicators so that your recordings are perfect at all times. These are featured on models CD-1920 and CD-S200.

Loading is, of course, simplified. The special compartment is air-damped and removable for uncramped head maintenance.

The JVC famous range of top-loaders is still available, offering you the very highest quality. All things considered, there is no other consideration.

JVC

the right choice

For details on JVC Hi Fi Equipment, write to: JVC Advisory Service, P.O. Box 49, Kensington, N.S.W. 2033.

electronics TODAY INTERNATIONAL

A MODERN MAGAZINES PUBLICATION

JANUARY 1977, Vol. 7 No. 1

Editorial — Steve Braidwood
Publisher — Collyn Rivers

Electronics Today International is Australian owned and produced. It is published both in Australia and Britain and is the fastest growing electronics magazine in each country.

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An easy-to-build modular design with CMOS switching

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For our VDU or other video projects

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Power supply and memory board for the ETI terminal

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COVER: The CB boom has hit the media but is it really happening? Roger Harrison, a regular ETI contributor and a well-known radio amateur, has been doing some research and you can read the full story on page 16 of this issue.

Action photographs by Bubbles Hofsteters; equipment shot from Peter Shalley (5 W AM/25 W SSB, $289).

*Recommended retail price only

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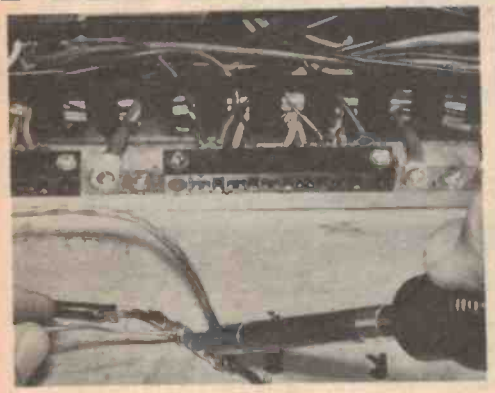
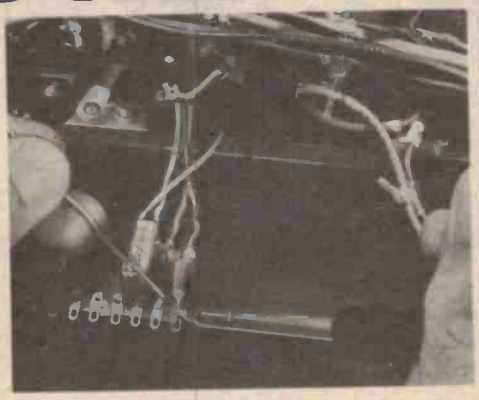
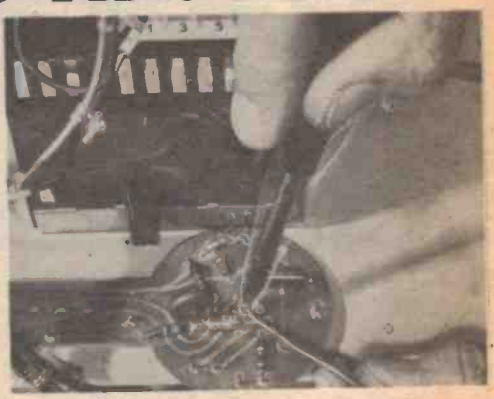
"WITHOUT MY SCOPE IRONS I RECKON I'D NEED A 25 HR. DAY."



8.00am "Start the day with a heavy earth connection on the emergency power plant. Need a 130 watt iron. My Superspeed's got that and more. Just as well, the workshop's 400 yards away".

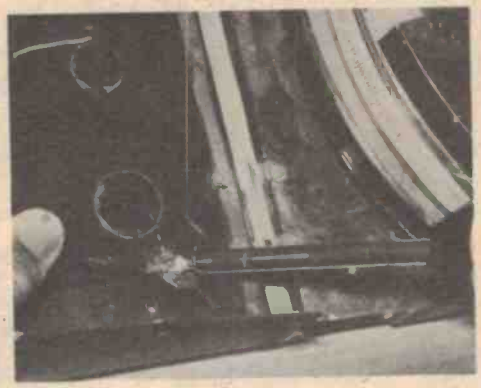


9.15am "Call from No. 2 Moulding Shop. Ran some temporary leads involving both tag joints and Printed Circuit Board (P.C.B.) connections. The Scope Minispeed handled the lot".

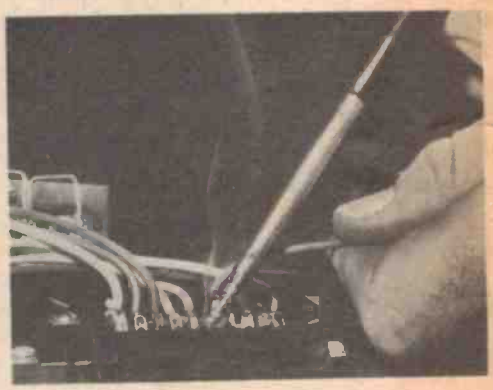


10.55am The V.D.U. in the process control room is playing up. Replacing miniature resistors on a P.C.B. is, ideally, the job for a temperature controlled 60w iron but my Scope Minispeed did the job and did it well.

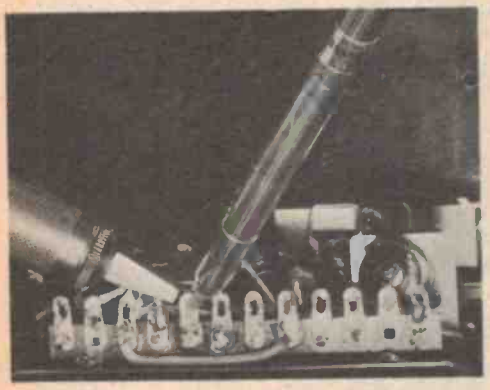
11.15am "Fix the speaker leads in the canteen P.A. Need a 30-40 watt iron, but my Scope Minispeed did the job".



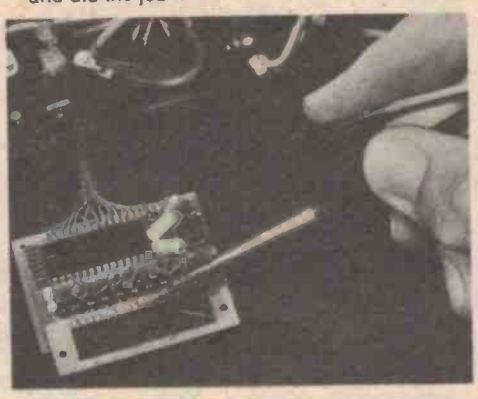
1.30pm "Resolder a 7/036 earth to sheet metal — LP gas flame would work, but too much risk of heat damage to PVC cable. The Superspeed iron produced its full 150 watts and did the job".



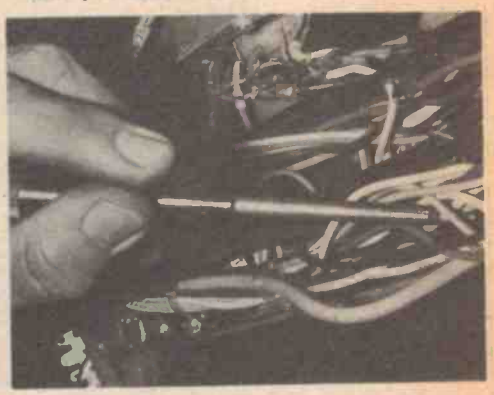
2.15pm "Fred borrowed my Minispeed to tackle an open circuit on the fork lift's headlights. He permanently soldered the wires to the terminal block, and used the Mini's 75 watts to do it".



2.17pm "Tag soldering in the workshop and a desolder job on a P.C.B. Using the Minispeed saves swopping between conventional 60 watt and 25 watt irons".



3.58pm "Emergency in shop six. I used my Minispeed to unsweat the leads of the main heater control circuit and then desolder the pyrometer circuit on the P.C.B. One iron, two different jobs".



4.18pm "This wiring's a real birds nest. Passed through the wires with the Minispeed stone cold, desoldered the three joints, let the iron cool down, then withdrew through the PVC insulation. The 5 second heat up and low tip mass let's me do this".

Scope soldering irons save time three important ways:

1. Versatility.

One Scope iron replaces several conventional irons because it can tackle a wide range of soldering problems, from integrated circuits and printed circuit boards to heavy earth and chassis connections.

You don't have to swap irons half-way through the job. Both the Minispeed and the Superspeed function as 20-30 watt irons, and then within seconds and a touch of the finger switch, you get increased heat output to increase the Minispeed to 75 watts, and the Superspeed to 150 watts.

2. Speed.

Five seconds gets both irons ready for work, and they cool down quickly as well. When you encounter a heat sink you want an iron that can make up the heat loss instantly and maintain good soldering temperature. Result, the job's done fast and you can move onto the next.

3. Safety.

Scope irons are isolated from the mains. The special isolation transformer lets you work on live equipment with a higher degree of safety than a conventional iron.

The Scope range of products is designed to deliver efficiency and convenience. Consider the advantages of these products.

(A) Scope Cordless. 60W.

Designed for working where no power is available or during temporary failure. It's powered by two rechargeable Nicad cells with the capacity to solder between 100 and 200 typical electronic connections before overnight recharging.

(B) Scope 12V Hobby Iron.

This versatile iron is designed to work within 6 metres of your car battery.

(C) Scope Vibroscope.

This electric pencil allows for permanent writing on all metals. Valuable in an engineering store identifying metal tools, dating and naming parts, inscribing trophies.

For enquiries and further information on the Scope range of products contact: Scope Laboratories, 93 Matthews Avenue, Airport West, Melbourne, 3042.

SCOPE

THE RIGHT IRON FOR THE RIGHT JOB.

SL1

NEWS

Video Changer

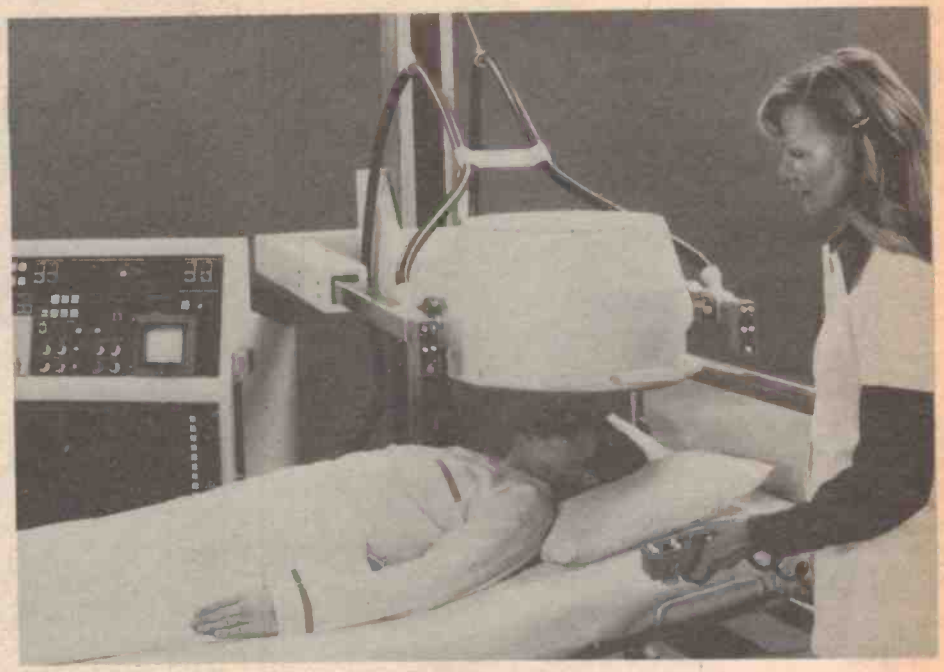
Teldec (Telefunken/Decca) have demonstrated their latest contribution to the inventory of the playboy who has everything: an automatic changer for their video-disk player. The changer holds up to twelve of their ten-minute discs and it will probably cost over US$800.

Complete Computer Kit

Processor Technology claim they have the cheapest complete personal computer on the US market with their $995 kit based on the Intel 8080. The complete microcomputer offers the benefits of personal computing to individuals and companies with no hardware expertise, and the PT system is just one of several complete computers now available.

Watching you watching me

RCA in Britain are developing a system to automatically log which TV programmes are being watched by a sample of viewers. The system is based on the CDP1800 microprocessor and uses 5K of memory and a 1,700-instruction program. Each day results are sent over the telephone line to a central processor. Eventually the viewers would wear some type of identity circuits to enable the loggers to record demographic data (age, sex, etc) automatically.



Mobicon

Nuclear medicine has already secured a prominent place among normal diagnostic procedures of today, beside the customary scintigraphic procedures, the gamma camera furnishes instantaneous pictures of organs being examined. For this purpose, Siemens offer the gamma cameras 100 and 110. In order to enable nuclear-medical diagnoses to be established of bedridden patients, too, at clinics and hospitals, the new mobile Mobicon camera has been included in the Siemens marketing programme.

For more information please contact your nearest Siemens Office or Siemens AG, Zentralstelle fur Information Joachim Ullmann, Telephone (09131) 7-3394 Postfach 3240, D-8520 Erlangen 2 Federal Republic of Germany.

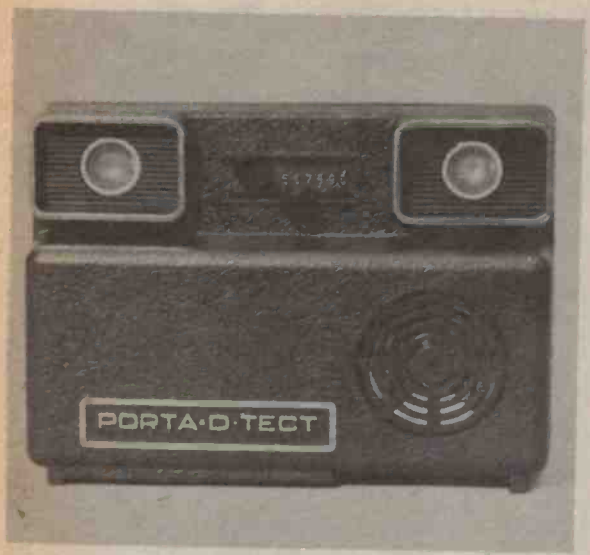
100MHz frequency counter

The new TC312 from Gould Advance Limited is a general-purpose frequency counter offering a comprehensive range of facilities within the bandwidth dc to 100 MHz. The instrument incorporates a 6-digit display and gate-open and overflow indicators.

Input attenuators and filters are provided, and input impedance is 1M (with less than 30pF capacitance). The 10MHz internal crystal standard has an accuracy within one part in 106, an aging rate within one part in 107 per month after four months, and a stability of 5 parts in 107, giving a very high degree of resolution in the displayed parameter. Further information from Jacoby Mitchell Ltd, Sydney.

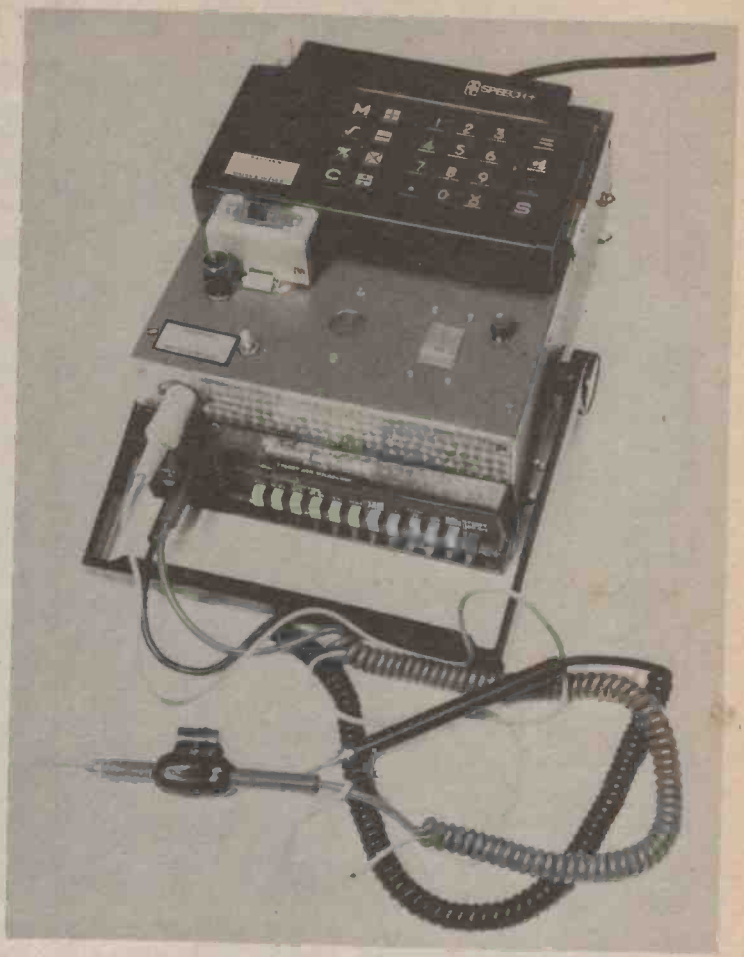
DIGEST

PORTABLE INTRUDER ALARM



The Porta-D-Tect is a portable battery-operated ultrasonic burglar alarm available from Electronic Concepts in Sydney. It protects a 45 degree cone against any movement from ten seconds after the user sets the unit. The alarm will sound for two or three minutes after detecting movement unless a two-digit combination code is set on the switches on the front of the alarm. The user has fifteen seconds to set this disarm code between the time he disturbs the ultrasonic field and start of the audio alarm.

The alarm is only about 95 x 135 x 45 mm but it produces a piercing 106 dB tone which not only frightens the life out of the intruder but alerts people for quite some distance around.



IFAF IC

The TDA2850 is a new linear IC from Siemens which contains eight stages of IF amplification, a demodulator, and an AF amplifier section capable of delivering four watts into four ohms.

Hand-Held Real-Time Analyser

A hand-held, battery-operated, real-time audio analyzer is available in the US from Ivie Electronics. The IE-10 covers octaves from 22Hz to 22 kHz with a range of 16, 32 or 48 dB (resolving 1, 2, or 3 dB). The unit has a built-in condenser microphone and sells for US$487.

DMM for the Blind

Either spoken or Braille readings are given by this digital multimeter. It was designed in Macquarie University's Electronics Laboratory for trial use by a blind man in his Melbourne tape-recording studio.

A Fluke 8000A multimeter, a Braille cell and a TSI "Speech Plus" talking calculator are interfaced. The calculator may also be used independently and is detachable.

PCM Audio on VTR

At the International Audio Fair in Tokyo Sony demonstrated an experimental adapter to enable VTR owners to record and playback audio using pulse code modulation techniques. The performance beats that of any analogue audio recorder.

A dynamic range of 85 dB (95 dB for commercially-recorded tapes) can be achieved and at 0.1 percent harmonic distortion the figure is 40 dB (50 dB commercially). Harmonic distortion can be as low as 0.03 percent.

WHERE THERE'S A NEED THERE'S A STANTON

Stanton have always satisfied the needs of those whose job it is to play records — of any sort. Here are some of the specific record playing tasks Stanton have been called on to cope with:—

• Lacquer masters • Metal Mothers • Quality Control • Equipment Calibration • Transcribing of historic 78's with non standard grooves • Transcribing of cylinders • Back cueing in Radio stations and Discotheques.

Stanton developed specific cartridges and styli to satisfy these needs.

Another need arose.

Hi Fi enthusiasts and music lovers wanted performance as close as possible to the unequalled 681EEE but at a substantially lower price.

Accepting the challenge, Stanton produced the 680EE. It has many of the universally acclaimed qualities of the 681EEE. It tracks at the same pressure as the 681EEE (0.75—1.5 gms) it has the same unsurpassed channel separation of 35dB (at 1KHZ) and its frequency response is almost as wide.

At $51 (R.R.P.) it's almost too good to be true. Audition one today and judge for yourself.

Sole Australian Distributors:

LEROYA INDUSTRIES PTY LTD

Head Office, W.A.: 156 Railway Parade, Leederville, Western Australia, 6007. Phone 81 2930.

N.S.W. Office: 100 Walker Street, North Sydney, N.S.W. 2060. Phone 922 4037.

Victoria Office: 103 Pelham Street, Carlton, 3053. Phone 347 7620.

Available at quality-conscious Hi-Fi dealers throughout Australia.

LER 149

PORTABLE SOLDERING

The hassles of bulky transformers and tangled transformer leads are a thing of the past with the advent of Royston Electronics' new portable soldering tool kit.

It accepts either the Adcola Thermatic (controlled temperature) or Duotemp (dual power) mains voltage soldering tools, and provides receptacles for a pack of solder, spare tips, and Soderwick desoldering braid. The tool holder pops up and locks when the lid is open, so that the tool is at the most convenient handling angle. It also protects the barrel from damage and provides free air around it to prevent overheating. Also, of course, it elminiates damage to carpets or tables when servicing home appliances.

The hot tool stows safely when the lid is closed, with complete protection for the flexible cord.

Royston Electronics, 22 Firth St, Doncaster, Vic 3108.

STATHMOLOGY

(Integrated and systematic study of measurement, instrumentation and control).

The third national residential school on Stathmology will be held at the University of New England, Armidale, NSW between the 19th and 24th February, 1977.

The programme will be similar to the previous course, including basics of measurements, hardware design, sensors, signal processing and some commercial viewpoints. Lectures on programmable controllers and microprocessors will also be given.

As previously, the residential fee includes lectures, course books and all accommodation.

All enquiries and enrolment applications should be addressed to The Department of Continuing Education, University of New England, Armidale, NSW 2351. (or phone Armidale (067) 72 2911 ext. 2123 or 2788).

Digitronics Power Supply

This 12 V, 3.5A, power supply comes in kit form from Digitronics of Newcastle. We are not sure of the price because this is currently being reviewed following devaluation.

C³ RAM

The achievable bit density of RAMs with single-transistor memory cells is limited by the attenuation of the stored signal during readout. At present the largest bit density can be obtained with CCDs. This advantage is unfortunately outweighed by the loss of random access.

An experimental semiconductor memory has been built by Siemens with a bit density comparable with CCD memories but still allowing random access. This C³RAM (continuously charge-coupled random-access memory) uses as storage elements single-transistor memory cells, which are connected to a common bit line implemented as an MOS transmission line.

Electronic Design Charts

Electronic Design Charts is the name of a book by Norman Crowhurst that's been around for a few years now and proved quite popular with circuit designers.

There are over 40 abacs and graphs covering the whole range of analogue electronics. Now Dick Smith has had a quantity of these books specially printed and he is selling them for $10.95 each.

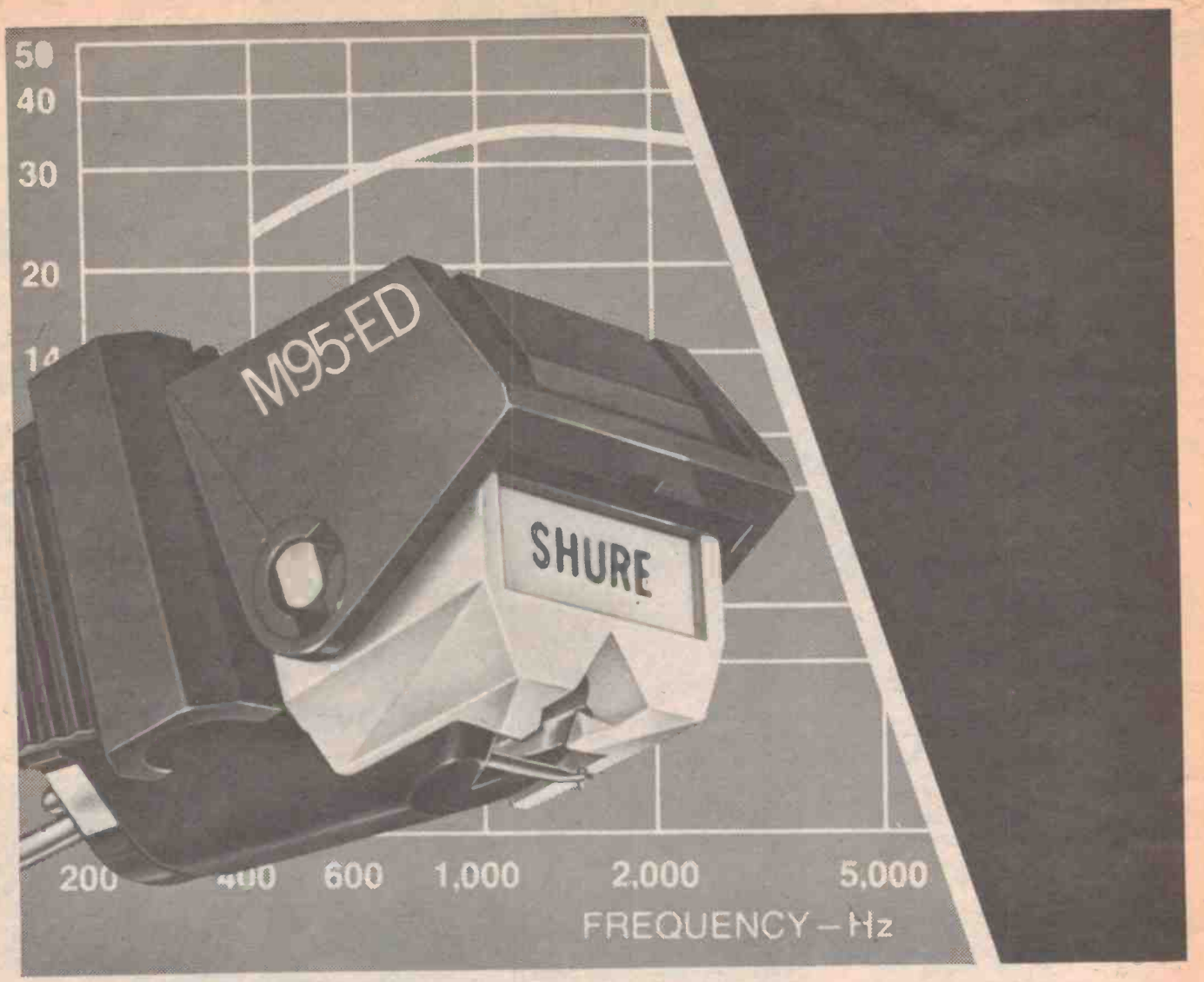
TI take on GI

Texas Instruments' Japan are producing a video game chip which directly replaces the General Instruments' chip we used in the ETI video game. It is not known whether these chips will be available outside of the Far East market.

Simple CTV TX

The first of a new generation of colour television transmitting stations which can be housed in a box rather than a building has gone into service in Britain.

The system has been developed by BBC engineers. The corporation claims it is less expensive and easier to install than other transmitters. The new equipment operates at very low power and is small enough to be housed in a box which can be bolted to a simple pole supporting the receiving and transmitting aerials.



M95ED: A Significant Technological Innovation

Shure now introduces a superb, moderately priced pick-up cartridge with a performance second only to the renowned V-15 Type III. The technologically advanced electromagnetic structure with a newly designed pole-piece virtually eliminates hysteresis loss. The frequency response from 20 to 20,000 Hz remains essentially flat. Operating at extremely light tracking forces of between ¾ and 1½ grams, the exceptional trackability of the M95ED enables it to trace the very high recorded velocities encountered on many modern recordings with the result that in addition to providing faithful reproduction of the recorded sound, stylus and record wear are reduced to minimum proportions. The M95ED: A notable addition to the Shure range with a performance never before available at such a competitive price.

Distributed in Australia by
AUDIO ENGINEERS PTY. LTD.
342 Kent Street, Sydney. Write for catalogue.

SHURE®

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

RON JONES PTY. LTD.
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MILTON. 4064. Qld.

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1000 Hay Street,
PERTH 6000 W.A.

AEO99/FP

AUSTRALIA HAS ONE OF WORLD'S MOST EXPENSIVE TELEPHONE SERVICES

"Due to very large increases in charges for telephone services, introduced in recent times, we now have one of the most expensive telephone services in the world".

This is stated by the Chairman of ATDA (Australian Telecommunications Development Association), Mr, T.E. Hodgkinson, in ATDA's 1976 Annual Report — 'Telecommunications 1976'.

Later in his report Mr. Hodgkinson states: "The high charge for new connections does not increase demand and, indeed, can only be considered to be a deterrent factor. Australia has approximately 35 telephones per hundred of population, a very low figure when compared with, say, the USA and Sweden, both of which have well over 60 telephones per 100 of population".

Bill & Norm Edge

NATIONWIDE ELECTRONICS

A new mail order firm, "Nationwide Electronics" of P.O. Box 184 Pennant Hills, 2120, has been started by Bill and Norm Edge. The business will be run by these two well-known personalities. Both Norm and Bill, who were former proprietors of Radio Despatch Service and Edge Electrix, respectively, are now completely independent again.

Both men have been out of the electronic parts industry for twelve months but have come back in order to provide a service which they feel is missing. Norm, who started his own electronics parts business some forty years ago has particularly noticed the lack of personalised treatment these days.

All your problems and orders will be dealt with by Norm and Bill personally and even specials will be ordered in for you as long as they satisfy suppliers' minimum requirements.

Nationwide Electronics do not have a catalogue as they feel that its cost has to be loaded into the selling prices which they hope to keep as low as possible to attract hobbyists. Plans are underway for a shop in the Parramatta area and further details of this venture will be advertised in this magazine.

HAND-HELD SUPER-TERMINAL

A good application of the latest techniques in electronics is a hand-held data terminal from Litton Industries. The unit is so up-to-date the designers had to design their own CMOS microprocessor because there were none available at the time when one was needed.

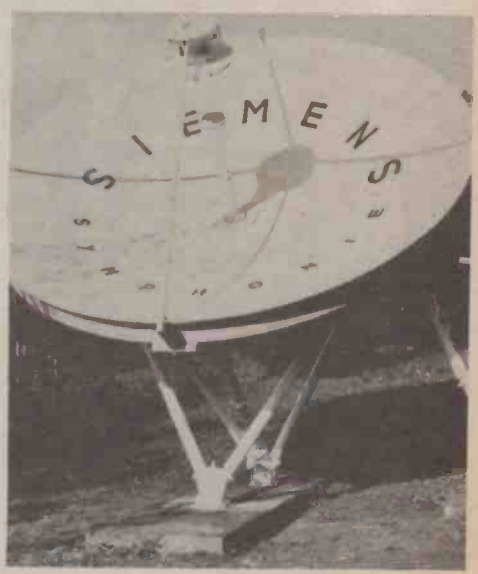
There is no separate keyboard and display – just an LED-studded panel (3x4½ in) covered with a transparent touch-input membrane. The terminal displays the alphanumerics and the user touches them with his finger when he wants to input data. The terminal will also display special function 'keys' or graphics.

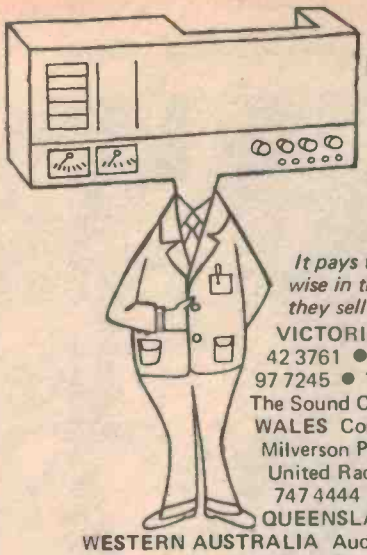
The LED panel is made up of three modules with 6398 LEDs on each. The switch membrane has 54 switch points.

The terminal comes with 20K of RAM and is designed to transmit data at 600 to 1200 bits per second over a voice channel. Initial units will go to the US Marine Corps and the West German Army for evaluation. Litton sees the main application as a connection over a radio channel between a military outpost and a command-network computer.

EDUCATION BY SATELLITE

Plans to provide developing countries with information and education by means of television often fail because of inadequate technical facilities. For Africa, the time has now come to introduce educational television on a larger scale: The experimental German-French communications satellite "Symphonie" offers the possibility of broadcasting suitable programmes, and a satellite receiving station developed by Siemens, with an antenna diameter of 4.5 m, can be installed quickly and easily anywhere to serve as an earth station.





The people who speak Nakamichi :

It pays to deal with an accredited Nakamichi Dealer. He has trained staff who are wise in the ways of Nakamichi. They prepare and tune Nakamichi products before they sell them. And if you need technical advice they are the people to talk to.

VICTORIA Allans Music (Aust) Ltd. 63 0451 ● Encel Electronics Pty. Ltd., 42 3761 ● Instrol Hi-Fi (Vic) Pty. Ltd. 67 5831 ● Southern Sound, 67 7869, 97 7245 ● Tivoli Hi-Fi, 80 4956 ● E & B Wholesale, Geelong, 9 6616 ● The Sound Craftsman, 509 2444 ● Buy-Rite Electrix, 42 6200 ● NEW SOUTH WALES Convoy Sound, 357 2444, 29 1364 ● Instrol Hi-Fi Pty. Ltd. 29 4258 ● Milverson Pty. Ltd. 412 2122, 635 3588 ● Riverina Hi-Fi, 938 2663/4 ● United Radio Distributors Pty. Ltd. 232 3718 ● Wests (Burwood) Pty. Ltd. 747 4444 ● Pitman's Radio & T.V. Wagga, 25 2155 ● QUEENSLAND John Gipps Sound, 36 0080 ● Premier Sound, 28 2701 ● WESTERN AUSTRALIA Audio Distributors, 31 5455 ● Arena Distributors A/Asia Pty. Ltd. 25 9993 ● TASMANIA Bel Canto, 34 2008 ● A.C.T. Pacific Stereo 95 0695 ● Duratone, 82 1388 ● SOUTH AUSTRALIA Blackwood Sound Centre, 278 1281 ● Decibel, 61 1865 ● Ern Smith Hi-Fi, 51 6351 ● Allans Music (Aust) Pty. Ltd. 223 5533 ●

Nakamichi System One

The Nakamichi 600 Series was originally envisioned as a group of components that would allow the creative audiophile a degree of flexibility and control in recording and reproduction of music never before available on consumer high fidelity equipment. With the introduction of the 620, Nakamichi is also making available a custom rack mount for the 600 Series components. Designated the SYSTEM ONE, this strikingly attractive module consists of the Model 600 Cassette Console, the Model 610 Control Preamplifier, the Model 620 Power Amplifier, and a unique multi-function digital programme timer. Differing in basic concept from the currently fashionable 19 inch standard rack mount components, the Nakamichi SYSTEM ONE offers a decidely non-industrial appearance. It will serve as the nucleus around which a high accuracy creative music system can be built.

Other fabulous Nakamichi products:

Nakamichi 1000 Tri-Tracer ● Nakamichi 700 Tri-Tracer ● Nakamichi 550 Dual-Tracer ● Nakamichi 350 Cassette System ● Nakamichi 250 Cassette Player ● ADS 200 Miniature Monitor Loudspeaker ● ADS 2002 Miniature Integrated Loudspeaker/Amplifier ● Nakamichi Microphones ● Digital Timer ● Remote Controller ● Head Demagnetizer Headphone ●

Sole Australian Agents:

Convoy INTERNATIONAL

4 Dowling Street
Woolloomooloo 2011
Sydney Tel 358 2088

WIN A CALCULATOR!

This month's calculator contest was sent in by Tim Cumpston of Scullin, ACT.

To enter this contest all you have to do is is give the next three numbers in the series given below:

110 20 12 11 10 ...

Then write your answer along with your name and address on the back of an empty envelope and send it to ETI/Unitrex Contest (Jan), ETI Magazine, 15 Boundary St, Rushcutters Bay, NSW 2011, to reach us by 15 February.

The winner will be the sender of the first correct entry randomly drawn after that date. **Permit number TC7585**

Build Your Own Music Synthesiser

It is quite some time now since we published constructional details in ETI of our 4600 synthesiser and its smaller brother, the 3600 synthesiser. Many hundreds have been built in Australia and the instrument has proved to be one of the most popular synthesisers in current use.

In the immediate future (some time this month) we will take delivery of a limited number of a special book on the International synthesisers. This publication will only be available direct from the publishers, Modern Magazines, and interested readers are advised to order a book immediately.

The book contains all the constructional details of the synthesisers and incorporates all the corrections we know about plus up-dated circuitry for some sections. To get your copy send a cheque for $12.50 to 'International Synthesisers' Book, Modern Magazines, 15 Boundary Street, Rushcutters Bay, NSW 2011.

ETI CIRCUITS BOOK

This book contains stacks of circuits taken from the Ideas For Experimenters section of the international editions of ETI. Many have never been published before in Australia and the whole collection is specially categorised to enable the designer to find the kind of circuits he is looking for without having to wade through a library of books and magazines.

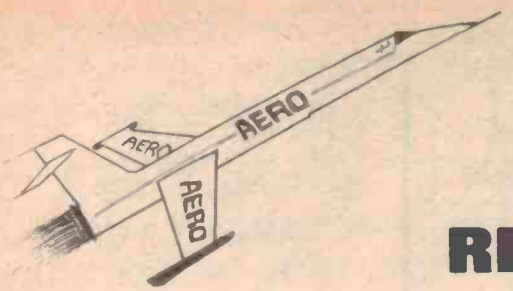
ETI Circuits No 1 is available from The Subscriptions Department, Modern Magazines, 15 Boundary Street, Rushcutters Bay, NSW 2011, for $2.50 per copy.

UP THE POLE

The closing date for our 'Up The Pole' contest is January 15th so there may still be time to enter and win a seat on Dick Smith's plane to the south pole. All you have to do is to think up a caption for the cartoon in the December issue and sent it to us with your name, address and phone number on the back of an empty envelope.

Erratum

Modifying TV Receivers for Graphic Display, December ETI, P86. Point 1 in the section 'Before You Start' should have advised you to check that the power supply section of your TV set does use an isolating transformer.



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3.3 µFd	25 p.c.b.	10c	8c
4.7 µFd	10 p.c.b.	10c	8c
4.7 µFd	25 p.c.b.	10c	8c
22 µFd	10 p.c.b.	10c	8c
22 µFd	50 p.c.b.	17c	15c
25 µFd	16 p.c.b.	10c	8c
33 µFd	6.3 p.c.b.	11c	9c
33 µFd	16 p.c.b.	12c	10c
47 µFd	10 p.c.b.	14c	12c
47 µFd	25 p.c.b.	16c	14c
47 µFd	50 p.c.b.	17c	15c
100 µFd	10 p.c.b.	16c	13c
100 µFd	25 p.c.b.	18c	15c
220 µFd	6.3 Axial	20c	17c
220 µFd	16 p.c.b.	20c	17c
220 µFd	35 p.c.b.	26c	22c
470 µFd	6.3 Axial	25c	22c
470 µFd	25 p.c.b.	25c	22c
			10 up
1000 µFd	10 Axial	38c	35c
1000 µFd	16 p.c.b.	40c	36c
1000 µFd	25 p.c.b.	52c	47c
1000 µFd	35 p.c.b.	52c	47c
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7402	40c	35c
7404	40c	35c
7408	40c	35c
7410	40c	35c
7420	40c	35c
7430	40c	35c
7447	$1.50	$1.40
7451	40c	35c
7454	40c	35c
7474	90c	85c
7490	80c	75c
7492	80c	75c
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4023	40c	35c
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LM307	70c	60c
LM304H	70c	60c
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LM377	$2.80	$2.50
LM382	$2.45	$2.30
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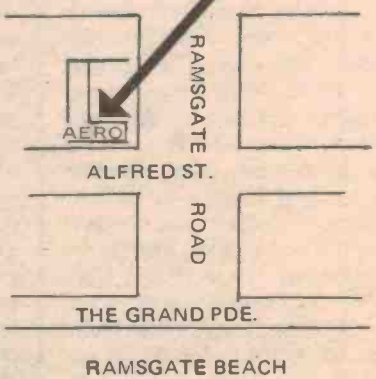

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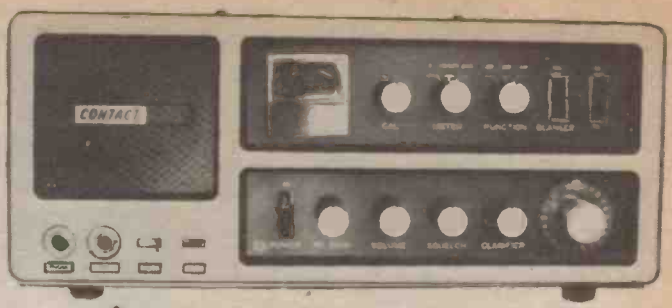

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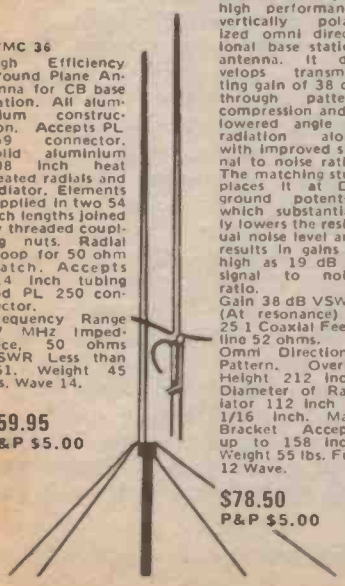

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High Efficiency Ground Plane Antenna for CB base station. All aluminium construction. Accepts PL 259 connector. Solid aluminium 108 inch heat treated radials and radiator. Elements supplied in two 54 inch lengths joined by threaded coupling nuts. Radial droop for 50 ohm match. Accepts 114 inch tubing and PL 250 connector.
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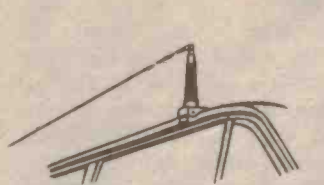

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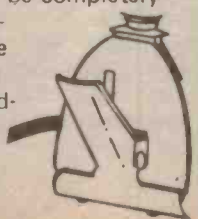

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CB

COLUMN 8

SUDDENLY, everyone wants a citizen band radio, licensed or not.

AN HOUR after the three Wollongong truckies were fined $40 each on Monday for using unregistered CB radios, there was hardly a set left in Wollongong. One distributor rang Sydney asking for 100 sets immediately.

THE electronics industry is ecstatic. Dick Smith, who runs five Sydney stores, told Column 8 his switchboard had been jammed by inquiries yesterday. All told, there were almost 600 callers. "Overnight, we've completely sold out of our most expensive sets selling for $239. Now we're holding back orders for $280,000 worth of CBs."

Taken from the Sydney Morning Herald, October 27, 1976, and reproduced with permission.

Roger Harrison takes a deep look at the latest activity on 27 MHz and the interest it is arousing in the public, the consumer electronics industry and the P&T Department.

Electronics Today does not often come up with strong editorial viewpoints — generally our subject matter is uncontroversial — but on this issue we have decided to take a stand. To find out what we think read on . . .

THE LATEST CONSUMER CRAZE IN the USA is CB radio. Already the events of its development have passed into legend and apparently the demand for transceivers still exceeds supply.

There has been increasing pressure in the past few years to have a Citizen's Band radio service introduced into Australia, a demand staunchly resisted by the P & T Department, a demand accompanied by articles and reports in the general press, TV programmes and discussions on talk-back radio — even a national demonstration in the major capitals one Sunday last November.

Discussion of the issues has often involved the airing of a great deal of emotional cant, the protagonists overstating the positive aspects and playing down the negative, while the antagonists do the opposite. Inevitably some erroneous arguments have been presented by both sides and some quite important aspects have been ignored or lost in the melee.

The Two Sides

The protagonists in the Great CB Debate are the current illegal operators on the 27 MHz band, the 'pirates' of this Penzance, and those who eschew pirating but who wish to see a CB service, styled after the American system, introduced into Australia. However, included in the protagonist camp must be the equipment suppliers and those with other vested interests who stand to gain financially from the possible introduction of CB, for they have played quite a significant role in fostering the rise of interest and demand.

The antagonists are the Licensing Section of the P & T Department and many licensed amateur radio operators, as claimably represented by the Wireless Institute of Australia.

For some insight into the issues surrounding the whole question, we will consider the historical development of both the concept and the inception of Citizen's Band radio in the United States, where it has been spawned, and the developments in Australia.

The American Experience

The concept of a "Citizens' Radio Service" was probably first mooted at the Atlantic City radio conference in the USA in 1947 when broadcasting and communications were restored to non-wartime status. The licensing and regulations set-up was reviewed and the world's first citizens' radio service was inaugurated. Its purpose was to provide two-way radio for private citizens for use in the conduct of their personal or business activities. The US Federal Communications Commission (FCC) allocated a band of frequencies from 460 MHz to 470 MHz and authorised powers up to 50 W. There were three classes of service — designated A,B,C — to provide for differing purposes.

The concept proved to be a little ahead of its time. It didn't exactly spark off any revolutions of that era. I guess

IN AUSTRALIA Yes or No?

too that the public imagination had not yet matured sufficiently to embrace the concept or its possible ramifications. Broadcasting and radio communications had largely developed within most people's living memory, the concept of *personally* owing and operating a transceiver (or a network of them) to conduct your own affairs probably sounded a little Jules Verne-ish.

The scarcity of equipment and its high cost ensured a low interest in 'citizens' radio'. UHF circuit techniques were only just out of their infancy in 1947 and few firms made or marketed equipment for the 460 MHz band. The concept did not really gain wide acceptance, either within the United States or beyond its borders. In the ten years following the Atlantic City conference only about 40,000 licenses were granted in the USA.

Then, in 1958, the FCC introduced the 'Class D' of the citizens' radio service, allocating a group of 23 channels between 26.965 MHz and 27.255 MHz. This allocation subsequently became known as the '27 MHz Citizens' Band'.

The Class D service was not originally intended for 'hobby' purposes and the FCC placed restrictions in the licensing regulations to discourage hobby activity — the amateur radio service was provided for that. Transmitter powers were limited to 5 W, no 'gain' antennas were permitted, maximum antenna height allowed was only 20 feet and only ground-wave communications were permitted, to restrict communications to licensees' local areas. Working 'skip', where signals are reflected from ionospheric layers enabling contacts over considerable distances, was strictly forbidden. It was these restrictions that gave rise to radio piracy on 27 MHz.

Equipment was not expensive, easily obtainable and provided a ready outlet for those frustrated communications enthusiasts who, for various reasons, eschewed amateur radio or had no inclination to take the relevant examinations.

As the interest in Class D CB grew, from around 50,000 licensees in 1959 to a quarter of a million in 1973, so did the number of pirates and regulation violations by licensees. The FCC had difficulty policing the regulations. The magnitude of the problem was beyond their capacity to cope with it. As the numbers mounted, so did the pressure to 'de-regulate' the Class D service and make it more widely available and for other than the narrowly-defined purposes.

As legend has it, it was the energy crisis of late 1973 that proved the turning point for CB in the USA. Long-distance truck drivers had already discovered the advantages of CB for themselves some years before, but when fuel shortages and the 55 mph speed limit threatened to hamper their livelihood they resorted to CB to locate fuel supplies and avoid police speed traps. They invented a colourful 'slanguage' of their own, adapting some of the existing CB jargon, which was subsequently immortalised in several pop/country songs. The style and imagery of the language caught the public imagination (with a little help from the Nashville publicity machine). The trucker-CBer was elevated to the status of folk hero, rivalling if not eclipsing) the position of that other giant among folk heroes of the American working man, John Henry (of 19th century railroad fame).

American motorists discovered the usefulness of the trucker's CB network, turning it to their advantage too. They also discovered other advantages in the personal communication that the 27 MHz transceiver offered. In this way, the American CB revolution was born.

The necessity and 'restrictions' of licensing was lost on many of the CB enthusiasts and this, coupled with the American passion for rampant consumerism, created a giant headache for the FCC. Almost inevitably, whatever consumer wants, consumer gets. At least, in the USA.

In September 1975, in the face of increasing public pressure and widespread violation of the existing regulations which had become virtually impossible to police, the FCC made several significant changes to the rules and regulations covering the Class D citizens' radio service. In the restructuring, one change was to have far-reaching effects — that was the removal of the 'hobby' restriction. Other changes included the reduction of antenna restrictions, the establishment of channel 11 (27.085 MHz) as a national calling frequency (channel 9, 27.065 MHz, had been designated the emergency calling channel by the FCC in 1970), and changes in operating procedure.

The result was nothing short of dramatic. To illustrate what happened, I will quote what has become the

CB IN AUSTRALIA

standard cliche on the development of CB in the US: said Richard Everett, assistant chief of the FCC's amateur and citizens' division, "It took 16 years, 1958 to 1974, for us to get to the first million licensees in Class D. Then it took eight months to get to the second million, and three months to get to the third." The first few months of 1976 saw the addition of a further two million licensees. Figures for late 1976 put the monthly average at around a half million.

The incredible consumer demand for CB radios caught the capitalists of the archetypal free-enterprise nation with their pants down. And Japan plunged into the breach (or is that breeches . . .???). Japan already had a flourishing communications manufacturing industry, but in the event, even it couldn't cope with such an enormous demand. CB transceivers accounted for something like 10% of all air cargo from Japan to the US in 1975, exceeding cassette recorders, cameras and calculators, in the end. In 1976, American industry began to catch up, but still demand exceeded supply late in 1976.

It was inevitable that the American CB boom, and the publicity surrounding it, would excite in other countries. And CB service or no, the rise of 27 MHz radio piracy in other countries followed the American example.

A Brief Look at CB in Other Countries

The concept of a citizens' radio service had been raised in other countries long before the mid-70s boom in the US. Some countries had introduced a limited service (no hobby enthusiasts allowed) in the 1960s. Amongst these were Denmark, Canada, Japan and New Zealand. The Australian PMG did provide for a limited communications service on the 27 MHz band but I shall look at that shortly. Denmark withdrew their citizens' radio service in 1975 following difficulties with piracy and violation of the regulations. Japan introduced a minimum-grade amateur licence into the existing amateur licence structure to provide for the hobby enthusiasts interested in the communications aspect rather than technical matters, with the result that Japan now has something like half the world's licensed amateur population! Some licensing authorities might follow their example.

Leaving the Australian situation out

Do you know what CB is, and what it can do for you?

CITIZENS' BAND (CB) radio offers simple 2-way radio communication for ordinary citizens, from home to car, car to car, home to boat or homestead to tractor, etc.

CB CAN POSSIBLY SAVE YOUR LIFE OR THE LIFE OF SOMEONE YOU KNOW!
In the USA, CB has proven itself time and time again, in reducing emergency service response time by an average of 17 minutes.

CB CAN SAVE YOU TIME!
How many times have you been caught in a traffic jam you wish you could have been warned about. You can have this facility with CB.

CB CAN SAVE YOU MONEY!
For the truckers in the USA. CB saves them money by summoning early assistance to shorten "down time" after a breakdown. This gets them rolling again quickly and cuts their costs which in turn can be passed on to the business community and then the public.

HAVING OUTLINED JUST SOME OF THE MANY BENEFITS OF CB, HERE ARE SOME OF YOUR QUESTIONS ANSWERED:

If I buy a CB transceiver, can I use it immediately?

No you can't! The present out of date regulations prohibit the use of unlicensed CB equipment. However the Radio Licensing Branch will invite you to apply for a licence, but — CATCH 22 — you can't have one. At present there are in excess of 200,000 sets in use in the country illegally.

Is there any way I can obtain a licence?
Yes! You can study for 6-8 months for an Amateur (ham) licence or for a Novice Amateur Licence which includes study and operational knowledge of Morse Code. **(Yes, in this day and age, Morse Code!!).**

If the Radio Branch impose such a complicated licence system, then isn't CB too complicated to use?
No! Once it is installed and basic controls are adjusted, then the microphone controls the set and that's all there is to it. No technical knowledge is required!

The PMG says that CB radios cause interference! Do they?
Not if the set you buy is of good quality. The cheaper, poorer quality sets can cause some interference, but usually no more than your everyday light dimmer. Remember, if the PMG allowed the better quality sets to be licensed then the poorer quality sets could be controlled through licensing.

Will I be able to use CB instead of my telephone?
No, not really! Firstly, the 27MHz band which we are asking for is not interference free, and does not provide top quality communication.
Secondly, this band does not offer privacy. It's like an open line, which means almost anyone can listen in on your conversation.
Thirdly, trying to contact a particular person by CB can be a lot more time consuming than using a telephone, as the other party in question could be tuned to one of 23 channels which means you would have to call across all channels, to locate them.
As a principle, CB should never be used instead of a telephone if it is available. If a telephone is available, then use it. It is more reliable, and offers better quality and privacy.

Why the 27MHz band? Couldn't we use VHF or UHF?
Yes, we could, however the cost of equipment for that band area would be astronomical compared to the 27MHz band (approximately $500-$700 UHF, compared to $50-$200 for 27MHz).
Also equipment for UHF or VHF is not readily available whereas it is for 27MHz. It should also be remembered that if we were allocated another band, there would still be a "pirate" problem on the 27MHz band.

Having covered all those previous points, don't Bushwalking & Fishing Clubs use CB already for safety?
Yes, they certainly do! It is good to see the Radio Branch at least realises that CB can be of use for safety. But why stop there and limit the availability of this aid to safety to bushwalkers and fishermen? Don't they realise that thousands of people die each year on the roads and that CB just might be able to save a human life simply by being there. **Why help protect only part of the community?**

This all sounds great but how can I help?
You can help by attending the Great CB Convoy Rally on November 21, starting at Bankstown Police Station and finishing at Parliament House, City, and immediately writing to your local Federal Member in Canberra.

This leaflet has been distributed in NSW by the national CB campaigning group — the National Citizens' Radio Association.

of this for the moment, it appears that the status quo will be largely maintained for some time, at least until the World Administrative Radio Conference (WARC) in 1979, even though Canada is slowly moving towards de-regulating their citizens' radio service.

What Now?

The question now arises as to what happens when the supply of transceivers to the American CB market finally exceeds demand. Too many manufacturers competing for a share in a saturated market will mean that some firms will go under, that's the free enterprise way and tough titty, but those remaining will inevitably seek out new markets. If they don't already exist then they will have to be created. And with an internationally-based manufacturing and marketing industry they are either going to seek to persuade consumers in other countries that they need CB or else exploit an already existing situation where minority groups have already jumped on the CB bandwagon and have laid the groundwork for the rise of 'consumer demand' for CB.

On November 21, 1976, there was a national CB demonstration with rallies in state capitals. Here the NSW deputation presents a petition to Arthur Viney MP (opposition spokesman for transport) outside Parliament House in Sydney.

A Review of the Australian CB Scene

In 1961 the Regulatory and Licensing Branch of the then Postmaster General's Department (PMG), in response to many applications, introduced licensing provisions for persons or organisations requiring short range, person-to-person communications to use type-approved equipment on the 27 MHz 'Industrial, Scientific and Medical' (ISM) band. Licence-seekers had to show the Department that they required such communications in order to "... facilitate industrial, business or pastoral activities or the conduct of sporting or other group events, and for such legitimate purposes as the Department considers warrants the grant of licences."

Considering the absolute monopoly they have on all other forms of communications except mental telepathy, face-to-face speech (eyeball QSOs) and courier services, it was a magnanimous gesture. The equipment approved for use under these provisions were hand-held transceivers with transmitter powers not exceeding one watt and the Department designated the service, in their own quaint way, the 'Handphone Mobile Service'. According to their figures, by June 1972, some 16,000 of these units were licensed to such public bodies as Police, Fire Brigades, Forestry Departments, Civil Defence Authorities, etc, as well as industrial organisations engaged in construction work, surveying, property management along with private individuals for boating, sporting and other leisure pursuits.

The Department also provided licences for the operation of low powered equipment, other than walkie-talkies, for such purposes as paging systems, maritime in-shore safety, rescue group activities (such as surf lifesaving clubs), communications within manufacturing plants, etc. For this service 5 W base stations and, in some instances (boating in particular), 5 W mobiles are permitted.

The overriding policy is that specific frequencies or bands are used for specific purposes and the regulations covering these services on the 27 MHz band placed restrictions on licensees such that this was adhered to. The channels were to be used for 'useful' purposes; 'unessential' conversations, together with inter-licensee communications, were strictly forbidden.

Paralleling the American experience, it was these restrictions, together with the ready availability of equipment, that gave rise to 27 MHz radio piracy in Australia.

For the 12 years following the inception of the handphone mobile service, radio piracy on 27 MHz was more of an irritation than a problem. However, as the legitimate demand for 27 MHz equipment increased, so did the available outlets for it. As the relative price of transceivers dropped, and their availability increased, the pirate problem increased. Owning a transceiver even became a status symbol amongst school kids. Besides, they made good Christmas and birthday presents and were cheaper than mini-bikes. "so what if it's illegal, they're not doing any harm."

By 1973, piracy was beginning to assume significant proportions and, all the while, various groups within the pirate fraternity were trying to attract public attention. At first, the media (particularly newspapers) were not really sympathetic, or informed. "PIRATE RADIO OPERATOR FINED" ran the occasional headline, or "HAM RADIO OPERATOR FINED", much to the painful chagrin of licensed amateurs.

Then, in May 1973, the ABC programme 'Four Corners' ran a segment on pirate 'CBers' treating the whole subject more than sympathetically. The predominant view that came across was that these pirate CBers were ordinary citizens, if somewhat eccentric, who

CB IN AUSTRALIA

were pursuing an activity that was essentially harmless and at times even provided a public service — so why should it be illegal? The adversary case, as presented by the PMG spokesman on that programme, appeared rather weak in the circumstances. To be fair, such a programme could not possibly cope with the scope of the questions implicit in the whole issue and the general thrust of Four Corners' coverage of an issue was to present a viewpoint, and not necessarily a balanced review of an issue. What wasn't revealed was that the instigation of the programme might have been a little incestuous — it is said that an employee of Channel 2 in Sydney, being an active 27 MHz pirate, approached the Four Corners producer and convinced him that there was mileage in their story! Chalk a big one up for the pirates.

In January 1974, an article by this author was published in ETI on the question of CB. It was prompted by a reader's letter concerning the Four Corners' programme. The article occasioned considerable discussion and was followed up in the May 1974 issue.

As a consequence, the stage was set for better media coverage when later events presented themselves. It wasn't until 1974, however, that CB began to get any real boost in Australia.

It was in 1974 that several suppliers of 27 MHz transceivers commenced advertising on a large scale in the capital city daily newspapers, the national weeklies and Sunday newspapers, even on TV. One prominent Sydney electronics supplier managed quite a spate of publicity articles in the press, drawing quite a bit of public attention, mention of CB being a significant part.

This was the period when publicity on the American CB scene was being exported — remember the pop/country records? — and US originated articles were finding their way into the local press. It was inevitable then, that CB would come to be discussed on talk-back radio programmes, which have considerable audiences.

When local suppliers saw from the American situation that was developing in 1973/74 that there was money to be made from CB, they set about to exploit what was then an embryo interest, generally inarticulate and largely impotent in attempting to gain recognition for their 'cause', at the same time taking advantage of the existing licensing situation. The only restriction placed on the advertising and sale of 27 MHz equipment was that it had to be type-approved by the PMG, the responsibility of licensing resting with the purchaser. Which of course the salespersons diligently pointed out as they extolled the virtues of the equipment — and CB as well!

In contrast to the American experience, open advertising of 27 MHz 'CB' equipment on a large scale, together with some well-managed publicity by the vested interests, is what has provided the predominant impetus to (illegal) CB operation in Australia. Certainly the same techniques were employed by American vested interests but it did not have the same effect there as occurred here. In large measure, the promotion in America came after the rise in demand, talking via radio was old-hat to the American public, it had to be given some special glamour or significance before they became interested.

Significant to any historical review of the Australian CB scene is the introduction of the Novice amateur licence. Commencing in the depths of antiquity, or at least 20 years ago, the Wireless Institute of Australia (WIA) had been mooting the introduction of a novice amateur licence. Accompanied by the usual amount of internicene bickering, self-righteous rantings ('. . . they won't be real amateurs . . .'), committee meetings, interminable reports et al, lobbying of the PMG began in earnest in the 1960s. Finally, the PMG's Department acquiesced, and in 1973, the Novice Licence was announced. It required a simple examination in theory and regulations with multiple-choice answers (daringly radical that!) and a morse proficiency test at five words per minute.

Novices were to be permitted 10 W (or 30 W PEP) transmitter output power and segments of the 3.5 MHz and 21 MHz amateur bands plus — big carrot for the donkey — all of the 11 metre amateur band, to wit: 26.9 MHz to 27.23 MHz! But too late. The gate was open and the whores had bolted. To make matters worse, examinations were not held until 1976.

The thinking was obviously that the above provisions would attract/appease the pirates at that time becoming increasingly noticeable on 27 MHz. It didn't. They had already eaten the carrot, thoroughly enjoying it, and besides, what was the point of the test if all you gained was the dubious benefits of a licence and two extra bands which you didn't particularly see much use for anyway apart from the extra equipment necessary to work them?

Even when the examinations finally arrived, although entrants were large in number (about 1000 per exam) it didn't make much impact on the pirate pop-

The campaign to legalise CB is well suported by the electronics industry. These campaigning stickers carry advertisements for one of the major retailers and his products.

The November demonstration in Sydney centred on a convoy of vehicles lead by a Saracen personnel carrier. Some observers expected a real 'CB War' between demonstrators and Radio Inspectors plus the Highway Patrol, but the demonstration was very civilised and there was no trouble.

ulation and the demand for CB a la USA remained.

Harking back to the pirates, one sees that as their numbers grew a number of clubs sprang up, their main purpose being some common interest, allied with their activities, and, as was inevitable, Australia's first CB lobby group – the Australian Citizens Radio Movement. This group distributed roneoed and photocopied pamphlets amongst themselves, and whoever else they could interest, as well as to newspapers etc. Until the American CB boom was gaining publicity in this country, and transceiver suppliers were pushing CB, their campaign had remarkably little success. Suppliers then began carrying their pamphlets on their counters or on their 'information' stands and 'the word', although oft times not terribly lucid, was spread.

The ACRM was based in Victoria and was followed in NSW by the National Citizens' Radio Association and later the Citizens' Band Legalisation Lobby (CBLL). In June 1976 a national lobby group was formed, through the NCRA, headed by Bill Payne, an executive of the Australian branch of IPC Magazines.

The NCRA styles itself as a responsible organisation and not a "pirate" association, as they point out on their publicity screeds. The NCRA have quite a deal of success in disseminating publicity on the positive aspects of CB, obtaining material from the USA to back up their claims. The NCRA has been able to win many supporters and most CB clubs and lobby groups have affiliated themselves with it, going so far as to nominate Bill Payne as their representative.

In the last week of August 1976, the minister for Posts and Telecommunications, Mr Robinson, announced that he had called for a detailed report on the merits or otherwise of introducing a CB service into Australia. To date, it appears that the report has not been finished and no details are available.

On Sunday, 21st November last year, there were demonstrations by CB operators in Melbourne, Canberra and Sydney which gained considerable coverage on both local and national news services.

The CB War

A kind of 'war' has been raging between the pirates on one side and the amateurs and Radio Inspectors on the other. It is more in the nature of a guerilla offensive, with on-air harrassment and prosecutions the ammunition against the 'enemy'.

Largely since the Four Corners' programme, amateurs have begun to make increasing use of their 11 metre allocation, encouraged by the WIA, in an effort to discourage pirate occupancy of the band. It hasn't been all that effective, relatively few converts have been made, partly because the effort is essentially too late and partly because many pirates profess no interest in amateur radio. The state divisions of the WIA have added 27 MHz transmissions to their weekly Sunday morning broadcasts.

Operating techniques adopted by amateurs on 27 MHz have certainly caused harrassment – calling CQ for lengthy periods on channels already occupied by pirates, conducting local contacts on the band running high power (anything from 100 W to 400 W PEP), lengthy 'tune-up' sessions on the band, running attended beacons etc. Needless to say, the unenfranchised occupants are not amused.

The P & T Department Radio Inspectors have been pursuing prosecutions with some effect, stepping up their campaign in late 1976 by enlisting the help of Highway Patrol police who have been instrumental in obtaining further prosecutions of unlicensed operators. This turn of events arose following the arrest of four truck drivers in Wollongong who were charged with the illegal use and possession of transceivers on October 11 last year. Their appearance in court was attended by a protest drive through the streets of Wollongong by a large convoy of trucks. The publicity surrounding this case was enormous and sparked off a further spate of discussion of CB in the press, a lot of it favourable to the CBers.

However, the sheer size of the pirate population is daunting, their numbers are variously quoted as being between 25,000 and 200,000, and they present what appears to be an almost insurmountable problem to the P & T Department. The sanctions of the Wireless Telegraphy Act clearly provide little or no deterrent.

The Protagonists' View

The arguments of those who favour the introduction of CB appear to be founded on two basic propositions. These are that personal communications is a basic public right – including by radio, and that a CB service would be in the interest of public safety. The latter argument is presented and illustrated ad infinitum and experience in America does show some foundation to the 'public safety' premise.

It is claimed that the radio spectrum is a national resource, and as such, it is owned by the people. In which case, why should they be denied access to a small portion of the spectrum for personal utilization without undue

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Not quite what it seems — there is no-one getting busted. These CB enthusiasts are explaining their cause to the friendly policeman and letting him try out their gear.

bureaucratic restriction? They consider CB a right and not a government-granted privilege to be doled out to the few who's requirements fall within a very narrow definition.

There is much anecdotal support for the argument that CB will assist public safety. The FCC set aside one channel specifically for emergency calls and the same channel is monitored in Australia. In the US a volunteer CB emergency service group called the Radio Emergency Association Citizens' Team (REACT) sprang up and are credited with providing a valuable public service. In Australia, a group called the Citizens' Radio Emergency Service Teams (CREST) monitors channel 9 (27.065 MHz) and ultimately will provide a 24 hours service. It is not an official service and is more a way of attempting to prove the 'public safety' concept by example.

Many protagonists, as represented by their spokesmen, argue that society should only have sufficient regulations and restraints to make the system work, consistent with protecting the interests of all concerned, rather than the totalitarian idea where the state controls all and only grants privileges and bestows limited freedoms when sufficient pressure is brought to bear.

There are other arguments advanced by the protagonists in support of their claims as well as arguments designed to counter objections raised by those opposing CB.

As noted in the NCRA pamphlet reproduced elsewhere, it is claimed that CB can assist the motorist to avoid traffic jams and delays. This is of interest particularly to the commercial traveller, delivery vans, etc, as well as the ordinary motorist. Which leads into the 'CB saves money' argument. The US truckers have long used CB to obtain assistance when breakdowns occur. Shortening 'downtime' obviously saves money in such cases — so goes the argument.

To counter the claims of interference to other services, the argument is advanced that if only those sets that meet adequate specifications are licensed then interference to other services will be controlled, if not eliminated. This issue however, requires much more careful consideration.

The Antagonists' View

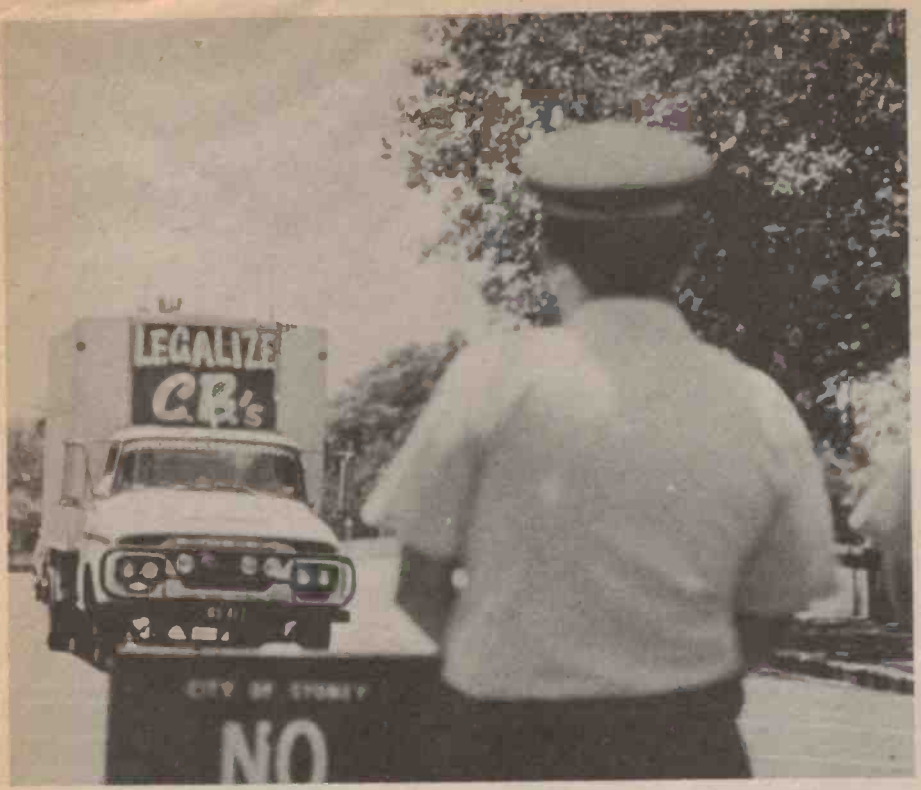
The view of the P & T Department, to date, is that they already provide for all the 'legitimate' needs of public and private concerns. To extend the licensing policy to cover CB operations as proposed would lead to a chaotic state (as they claim has happened elsewhere) in the 27 MHz band, which would be to the detriment of the existing licensed users and would thus not best serve the public interest. Secondly, they claim that to introduce CB would be in contravention of the long-standing Australian government policy that the public telephone system ("... provided at considerable public expense") should be the normal means of communication between people where the service is available. The then PMG issued a lengthy statement on 'Citizens' Radio Services' in February 1973 (see ETI, May 1974, pp 97-98).

The attitude of the WIA stems largely from self-preservation motives. Australian amateurs stand to lose their 11 metre allocation (26.96 MHz to 27.23 MHz) if CB is introduced. The WIA additionally argues that conservation of the frequency spectrum is important and further supports the Department's view that CB brings communications chaos, citing overseas examples.

In July 1974, the Secretary of the WIA, Peter Dodd, wrote to the Postmaster-General with the official view of the Institute which has changed little since then. I quote the prime arguments from that letter:

> "The Wireless Institute of Australia opposes any and all steps designed to establish a radio communications service for, or on behalf of, unqualified persons under uncontrolled conditions."
>
> "... the Institute wishes to direct attention to two additional considerations, namely the conservation of the Frequency spectrum and the disrepute of the 'Citizens' Band' radio in certain overseas countries where it is authorised."
>
> "... potentially great interference to other services and facilities ... CB permits and licences would soon be grossly exceeded both in respect to power limitation and to forbidden subjects, language or comment."

The WIA and amateurs have also expressed the view that the introduction of CB would attract people away from amateur radio, where their interests might otherwise be best served, encouraged by the soft option of CB. It is supported by example from America where growth in the amateur ranks slowed markedly in the years following the introduction of Class D licensing there.



In this photograph George Hofsteters captures the conflict as it is seen by many CB users.

It should be pointed out that the officially expressed view of the WIA is by no means necessarily the view of the majority of amateurs. Listening to discussions both on the air and at club meeting, one gets the impression that there is a differing range of opinions and that CB may not be the consummate evil it is made out to be.

CB for Safety

The slogan "CB FOR SAFETY" implies that CB would bring a measure of personal safety by providing a widespread, constantly monitored communications facility. While CB certainly has such a potential, which can be supported by the American example, in actual practice its potential is quite limited. The ease of access afforded by currently proposed licensing regulations means that congestion on whatever channels are available will be inevitable making communications difficult under the circumstances. Even if one channel can be set aside purely for emergency purposes, limited range, adjacent channel interference and those irresponsible persons always evident who would use the 'clear' channel (and it does happen

CREST

Citizens' Radio Emergency Service Teams is the title of a group in Sydney who regularly monitor CB channel nine for emergency calls. The Sydney operation is a pilot study for the nationwide operation of CREST.

Channel nine has been used in overseas countries (USA, Venezuela, and Germany, for instance) for many years as an emergency channel. In the USA there are groups called REACT and ALERT who monitor this frequency (27.065 MHz) and in the past, on occasions when skip conditions were good, these services have suffered interference from Australian transmissions. Thus channel nine was the obvious choice for Australia's CB emergency channel.

Since the inauguration of the CREST service a few months ago the organisers have had no trouble in getting the cooperation of CB operators and radio amateurs in keeping the channel clear (except for emergency traffic). The Sydney team aims to keep the channel monitored for for as much of the day as possible, and they hope to be be able to provide a 24 hour service quite soon.

CREST has strict selection proceedures for its monitors and so far they have succeeded in recruiting a very responsible team. Most of the monitors have previous experience of dealing with emergency services or in related areas of community service. One of the major attributes CREST looks for in their monitors is the diligence needed to listen to a receiver on a basically quiet channel for shifts like 2am to 5am or even 8am to 6pm (hopefully easier shifts will be introduced as CREST gets going!).

A typical CREST emergency would go like this . . . a CB operator is out in his vehicle when he comes across an emergency, say a road accident. Realising that he is the first on the scene and maybe some distance from a telephone, he calls CREST on channel nine and the monitor calls him back. Then the monitor extracts the necessary information from the caller and takes appropriate action. In practice this has meant getting an ambulance to the scene in less time than would be possible under normal circumstances.

Sydney CREST has already dealt with many emergencies, and currently deals with several calls per week. Soon after starting operation one caller reported a bush fire and later had to help direct the fire brigade, via CB, to the blaze. Another caller found that the nearby telephone was out of order after using CREST to get emergency services to a road accident.

The current CREST activity is in the city but we feel it will eventually prove itself in country areas (provided operators are equipped with suitably powered transmitters). In these areas the time advantage of calling immediately by radio over the alternative of travelling to a telephone to make a call would prove considerable in many instances.

But now it is a little early to talk of a country service, CREST will first have to establish itself in the cities. The organisers are wisely being cautious about expanding, they must not make any mistakes in selecting members for their teams. And there's quite a way to go in establishing a strict organisation capable of maintaining the high standards that have been set so far.

Non-emergency communications with CREST are possible via Box M101, Sydney Mail Exchange, NSW 2102.

CB IN AUSTRALIA

– this sort of violation is becoming an increasing problem in the USA) would limit the potential of any 'safety' aspects.

Sheer distance, and geographical obstacles would further limit the safety feature of CB in 'the outback' where many proponents argue CB would be of great use. Atmospheric noise presents a problem in such areas also. Dust static generated by wind-borne dust and noise generated by electrical storms peaks in amplitude between 25 MHz and 40 MHz and this sort of noise is more prevalent in inland areas. Urban electrical noise places limitations on range in city and surrounding areas. This also peaks between 25 MHz and 40 MHz – what's more, it's substantially vertically polarised (as is the practice with the majority of CB antenna installations). VHF FM fares much better in cities.

While CB certainly has a demonstrable potential for 'safety communications' (how about a 'rape channel' for handbag mobiles?) it must be realised that there are limitations – and these must be considered when we listen to the protagonists of CB.

Some of the t-shirts picked up by our camera at the Sydney demo. The usual way to get a call-sign is to join a club and be given a number. These are some of the clubs in NSW: BA (Bay Area), KB (Sutherlandshire), FX (Bankstown), NSR (North Shore), XT (St Mary's), TR (Truck Radio), WR (Wollongong), KT (mainly a QSL club) and ARS (another QSL club). Some of the clubs meet for social purposes in the districts shown.

The Magazine's View — The Political & Philosophical Questions

Certain political questions are raised in the whole issue of a Citizens' Radio Service. Basically, these come 'before the fact' and have been largely unconsidered in the whole debate. Many of the pro and anti arguments have been speculations of what will follow 'after the fact'.

Is there any 'rightful owner' of the frequency spectrum? Protagonists of CB argue that it is 'the people' who own it. The question should really be 'who should have access to which portions, and for what purposes?

To say that 'the people' own the spectrum could mean either (1) any person has unlimited rights of usage or (2) the people should decide how rights are allocated. The former is dealt with below and the latter ought to be automatic in a democracy. At the present time the machinery of government under our present system is in progress — interested members of the public are lobbying their representatives who will have to respond quite soon.

How Is The Spectrum Allocated?

This introduces a philosophical question. The guiding policy of most frequency regulation authorities is 'specific frequencies, or bands, for specific purposes'. The philosophy is one of conservation, based on the assumption that, without regulated access and use, chaos would arise, so wasting the spectrum and rendering it largely useless. This is a reasonable argument and certainly difficult to replace with something equally reasonable, but with a different thrust. It is why we have 'Broadcast Bands' 'Amateur Bands', 'Marine Bands' etc.

As things have developed, it is military interests which seem to hold the most power on the spectrum. It seems they are in a position where they can dictate all frequency allocations within a nation — for 'national security' purposes of course. Everybody else's franchise is of lower priority. In most nations, radio amateurs come last and the general public is not even on the ladder!

There is no basic philosophical argument against allowing public access to the frequency spectrum. Those with rights to the spectrum resist public inclusion largely because they see it as a threat to their position in the heirarchy. Collectively, as a technical elite, they have managed to grasp their portions of the cake and have 'eaten' it since 1918.

Could you imagine the result if, since the early development of the car, only licensed mechanics, engineers, certain public servants and the military were allowed to own and drive cars on the 'public highway'? (The ecologists cry — fantastic!!) How long would it be before the general public exercised their political power to gain access to this sort of transport?

The Individual's Rights

The basic right of people to use and enjoy the environement without unnecessarily encroaching on the rights or limiting the enjoyment of others has been long since established. Why should the frequency spectrum be exempt?

Most human activities are regulated by some authority, when man lives in groups there is always a political system — whether representative or not. In the case of radio-frequency management we feel that the authority is not representing the people in a democratic way. The authorities have established themselves as a technical autocracy who dole out 'privileges' as they see fit. They seem to see themselves as, a priori, the arbiters of public interest in this area — and it is in the public interest that the public have no interest in the frequency spectrum! Amateur radio is a concession to history — and they must prove their worthiness to join the technical elite. Hence the amateur licence examinations.

Some balance must be established between the extremes of autocracy and total freedom, and this must be worked out between the parties concerned. Some formal public forum should be established, as preceeded the introduction of FM and expansion of the MF broadcasting services.

If The People Haven't the Power, the Capitalists Should Have.

There are other social questions to be examined in regard to the introduction of a citizen's radio service. Is it simply a consumerism cult being promoted by the owners of capital in the western world? The booms in other consumer electronic gadgetry — monochrome TV, colour TV, Hi-Fi, cassette recorders, calculators, digital clocks and watches — have come and gone. Something has to be found to take their place. Why not CB? As I have already pointed out, it is largely the promotion of vested interests that has brought the rise of CB in Australia. At present, all the CB equipment available in Australia is imported. That situation is most likely to continue if CB is introduced. What are the economic effects and consequences of an import boom in this area? Is it worth any benefits that may derive from the introduction of CB? Will it assist peripheral industries (such as service industries)? Can the government derive any significant income from licensing? That doesn't cover all sorts of other questions that arise but it certainly gives food for thought.

Another of George Hofsteters' witty snaps — It was a mere coincidence that the NSW CB convoy passed this building in North Sydney.

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The Magazine's View — The Technical Questions

There are technical questions we need to consider. The claims of the NCRA, and many other protagonists, that CB either does not cause interference, or causes only minimal interference, are simply not borne out in fact. Firstly, one must define the type and area of interference.

Consider interference to domestic electronic appliances such as TV sets, Hi-Fi gear etc. In the immediate vicinity of almost any transmitter, the tuner of the TV set may suffer from overload owing to high local RF field. This affects both picture and sound usually. Some sets are better than others and a cure may be affected by using a high-pass filter, that attenuates any signals below Channel 0 frequencies. Next victim in the TV set is the 30 MHz IF. 27 MHz signals seem to go straight down them, again affecting picture and sound. The effect is usually more dramatic, and certainly harder to cure. In audio equipment of almost any description, RF pick-up and rectification causes problems. Again it can be cured, but some systems are more susceptible than others. It is, in effect, the 'fault' (if that's what it can be labelled) of the equipment manufacturer. Electromagnetic Compatibility (EMC) is increasingly becoming a subject of examination by both Licensing authorities and Standards Associations, as well as enineering societies etc. Nevertheless, widespread use of transmitting equipment does produce problems, as the American FCC found out.

From Worldradio News for June 1976 — "Discussions with Mr Richard Smith Federal Communications Commission, Washington DC, indicate that the commission received 25,282 RFI complaints during the third quarter of fiscal 1976. This brings the total number of complaints for the fiscal year to date to 57,014, 2000 more than all of the complaints received in fiscal 1975."

"Roughly 46,000 of the 57,014 complaints received by the commission involve electronic home entertainment equipment, with 80% of these complaints related to the operation of stations in the Citizens' Radio Service. Amateur operations are involved in about 7% of the complaints. The FCC is still projecting that it will receive about 77,000 complaints during fiscal 1976, which, if true, would represent a 40% increase in complaints over those reported last year".

A realistic technical specification would need to be established for equipment to be used for any proposed citizen's band. Would existing specifications pertaining to equipment now licensable be sufficient? Could, or should, they be relaxed?

Should any allocation be shared or exclusive? If shared, which services would take priority? It is really beyond the scope of this article to discuss these questions — but they need to be asked as existing conditions may be seen to prevent the introduction of a CB service on the band proposed — or at all, unless major rearrangement of current allocations is made. It should be borne in mind that many 'essential' services currently have allocations within the 27 MHz band. In no way could a citizen's service replace these bodies.

The question even arises whether some other frequency band should be considered (40.68 MHz for example) and strict conditions placed on the licensing and sale of 27 MHz equipmentment for the current allocation.

Whatever frequency is considered, except perhaps for upper UHF, how should contacts beyond the 'horizon' be regulated. Contacts across the international borders of the USA are currently forbidden — not that it isn't violated. Tropospheric and Ionospheric conditions influence propagation and USA-Australia, Australia-Pacific regions etc contacts are not necessarily infrequent on 27 MHz.

Summary

Do we support the introduction of CB? Well, on philosophical grounds yes. On practical grounds we see no reason for it to be withheld. There are problems (from interference, etc) but they are of human making and they can be overcome by human effort. On sociological and technical grounds we think some reasonable — workable — regulations can be introduced, need to be introduced. The technical elitism of the controlling bureaucracy and the Wireless Institute of Australia is a totalitarian 19th century viewpoint and needs to be thoroughly examined and overhauled — dragged into the 1970s if possible.

Some sort of public inquiry needs to be held to openly examine the whole issue, its implications and consequences, preferably a Royal Commission. We needed it for FM broadcasting, why not for CB?

CB in ETI

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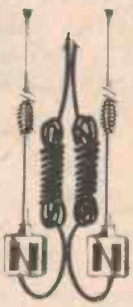

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VCT

AN INVENTION THAT WILL CHANGE THE FACE OF ELECTRONICS

Ron Harris, from our London office, went to talk to Professor Gosling of Bath University about this new device about to be released by Texas Instruments.

THE BASIC OP-AMP HAS BEEN WITH us since the days of the valve, and when semiconductors crept up on us, it was simply re-designed to use transistors. This, in the opinion of many designers, means that the advantages of transistors are not being fully exploited.

BASIC IDEAS

One of the better improvements to the basic op-amp was the comparator input designed by Carl S. Brinkler – a name to which we shall return – and patented in April 1965. However Mr. Brinkler was still dissatisfied with the op-amp and some years ago began discussions with Professor Gosling, with a view to producing a totally new circuit block. The basic guidelines were finally set as being that

1. No feedback should be needed to stabilise the device by limiting the high frequency response, or to define the stage gain.
2. Both the input and output ports must be totally floating – a true four terminal device. This leads to much greater freedom with respect to the output – it can quite simply be fed into anywhere!
3. The output should be a constant current source i.e. very high impedance. Then, should a voltage output be required at any time, a resistor need only be inserted across the port.

TEXAS AND THE PROTOTYPES

In 1974 Texas Instruments authorised Carl Brinkler to undertake research into producing such a device. Because of the scope and magnitude of the task, it was to be a joint undertaking with Bath University, i.e. Professor Gosling. In the autumn of 1974 the microcircuit design was breadboarded up for the first time with discrete components, and early in 1975 the first ICs rolled out of the ovens. The first vast improvement over the op-amp to become apparent was the slewing rate, up to 20V per microsecond, as compared to 0.5V per microsecond for the 741.

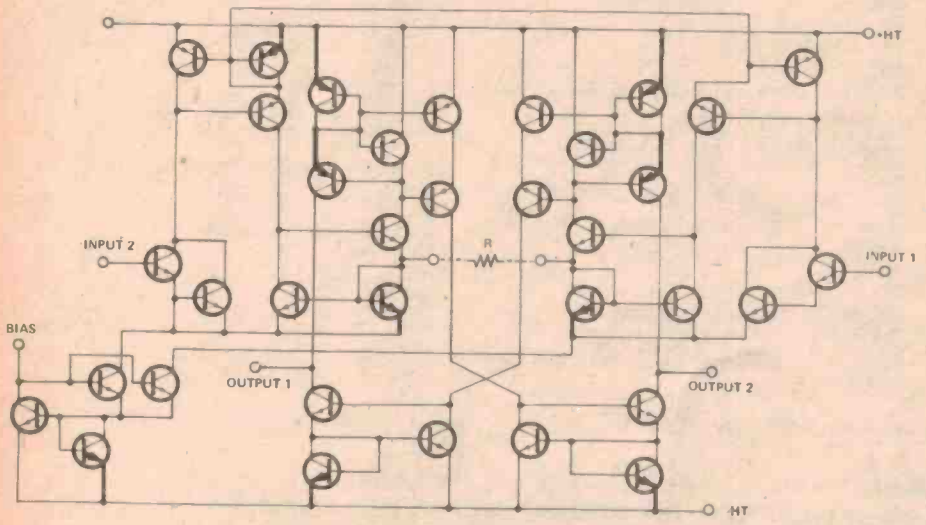


Fig. 1. Internal circuit of the prototype VCT. The 'R' in the middle is external.

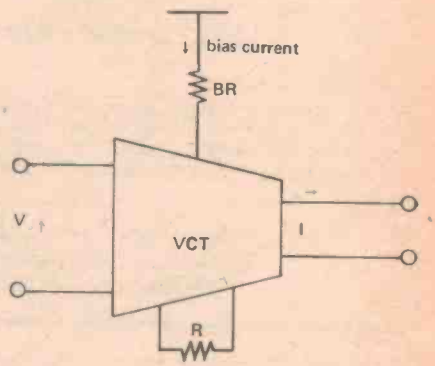


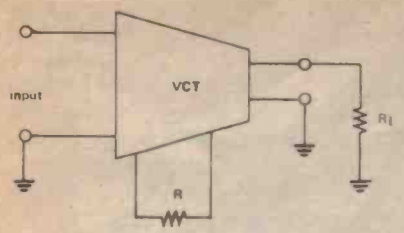
Fig. 2. The agreed symbol for VCT.

The offset on these prototypes was ≙10 mV, due to the layout not being totally symmetrical. Production models, when they appear, will have a much much lower offset. Up to this point in the proceedings the project had been running on a shoe-string. But with the prototypes showing this incredible potential, Texas whipped the whole show off to Dallas for development. They feel the VCT is the greatest advance in circuit design for a long time, and we have to agree with them.

ABILITIES IN CIRCUIT

Let's take a look at what the VCT will do. Figure 1 shows the internal circuit of the Mark 1 VCT. The thick lines represent multiple emitters, and these provide the current gain. You may recognise the current mirrors around the top centre of the circuit.

The agreed symbol for the VCT is shown in Figure 2, the circuit is that used for all linear applications. For a voltage input, we get a pure constant



Voltage gain = k. RL/R.

Fig. 3. VCT as a non-inverting amplifier.

current output. Both input and output impedances are very high, around tens of megohms in the production devices.

There is a fixed ratio between V_{in} and I_o, which is set by one fixed resistor R, i.e. $I_o = k/R\ V_{in}$. The constant k can be designed to be any value – it will be four in the Texas VCTs. A bias current is applied down BR, and the device can only output twice as much current as it draws through BR. Early devices will be 20 mA output VCTs, but later marks will be up in the amps range. A ±15V rail is used with the VCTs, and a ± 13V is quite permissible!

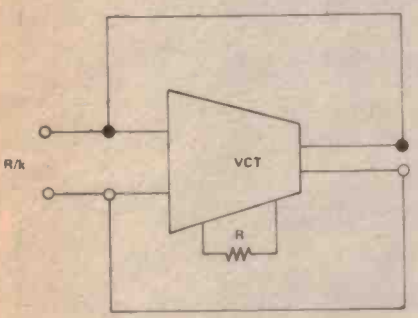


Fig. 4. VCT as a simple resistor.

Some circuits now, for instance an amplifier, see Figure 3. The simplicity of gain inverting arises because the output port naturally has a fixed phase relationship to the input. Since we get a current out for a voltage, a VCT connected as in Figure 4 will look like a resistance, value R/k ohms.

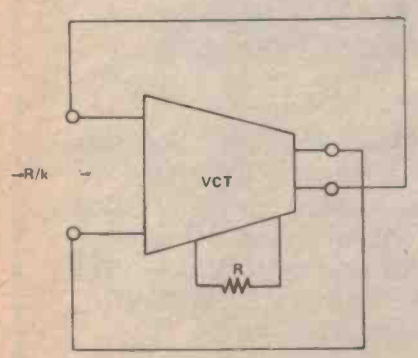


Fig. 5. VCT working as a negative resistance.

Consider however a device cross connected as in Figure 5. What we have now, looking in at the input terminals, is no less than a negative resistance! I.E.,

$$V_{in} = -\text{const.}I_o.$$

What's more, the transfer characteristic is perfectly linear!

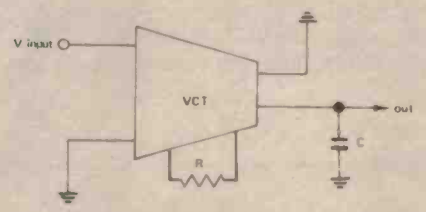


Fig. 6. VCT as an integrator.

Applications are literally infinite. Anything an op-amp can do, so can a VCT – only usually it does it better! For instance an integrator, see Figure 6. At point A we have $\int V_{in}\,dt$ since the output is a constant current which follows the input voltage. If we feed back this integral to the input as in Figure 7, the output will be the differential of V_{in}.

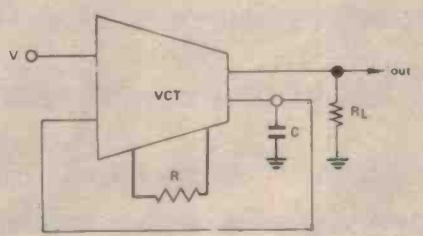


Fig. 7. VCT differentiator.

Gyrators are by now quite commonplace, but what about one which can reach inductor values of tens of Henrys and with a Q of well over 100? Easy!

Values of Q up to 200 have been achieved experimentally. This circuit introduces the concept of using two VCTs together.

Texas are packaging the VCT in a 16-pin DIL dual package. There are more pins to a VCT than a 741, since we have those already mentioned, plus a centre tap on the output which is not always used, but extends the versatility.

The application we found initially most amazing is the VCT's ability to replace a transformer, better than a transformer! All transformers exhibit some power loss, but this circuit has a selectable loss factor, which naturally can become a *gain* if so desired.

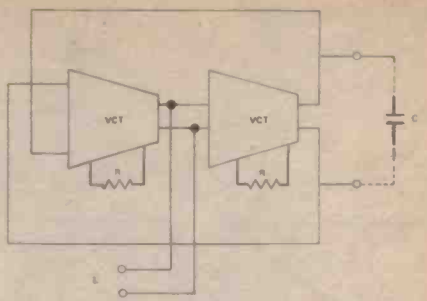
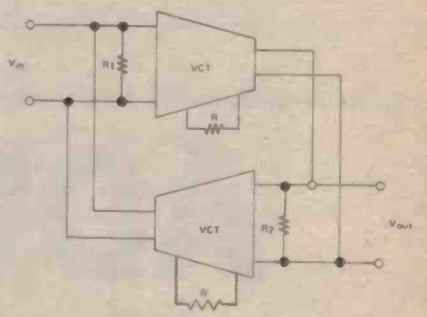


Fig. 8. A VCT gyrator.

Choose R such that $R^2 = R_1\ R_2$ to give no loss/gain in circuit i.e. a perfect transformer.



Transformer Ratio = $(R_1/R_2)^{1/2}$.

Fig. 9. VCT as a transformer.

NON-LINEAR

We will consider just one non-linear application to show it can be done – that of a limiter. Since the VCT can output only 2x bias current with the circuit of Figure 10, we will get a characteristic shown in Figure 11, very simply indeed with only two resistors.

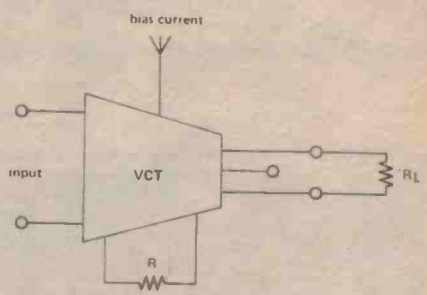


Fig. 10. Circuit to give the characteristics shown in Fig. 11.

GAINS FROM LESS

It is apparent from the preceding circuits that one of the biggest gains when using VCTs, is in reducing external component count over a similar op-amp or discrete circuit. In industrial applications this will lead to less pcb design and assembly complications, with resultant reduction in costs.

Another gain is the fact that when used as an inverting amp, no input resistor is used to drop the signal, as it is in op-amp circuits. In these circuits,

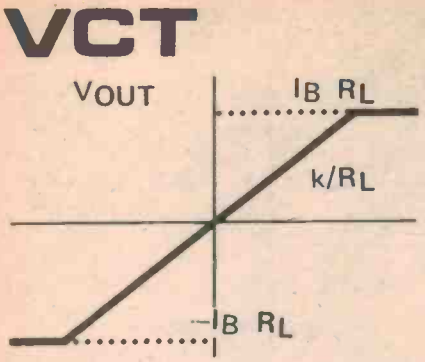


Fig. 11. Characteristics of the circuit in Figure 10.

since the input is usually a virtual earth, most of the signal is dissipated in the resistor, with a resultant poor signal-to-noise ratio upon amplification at the output. With VCTs no resistor is required, and this gives a distinct improvement in S/N ratio, with the attendant gain in dynamic range.

THE PRICE OF A FUTURE

One question remains – how much? Well, this depends entirely on Texas Instruments, and the marketing policy they persue. No doubt the price will be high at first, falling as the volume of sales climbs, as it surely must. Interestingly, the VCT occupies only half the chip area of a 741 op-amp, but whether this affects pricing remains to be seen. We'll keep you informed of developments, as we're convinced you'll be hearing much more of VCT in the years to come.

OUR THANKS and congratulations to Professor W. Gosling of Bristol University, who provided the information for this article.

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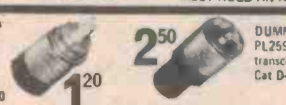

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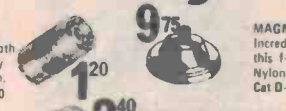

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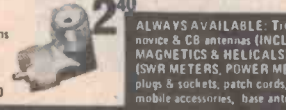

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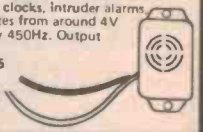

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3 DIGIT COUNTER

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WHAT CAN YOU USE A TAPE COUNTER FOR? Besides counting tape of course! How about turns counters & length measurement for coil or transformer windings. 1001 uses — anything that revolves can be linked into one of these by a simple belt system. Ideal for the experimenter's 'junk box' (You'll never know when you might need one ...)
Cat C-3504 ..... $2.50

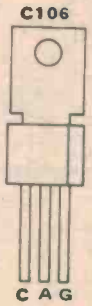
DICK SMITH ELECTRONICS GROUP

DICK SMITH DEALERS: (Prices may be higher to cover freight, etc)
A.E. Cooling, 6 Trimmer Rd, Elizabeth Sth. SA. Ph 255-2249
Veneman & Wyatt, 24 Stuart Hwy, Stuart Park. NT. Ph 81-3491
Aero Electronics, 123a Bathurst St, Hobart. Tas. Ph 34 8232
Hunts Electronics, 23 Russell St, Toowoomba. Qld. Ph 32-6944
The Record Centre, 222 Banna Ave, Griffith. NSW. Ph 62-1577
Wills & Co, 11 Quadrant, Launceston. Tas. Ph 31-5688
Altronics Parts, 105 Stirling St, Perth. WA. Ph 28-1599
Sound Components, 78 Brisbane St, Tamworth. NSW. Ph 66 1363

ETI data sheet

C106, 4A SCR

The C106 SCR is the most common SCR in our projects and advertisements and can be used in a wide variety of applications. In this issue we use the device in our Electronic Tie-Breaker project on page 51.



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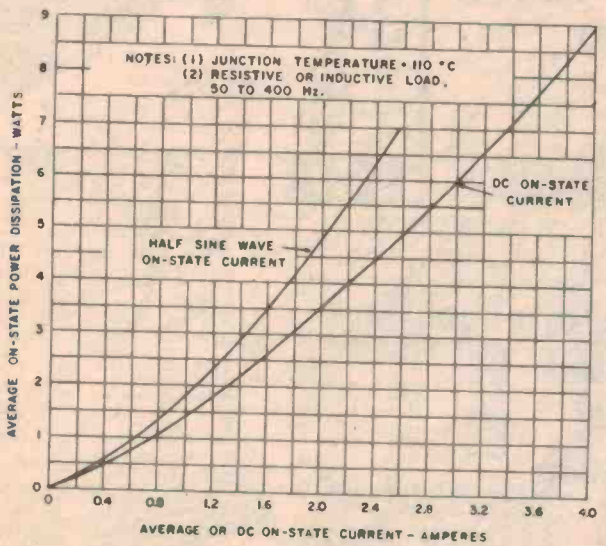
CHARACTERISTICS – C106

Test	Symbol	Min.	Typ.	Max.	Units
Reverse or Forward Blocking Current (All Types)	I_{RX} or I_{FX}	–	0.1	10	μA
Gate Trigger Current	I_{GT}	–	30	200	μAdc
Gate Trigger Voltage	V_{GT}	0.4	0.5	0.8	Volts DC
Peak On-Voltage	V_{FM}	–	1.8	2.2	Volts
Holding Current $T_L = 25°C$	I_{HX}	0.3	1.0	0.3	mAdc
$T_L = 110°C$		0.14	0.6	2.0	mA dc
Latching Current	I_{LX}	0.3	1.5	0.4	mA dc
Critical Rate of Rise of Forward Blocking Voltage	dv/dt	–	8	–	μs
Turn On Time	$t_d + t_r$	–	1.2	–	μs
Circuit Commutated Turn-Off Time	t_{off}	–	40	100	μs

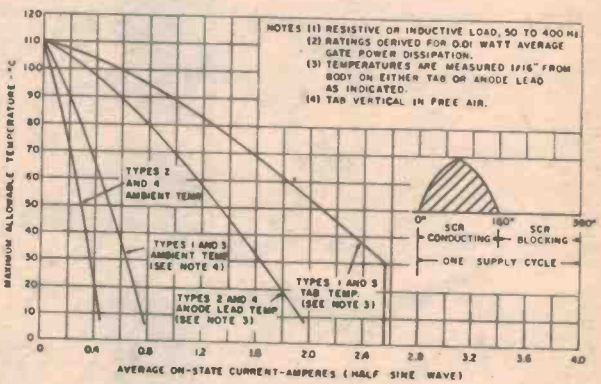


Graph 1. Maximum On-State Power Dissipation.

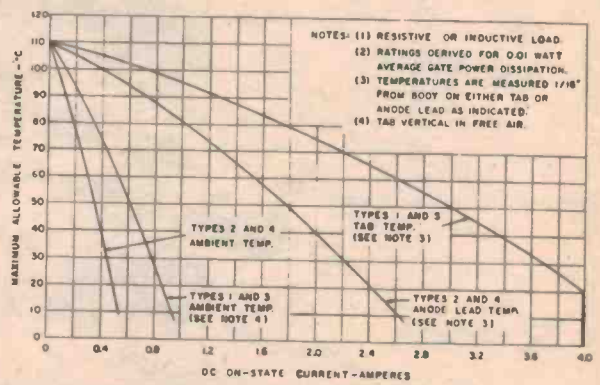
MAXIMUM ALLOWABLE RATINGS – C106

Type	Repetitive Peak Forward Blocking Voltage, V_{FXM} R_{GK} = 1000 Ohms Working and Repetitive Peak Reverse Voltage, V_{ROM}(wkg) and V_{ROM}(rep)
C106Q	15 Volts
C106Y	30 Volts
C106F	50 Volts
C106A	100 Volts
C106B	200 Volts
C106C	300 Volts
C106D	400 Volts

RMS Forward Current, On-State . . . . . 4 A
Rate of Rise of Forward Current (non-repetitive), di/dt . . . 50 A/μs
Peak Forward Current, On-State (repetitive) . . . . . .75 A
Peak One Cycle Surge Forward Current, Non-Repetitive, I_{FM}(surge) . . . . . .20 A
I^2t (for fusing) . . . . . .0.5 A^2 s (for times <1.5 ms)
Peak Gate Power, P_{GM} . . . . . 0.5 W
Average Gate Power, $P_{G(AV)}$ . . . . . 0.1 W
Peak Gate Current, I_{GFM} . . . . . 0.2 A
Peak Reverse Gate Voltage, V_{GRM} . . . . . 6 V

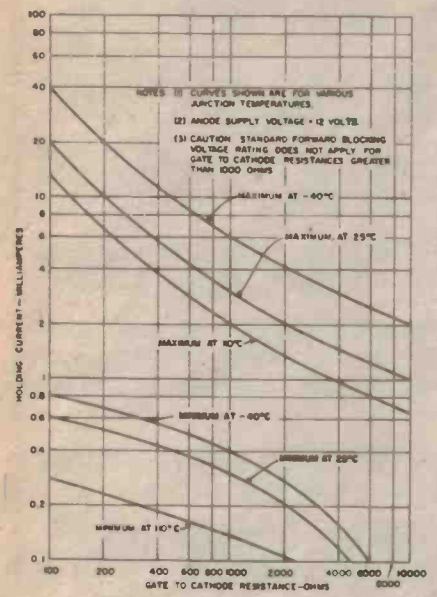


Graph 2. Maximum Allowable Temperatures for Half Sine Wave On-State Current.



Graph 3. Maximum Allowable Temperatures for DC On-State Current.

REPRESENTATIVE APPLICATIONS – C106

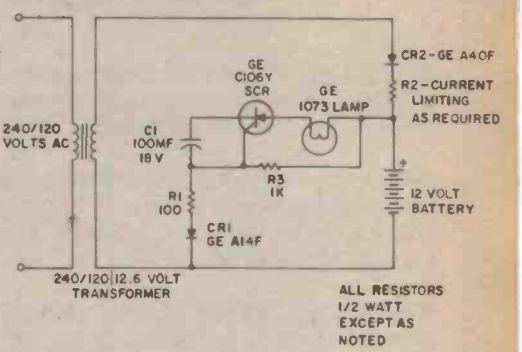


Graph 4. Maximum and Minimum Holding Current Variation with External Gate-to-Cathode Resistance.

Emergency Light

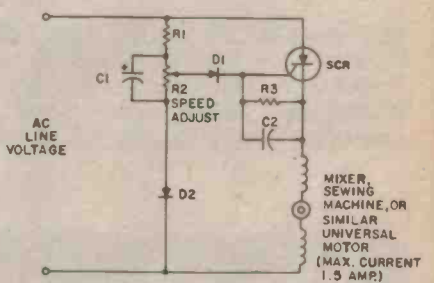
This simple circuit provides battery operated emergency lighting instantaneously upon failure of the regular ac service. When line power is restored, the emergency light turns off and the battery recharges automatically. The circuit is ideal for use in lifts, corridors and similar places where loss of light due to power failure would be undesirable. Completely static in operation, the circuit requires no maintenance.

With ac power "on", capacitor C1 charges through rectifier CR1 and resistor R1 to develop a negative dc voltage at the gate of the C106Y. By this means the SCR is prevented from triggering, and the emergency light stays off. At the same time, the battery is kept fully charged by rectifier CR2 and resistor R2. Should the AC power fail, C1 discharges and the SCR is triggered on by battery power through resistor R3. The SCR then energizes the emergency light. Reset is automatic when ac is restored, because the peak ac line voltage biases the SCR and turns it off.



Universal Motor Speed Control

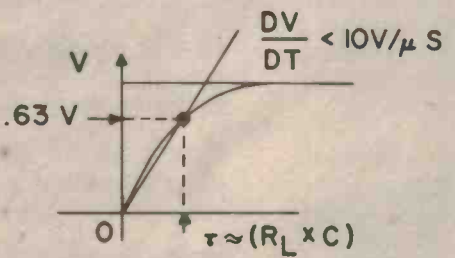
This circuit can replace the carbon-pile speed controller commonly supplied with household sewing machines. It is equally effective for use with other small ac-dc motors, such as those found in food mixers and similar traffic appliances. Maximum current capability is 1.5 amps. Provision of speed-dependent feedback gives excellent torque characteristics to the motor, even at low speeds where other types of controllers are completely ineffective.

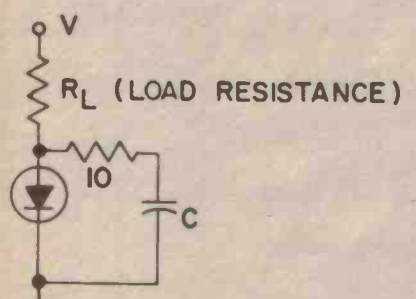


The resistor capacitor network R1-R2-C1 provides a ramp-type reference voltage superimposed on top of a DC voltage adjustable with the speed-setting potentiometer R2. This reference voltage appearing at the wiper of R2 is balanced against the residual counter emf of the motor through the SCR gate. As the motor slows down due to heavy loading, its counter emf falls, and the reference ramp triggers the SCR earlier in the AC cycle. More voltage is thereby applied to the motor causing it to pick up speed again. Permormance with the C106 SCR is particularly good because the low trigger current requirements of this device allow use of a flat top reference voltage, which provides good feedback gain and close speed regulation.

CIRCUIT DESIGN – C106

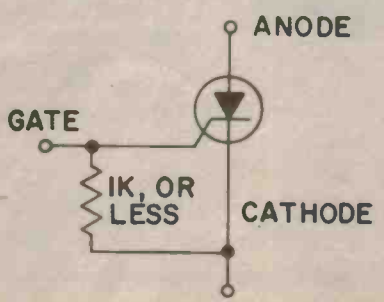
Suppression of Rate Effect In circuits where the C106 is subjected to fast rising anode voltages, as for instance where voltage is applied suddenly with a switch, RC "Slow down" filters may be required to prevent the SCR from triggering spontaneously. C should be selected in conjunction with R_1, so that dv/dt is less than 10 volts per micro-second thus:





(The 10 ohm resistor limits turn-on current through the SCR to a safe value when the SCR turns on).

Use of Gate Resistor The C106 SCR is guaranteed to block rated voltage over its rated operating temperature range only if a resistance of not more than 1000 ohms, or equivalent, is connected between its gate and cathode terminals as follows:

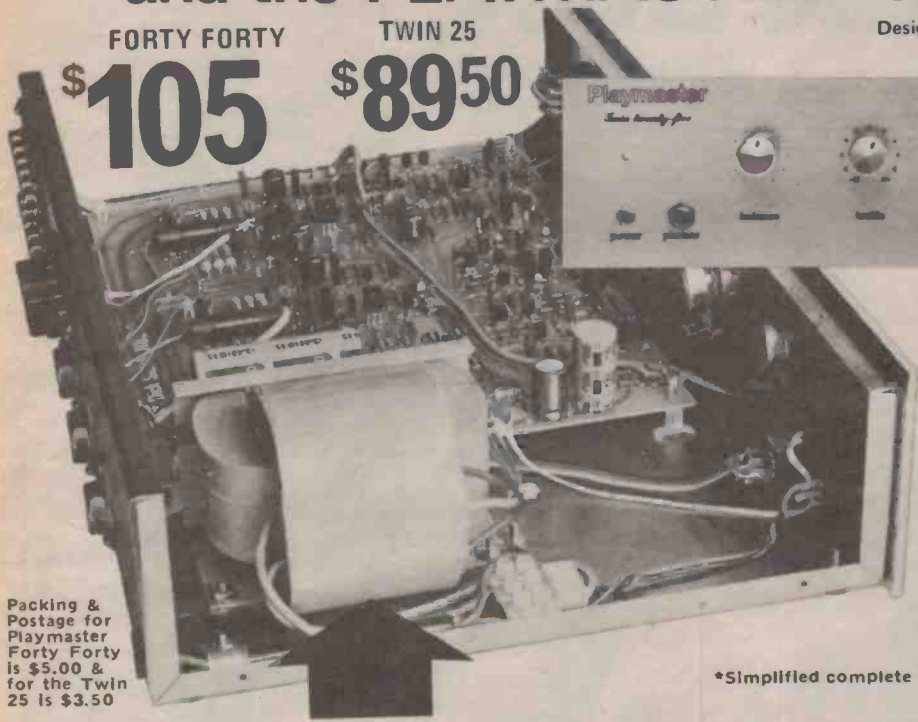


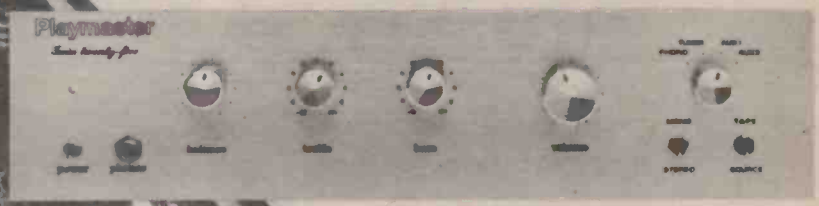
NOW YOU CAN BUILD THE FABULOUS PLAYMASTER "FORTY FORTY" and the PLAYMASTER "TWIN 25"

Designed by Leo Simpson of Electronics Australia.

FORTY FORTY **$105**

TWIN 25 **$89.50**





Packing & Postage for Playmaster Forty Forty is $5.00 & for the Twin 25 is $3.50

ATTENTION

This Playmaster Forty Forty has the low noise transformer. The Twin 40 is a cheaper amplifier with a normal iron core transformer. We do not supply the Twin 40 and do not intend to.

FEATURES

*Exclusive Bronzed Anodized Front Panel
*Professional Knobs to match the Front Panel
*Level graduation on Treble and Bass controls
*Simplified complete Instruction Manual and Assembly Instructions
*Special silk screened fibreglass PC Board

THE "FORTY FORTY" HAS AN EXCLUSIVE 'C' CORE LOW NOISE (LH) TRANSFORMER

The "C" core transformer in the Dick Smith kit is EXCLUSIVE — and its one of the key components in this amplifier. Normal interleaved (laminated) transformers are alright – just – but for the optimum performance the "C" core, with its grain-oriented steel and better electrical characteristics is hard to beat. The result : a quieter more powerful amplifier. More power can be delivered by transformer with less "noise" being radiated to get in the sensitive front end of the amplifier.
ATTENTION: This amplifier is slightly more expensive because of the "C" core (LH) low noise transformer — however it is really worth the extra $5 — on headphones alone the background noise level is lower.
Cat. K-3411 .. .. Playmaster Forty Forty Kit $105.00

SPECIFICATIONS for BOTH AMPLIFIERS

Power Output:
Forty Forty — 40 W per channel into 8 ohms with 1 channel driven.
Twin 25 — 25 W per channel into 8 ohms with 1 channel driven.
Frequency Response: ± 1dB from 25 Hz to 20 kHz with tone controls level.
Compensation: RIAA to within ± 1dB.
Sensitivity: Phono 2mV into 56k for 25W or 40W output. Other inputs 150mV into 36k minimum.
Overload: On phono 120mV.
Sig/Noise: 70dB (on phono) @ 10mV. 70dB (other inputs).
Crosstalk: Better than -45dB over 100 - 10 kHz.
Distortion: Less than 0.05% at normal listening levels.
Bass / Treble Controls: ± 13dB nom. at 50 Hz and 10 kHz.
Stability: Unconditional.

PLAYMASTER "TWIN 25"

For those who require a lower powered unit or who do not have the living area suitable for the higher powered Forty Forty, then the Twin 25 is the ideal amplifier. The 25 watts RMS per channel suits most available speaker systems. "It is about half the price of an imported amplifier with the same power output" says Leo Simpson in Electronics Australia for April 1976. Thousands of these units have already been built during the last few months.
Cat. K-3410 .. .. Playmaster Twin 25 Kit $89.50

CONVERT YOUR EXISTING TWIN 25 TO GIVE YOU 40 WATTS RMS PER CHANNEL.

With this conversion kit you can boost your Twin 25 to give 40 watts RMS per channel. Complete with full instructions and all necessary parts including "C" core transformer. **Cat. K-3435 Conversion Kit Only $25.00**

FREE Power supply circuit included when you purchase the above kit to show you how to use your existing Twin 25 Transformer for a 13.8 volt 2-4 Amp Regulated Power Supply. A must for the hobbyist.

"C" CORE TRANSFORMER ONLY
Cat. M-0148 .. $24.50

OPTIONAL CABINET

Dress up your amplifier with an attractive high quality simulated Teak timber cover. Will give it that $500 look. Suits both the Playmaster Forty Forty and the Twin 25 amplifiers.
Cat. H-3113 .. .. $7.50

SPEAKER PROTECTOR KIT

Suits both the Playmaster Forty Forty and the Twin 25. Get that extra protection for your speakers from damage by amplifier malfunction and switch on / switch off thump.
Cat. K-3425 .. .. $10.75

DICK SMITH ELECTRONICS GROUP

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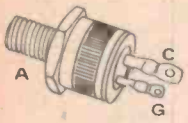
A.E. Cooling, Elizabeth South (255 2249)
The Record Centre, Griffith (621 577)
Altronics Parts, Perth (28 1599)
Bladen Brook Electronics, Tamworth (66 1363)
Dealer prices may be higher due to transport costs.

ETI data sheet

C220, 10A SCR



MAX RATINGS – C220

C220U	C220F	C220A	C220B	C220C	C220D	C220E
25	50	100	200	300	400	500
35	75	150	300	400	500	600

Test Conditions

V_{DRM} – Repetitive Peak Off-State Voltage

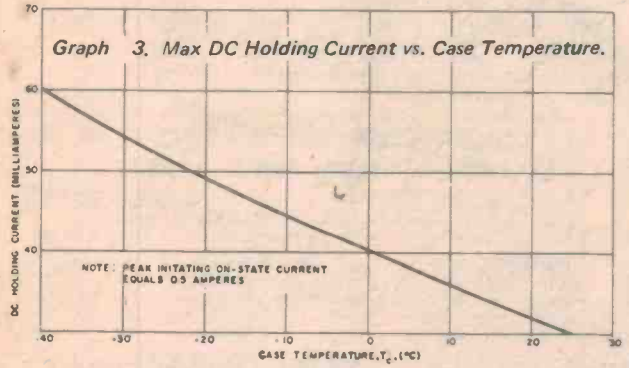
V_{RRM} – Repetitive Peak Reverse Voltage

V_{RSM} – Non-Repetitive Reverse Voltage

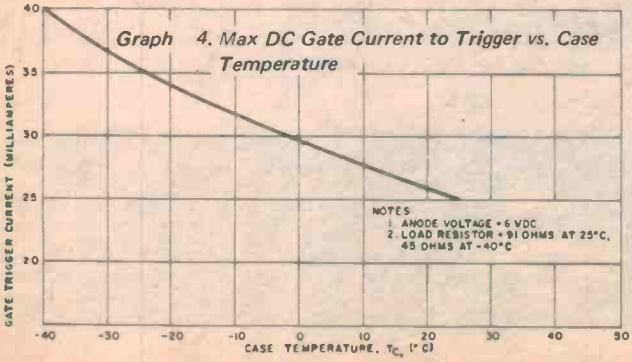
Peak Positive Anode Voltage . . . . . 560 V
RMS On-State Current, $I_{T(RMS)}$ . . . . . .
Peak Positive Anode Voltage . . . . . 560 V
RMS On-State Current, $I_{T(RMS)}$ . . . . . 10 A
Average On-State Current, $I_{t(AV)}$ . . . . . (see Charts 1 and 2)
Critical Rate-Of-Rise of On-State Current, di/dt: . . . . . .
Gate triggered operation
Switching from 200 volts . . . . . 100 A/µs
Switching from 500 volts . . . . . 50 A/µs
Peak One cycle Surge (non-rep) On-State Current, I_{TSM} 50 Hz. . . . 82
60 Hz. 90
I^2t (for fusing), for times at 8.3 milliseconds 34/2
1.5 milliseconds 27A2s
Peak Gate Power Dissipation, P_{GM} . . . . . 5 W or 10 µs
Average Gate Power Dissipation, $P_{G(AV)}$ . . . . . 0.5 W
Peak Positive Gate Current, I_{GM} . . . . . see Graph 5
Peak Positive Gate Voltage, V_{GM} . . . . . see Graph 5
Peak Negative Gate Voltage, V_{GM} . . . . . 5 V

CHARACTERISTICS – C220

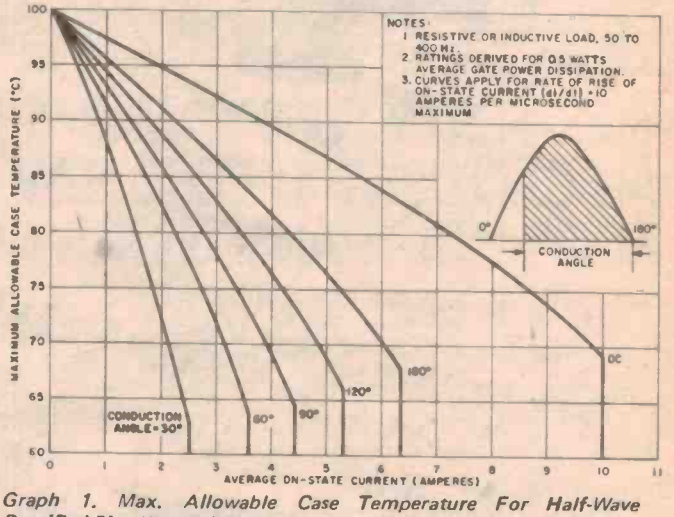
Test	Symbol			Units
Peak-On-State Voltage	V_{TM}	max.	1.95	Volts
Critical Rate of Rise of Off-State Voltage (Higher values may cause device switching)	dv/dt	Typ.	50	Volts/µs
Circuit Commutated Turn-Off Time	t_q	Typ.	50	µs
D.C. Gate Trigger	I_{GT}	Max.	25	mAdc
D.C. Gate Trigger Voltage	V_{GT}			V_{dc}
T_c=+25°C V_D=6 Vdc R_L = 91 ohms T_c=+100°C Rated V_{DRM}		max.	1.5	
R_L = 1000 ohms		min.	0.2	
Holding Current	I_H	max.	30	mAdc
Latching Current T_c=+25°C	I_L	max.	60	mAdc
Steady-State Thermal Resistance				
Junction to Case	$R\theta_{JC}$	max.	2.0	°C/Watt
Junction to Ambient	$R\theta_{JA}$	max.	45	



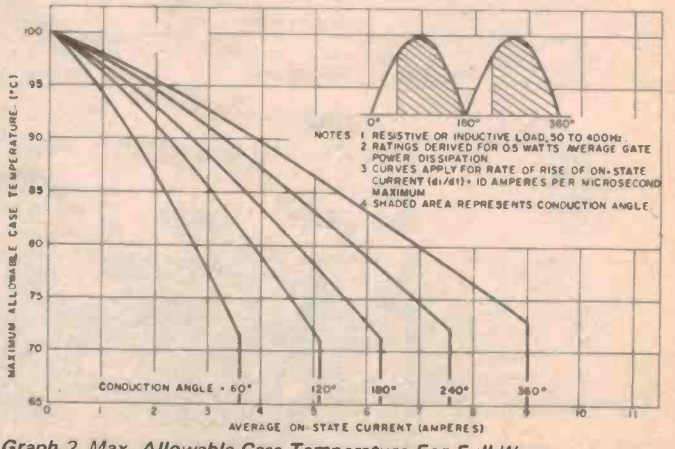
Graph 3. Max DC Holding Current vs. Case Temperature.



Graph 4. Max DC Gate Current to Trigger vs. Case Temperature



Graph 1. Max. Allowable Case Temperature For Half-Wave Rectified Sine Wave of Current.



Graph 2. Max. Allowable Case Temperature For Full-Wave Rectified Sine Wave of Current

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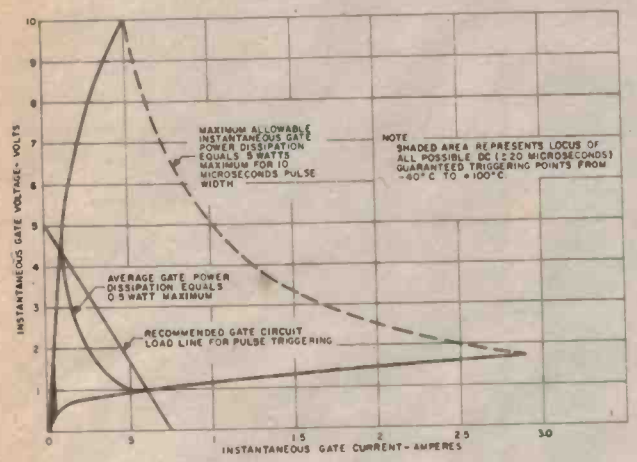
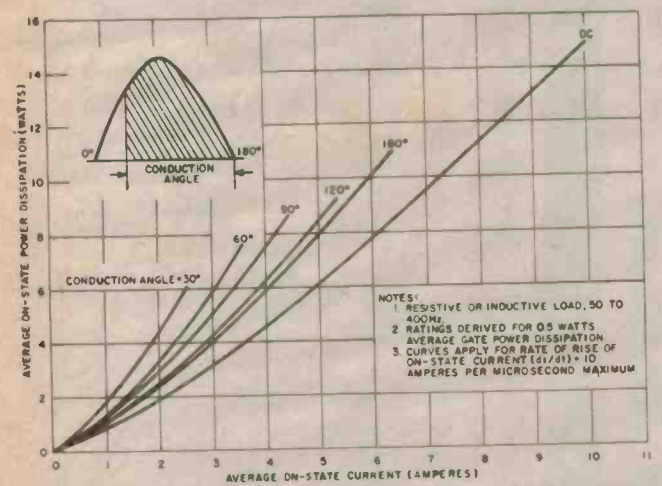
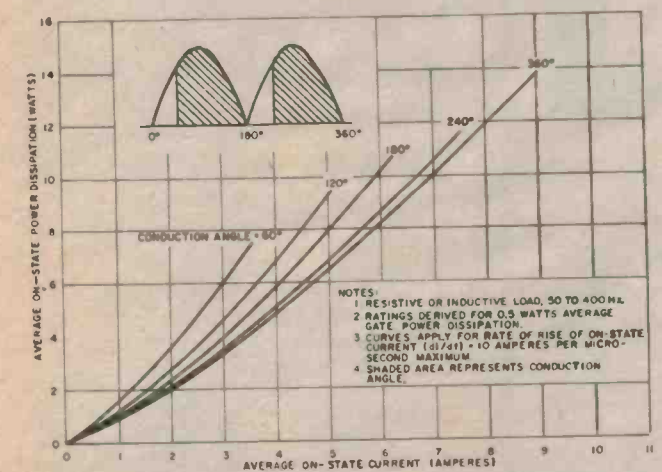


Graph 5. Gate Trigger Characteristics



Graph 6. Max. On-State Power Dissipation for Half-Wave Rectified Sine Wave of Current.



Graph 7. Max. Allowable On-State Power Dissipation for Full-Wave Sine Wave of Current.

Why the cannon on your 1812 Overture sounds more like a popgun.

A rather unfortunate situation occurs during a recording session.

Because the dynamic range of most recording equipment doesn't equal the dynamic range of live performances, the loudest sounds end up being very much compressed, while the softer sounds have to be lifted above tape noise.

So no matter how good your equipment is, it will never ever give a true performance.

Introducing dbx.

Fortunately for the home hi-fi buff there's now an extremely effective solution available.

The dbx 117.

Basically it's a dynamic range enhancer that works on the signal's voltage level without changing the frequency response. (Unlike other systems that are designed merely to filter out high frequencies.)

And attached to any good system it will noticeably increase the entire dynamic range of any signal put into it. While at the same time reducing surface noise.

So now your softs become even softer. While your louds, especially your crescendo's, become much more dramatic when they finally reach the top.

Consequently giving the recorded performance both more body and definition.

dbx will also improve the sound of your older records. So there's less need for you to have to replace them. (The dbx 117 will also help reduce hiss from FM broadcasts as well as your tapes.)

In fact should you desire to test the dbx before purchase, we then suggest you contact one of our dealers listed opposite and politely ask him to play you a copy of the 1812 Overture.

Should you still have a few reservations then all we have to say is that perhaps the 1812 Overture was recorded featuring a popgun.

Or your ears aren't as good as you thought they were.

dbx

AUR19


"Let's make it at your place"
DYNACO DYNAKITS have an international reputation for value-for-money high fidelity quality in performance and musical excellence.
If you want giant results and savings too, "LETS MAKE IT AT YOUR PLACE" with DYNACO DYNAKITS.
• Pat 4 Preamplifier • Pat 5 Preamplifier • Stereo 80 • Stereo 150 • Stereo 400 • Power Amplifiers • AF6 AM/FM Tuner • FM5 FM Tuner • QD.1 Quadaptor
dynaco dynakit

NEWS FROM DYNACO DYNAKITS

Dynaco Dynakits are high fidelity, amplifiers, AM/FM and FM tuners, preamplifiers and power amplifiers in bolt together form. All printed circuits have been built and tested for you and the accompanying plan book takes you through each tiny step in the hook up soldering.

THE RESULTS are high performance, quality Hi Fi electronics that represent considerable cost savings over competitive devices, and you know yourself how it went together.

THE KITS. The control preamplifiers PAT-4 and PAT-5 are legendary value and incredible performers. With either of these up front, the power AMPS ST80 (40 x 40W.) ST 150 (75 x 75W) and the ST150 (75 x 75W)and the ST400 (200 x 200W) built by you, represent not only the highest musical performance, but the cheapest way to get the sound you want.

YOU NEED a soldering iron, good resin core solder, and the tools in your kitchen drawer. LADIES : no kidding, we can make it at your place. The careful kits are built by girls.

Dynaco Dynakits made in U.S.A. are sold in each state by factory distributors. Give them a call.

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Russin Electronics,
256 Liverpool Road, Ashfield. 2131.
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Manuka. 2603 Ph: (062) 95-0695

VIC.
Optro Pty. Ltd.,
17 Arawatta Street, Carnegie. 3163
Ph: (03) 569-0978

TAS.
Quantum Electronics Pty. Ltd.,
Cnr. Harrington & Liverpool Sts.,
Hobart. 7000 Ph: (002) 28-1337

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66 King Willlam Road, Goodwood.
5034. Ph: (08) 71-9438

Let's make it at your place
dynaco dynakit

Dynaco Dynakits are now being distributed by Dynakit Distributors in each State (except W.A. at present). Intending purchasers of Dynakits now have sales/serivce centres in reasonable proximity to their homes, and these Dynakit centres are run by people who know the product, and can give assitance with kit construction.

DYNAKIT SYSTEM OF THE YEAR—1977

As the PAT-5 preamplifier is reviewed by more and more audio magazines, the accolades pile up. It is seldom that so much praise is heaped on a single HiFi product, yet the greatest equipment critics in the world have called the PAT-5 preamplifier "the preferred solid state control centre for audiophiles with no qualification as to price".

Kit price: $399.00

"Our previous absolute standard (preamp) . . . clobbered by the PAT-5" THE AUDIOPHILE

"Measurements made at CBS Labs match the published specs or exceed them, sometimes to a spectacular degree. Distortion readings generally are one hundred times better than claimed. Response is ruler straight across the audioband". HIGH FIDELITY MAGAZINE — Sept. '75

The ST 150 POWER AMPLIFIER. (75w x 75w FTC) is a real surprise package — in performance, price and sound. As more and more dealers in the U.S.A. listened to the ST150, the enthusiasm for the product was unanimous. The main question seemed to be "How can 150 watts sound like that? It makes all other so-called 75 a channel amps sound like 15w".
The ST150 makes use of design concepts and component configuration which previously had been limited to much more expensive equipment. Despite advanced design, the ST150 is easily assembled, even by inexperienced constructors.

Kit price: $399.00

THE DYNAMIC DYNAKIT DUO— FOR 1977

THE DYNAMIC DYNAKIT DUO FOR 1977
The astounding demand and popularity of the PAT-5 and ST150 has denied full supplies to Australia for a few months. Dynaco have recently increased prices, but due to our large orders for PAT-5 and ST150, supplies of these kits are available at good savings ($399 is the price after devaluation).

SEE THE DYNAKIT SPECIALIST in your State for details of the savings on the PAT-5/ST150 combination. This special offer is limited to the first two hundred sets.

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ERRATA & ADDENDA 1976

Active Antenna ETI 708 – Mar. 76.

Some of the components in Fig. 5 are not marked with values. The values may be found by referring to Fig. 6.

Audio Limiter ETI 446 – Aug. 76.

The integrated circuit IC1 should *not* be a Philips type as these versions of the IC have buffered outputs. These devices cannot therefore be connected to give a FET for use in the linear mode as required in the audio limiter.

Audio Phaser ETI 447 – Sep. 76.

The integrated circuit IC9 should *not* be a Philips type. These have buffered outputs and therefore cannot be connected to obtain a FET as required in the Audio Phaser.

On the circuit diagram RV1 is shown connected between +9 volts and the junction of R5 and R6. On the printed-circuit board it is connected between +9 volts and the zero-volt line. This variation in connection does not affect operation of the phaser.

The phaser is sensitive to supply-voltage variations especially when using small batteries. Use a large battery, or use a 12 volt battery to feed a 9 volt zener regulator via a 220 ohm resistor.

Cannibals and Missionaries ETI 803 – Dec. 75.

In Fig. 2 on page 101 the line joining the contact M3d to the buzzer common line should be deleted. Switch M3d should be normally open. On page 102 Fig. 5 a connection should be made between the bottom-left contact of M3 and the bottom-right contact of M1.

For those who built this project and think that it cannot be solved – and for those still struggling with the problem on bits of paper – here's a solution:

M means any missionary. C means either of the non-rowing cannibals. C2 means the cannibal who can row.

1. C and C2 go over
2. C2 comes back
3. C and C2 go over
4. C2 comes back
5. M and M go over
6. M and C come back
7. M and C2 go over
8. M and C come back
9. M and M go over
10. C2 comes back
11. C and C2 go over
12. C2 comes back
13. C and C2 go over

Five Watt Stereo Amplifier ETI 444 – June 76.

On page 44 in the specification table the frequency response should be 4 Hz to 200 kHz within +1 and – 3 dB.

FM Tuner ETI 740 – Apr. 76.

The LED spacing is 1.25 MHz *not* 800 kHz. The display driver IC is a UAA 170 *not* a UA 170. The varicap stabiliser is a TAA 550 not a TA550.

General Purpose Power Supply ETI 131 – Apr. 76.

Several references are made throughout the text to R14 and R15. Wherever R14 appears read R12, and wherever R15 appears read R13. In the How It Works section wherever R7 appears read R5.

Heart-Rate Monitor ETI 544 – Sep. 76.

In the parts list on page 77, C1 should be 100 nF and C2 should be a one microfarad 35 volt electrolytic.

Due to the simplicity of this device adjustment of the sensitivity control is fairly critical. To use the instrument adjust the sensitivity control upwards only sufficient to obtain reliable triggering. A too-high setting will result in false triggering and hence a too-high heart-rate indication.

In the How It Works section on page 79 in the third column, seventh line, read IC2/2 *not* IC2/1.

Magnavox MV50 Speaker System – Feb. 76.

The top, bottom and three sides may be cut from a 2400 x 300 mm sheet (old 8 x 1 feet size), not a 7 x 1 feet sheet as specified in the article.

Marker Generator ETI 706 – Feb. 76.

The photo on page 55 is not that of the marker generator as stated. The correct photo can be found on page 45.

Remote Control Switch Receiver ETI 711 – Sep. 76.

MPF 121 transistors are no longer available. The MPF 131 may be used as a substitute as these are the same chip mounted in a slightly different package.

Remote Control Switch Transmitter ETI 711 – July 76.

In the circuit diagram on page 65 the pin numbers 9 and 11 on IC3 should be reversed.

The junction of R21, 22 and 23 should be shown connected to +9 volts.

The printed-circuit board has an error in the layout for the rear side (Fig. 8). Referring to Fig. 7, cut the track between C3 and C12 nearest to the edge of the board.

Simple Amplifier ETI 061 – Oct. 76.

On page 64 the negative lead from the 9 volt battery to the Veroboard (Fig. 2) should be connected to the copper track above that shown, i.e. to the track marked 'common'.

Temperature Meter ETI 130 – Feb. 76.

The photo on page 45 is not that of the temperature meter. The correct photo may be found on page 55.

Touch Switch ETI 539 – Mar. 76.

Add to the parts list:

IC1 integrated circuit 4049 or 449 (CMOS) (do not use Philips ICs or the 4009).

It is recommended that a 2k2 half watt resistor be fitted between gate and cathode of the SCR.

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7403	.39	7448	1.80	74121	.75
7404	.39	7450	.39	74122	.85
7405	.39	7451	.39	74123	.95
7406	.89	7453	.39	74132	1.50
7407	.89	7454	.39	74141	2.20
7408	.89	7460	.39	74145	1.95
7409	.39	7470	.70	74150	2.60
7410	.39	7472	.60	74151	1.70
7411	.45	7473	.68	74153	1.55
7413	.95	7474	.69	74154	2.50
7414	2.25	7475	1.10	74157	1.70
7416	.85	7476	.75	74160	2.20
7417	.95	7480	1.30	74164	230
7420	.39	7482	1.90	74165	2.30
7425	.80	7483	1.80	74174	2.30
7426	.59	7485	2.50	74180	2.30
7427	.55	7486	.70	74181	4.90
7430	.39	7489	3.90	74185	3.90
7432	.55	7490	.65	74190	2.50
7437	.75	7491	1.55	74192	2.20
7438	.75	7492	.95	74193	2.20
7440	.39	7493	.95	74194	1.95
7441	1.50	7494	1.80	74195	1.50
7442	1.20	7495	1.30	74196	2.20

SCHOTTKY SPECIAL

74S00	1.15	74LS78	.59
74S10	1.40	74LS86	.77
74S20	1.40	74LS90	1.60
74S74	2.75	74LS92	1.60
74S112	2.50	74LS93	1.60
74S251	5.30	74LS95	2.15
74S258	4.75	74LS109	.70
74LS00	.45	74LS113	.70
74LS01	.45	74LS114	.70
74LS02	.45	74LS151	2.10
74LS03	.45	74LS157	1.95
74LS04	.49	74LS163	3.29
74LS05	.49	74LS164	2.35
74LS08	.45	74LS174	2.15
74LS09	.45	74LS175	2.15
74LS10	.45	74LS181	5.30
74LS11	.45	74LS191	3.50
74LS13	.99	74LS192	3.50
74LS14	2.35	74LS193	3.50
74LS20	.45	74LS194	2.15
74LS21	.45	74LS195	2.15
74LS27	.49	74LS196	2.15
74LS28	.49	74LS221	2.00
74LS30	.45	74LS253	2.20
74LS32	.55	74S196	2.80
74LS37	.55	82S23	6.95
74LS38	.55	8281A	3.90
74LS40	.49	82S90	5.95
74LS42	1.75	9001	1.60
74LS73	.59	9368	3.20
74LS74	.70	95H90	14.50
74LS75	.99		

DIODES ETC

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C106D1	1.50	IN751A	.35
EM402	.20	IN752A	.35
EM404	.20	IN753A	.35

STOP PRESS

Since this advertisement was prepared early November, price rises resulting from devaluation have been passed on by our suppliers on varying bases. Some rises were immediate, while others were to be effective as new stocks were delivered. Our policy, since devaluation, has been to retain prices at old levels until we are actually charged higher prices for new stock. TIME DID NOT PERMIT ANY RISES TO BE INCORPORATED IN THIS AD AND IN MANY INSTANCES, PRICES WILL BE INCORRECT. We trust you will understand our predicament, and bear in mind that rises of up to 25% have taken place.

EM408	.35	IN754A	.35
OA91	.25	IN755A	.35
IN914	.10	IN759A	.35
IN748A	.35	IN5626	.65
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V413	.95	OA47	.45
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MEL12	$1.10	2530	.95
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			+ others

CMOS

74C00	.45	CD4006	1.90
74C02	.65	CD4007	.45
74C08	1.10	CD4008	1.90
74C10	.50	CD4009	1.25
74C14	2.25	CD4010	1.20
74C20	.50	CD4011	.45
74C32	.65	CD4013	1.25
74C42	2.95	CD4014	1.90
74C48	4.95	CD4016	.75
74C73	1.90	CD4017	1.90
74C86	1.60	CD4019	1.10
74C89		CD4020	2.10
74C90	1.95	CD4026	P.O.A.
74C154	4.75	CD4027	1.60
74C160	2.95	CD4040	2.10
74C162	3.50	CD4051	1.90
74C174		CD4096	P.O.A.
74C901	1.50	CD4502	2.40
80C95	1.75	CD4053	P.O.A.
80C97	1.75	CD4511	2.75
CD4001	.39	CD4520	2.10
CD4002	.39		+ others

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HEF4011	.45	HEF4071	.45
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HEF4013	.75	HEF4073	.45
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HEF4020	2.10	HEF4093	1.50
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HEF4022	1.80	HEF4510	2.65
HEF4023	.45	HEF4511	2.75
HEF4024	1.45	HEF4514	5.40
HEF4025	.45	HEF4515	5.40
HEF4027	.88	HEF4516	2.60
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LM340K6	3.90	NE5623)	LM
LM340K12	3.90	NE565)	
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BC178/158MET	.30	2N3054	1.70
BC179/159MET	.30	2N3055	.95
BC212	.50	2N3564	.55
BC327	.55	2N3565	.45
BC547	.55	2N3566	.65
BC548	.55	2N3568	.75
BC549	.55	2N3569	.45
BC559	.39	2N3638	.45
BC639	.95	2N3638A	.50
BC640	.95	2N3642	.45
BD131 use BD237		2N3643	.45
BD132 use BD238		2N3694	.45
BD139	.95	2N4032	.95
BD140	.95	2N4249	.45
BD237	1.50	2N4250	.55
BD238	1.50	2N4355	.55
BD173	1.25	2N4356	.55
BF180/200	120	2N4360P-FET	.95
BF194	.85	2N5245N-FET	.75
BF450	.75	2N 5457 use MPF103	
BSX19	.75	2N 5458 use MPF104	
MFE131(Metal)	1.95	2N 5459 use MPF105	
MPF102	.65	2N 5485 use MPF106	
MPF103	.85	2N5590 use MRF603	
MPF104	1.10	2N6027 UJT	1.25
MPF105	.85	40409	3.85
MPF106	1.15	40410	3.35
MPF121/131	1.50	40637A	2.85
MJ2955	2.40	40673	1.65
MRF603	6.90	40841	1.50
TIP31C	1.00	7805	2.50
TIP32C	1.00	7812	2.50
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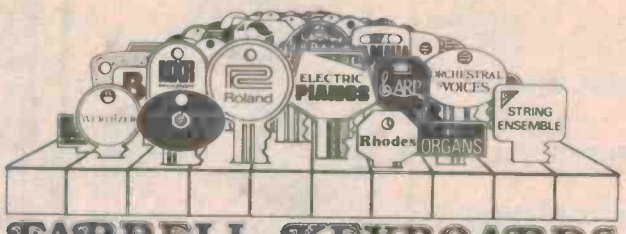

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NATIONWIDE ELECTRONICS

P.O. BOX 184
PENNANT HILLS. 2120

Please see "News Digest" in this magazine for a quick explanation of our business. We will endeavour to give you all your electronic requirements others give you, but with extra personalised service, faster despatch, "specials" ordered for you (provided they meet our suppliers' minimum requirements), cheaper prices and the experience of two of the industry's most well known personalities — Norm and Bill Edge (formerly of Radio Despatch and Edge Electrix, respectively). We have not sufficient space in this advertisement for all our lines, but we feel because there are so many catalogues on the market at the present time, we do not want to add to the confusion. Our stock lines include all the standard electronic parts like resistors, capacitors, semi-conductors, switches, relays, transformers and some of the most popular kits. When ordering from us you will no doubt find it very difficult to know what money to send us and whether we have the goods in stock. (unless in this ad.) We suggest you use one of the better known component catalogues and send us the same amount as our prices will not be dearer and where we are cheaper your money is immediately refunded with order. This is especially a good service for you if you are a country resident and you are sick of waiting weeks to months for your order. Orders are despatched within two days of receiving — why not try us — if we can't get what you want your money is returned — no back ordering unless you specify. There's no chance of a shoddy deal with us — we've been in the electronic parts business for FORTY YEARS — just look at the following for the best deals in Australia.

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SPEAKER BOXES

Completely made up from start to finish — even innerbond is fitted — these boxes are beautifully finished in either teak or walnut (please specify) mat finish. If customer is not at all satisfied with these boxes money will be completely refunded. Our reason for selling these boxes completely made up rather than in kit form is that we have found through experience that we are supplying electronically minded people rather than carpenters. All you have to do is screw speakers in (we supply screws) and if you haven't a screw driver we suggest you borrow one. Cloth for boxes is either in mat black or dark brown. Boxes are available for Coral 12SA1, 10SA1 and 8SA1 kits, Goodmans Mezzo Twin Kit, Magnavox MV50 and all at the ridiculous price of $40 each box unbelievable — by doing it this way you can save as much as $200 from completed systems of the same class and still have the professional look — as these boxes are built by professionals. Boxes for Philips and other systems also available. Price on application.

GOODMANS LOUDSPEAKER KITS

MEZZO TWIN KIT (GOODMANS) $211 Pair

— YES GOODMANS — they are not some odd Japanese or American brand you have never heard of before — but genuine Goodmans speakers — the same company that has produced some of the world's finest speakers — but the most important factor is their low, low price and we don't know how long they will remain at this fantastic price, so, if you want a kit, you'd better be quick — ONLY $211 pair for Mezzo Twin Kit.

This kit has been designed to give the Do-It-Yourself enthusiast the opportunity to make, at moderate cost, two truly high fidelity stereo loudspeakers. Frequency range — 40-2000 Hz, power handling (DIN 45:500) — 50 watts; recommended amplifier music power — 10-60 watts; recommended amplifier impedance — 4-8 ohms; crossover frequency — 2000 Hz. The kit contains all parts necessary to make two high fidelity loudspeaker systems, except timber and other material for finishing and lining the cabinet itself. All necessary dimensions for construction of cabinets, two bass loudspeakers 250mm (10 inches), two dome high frequency radiators 38mm diaphragm, two port tubes, two crossover networks with terminal boxes, two connecting leads, two Goodmans name plates and fixing screws, gaskets, Velcro pads, etc. Box size 500mm x 300mm x 260mm.

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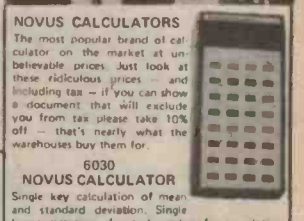

NOVUS CALCULATORS

The most popular brand of calculator on the market at unbelievable prices. Just look at these ridiculous prices — and including tax — if you can show a document that will exclude you from tax please take 10% off — that's nearly what the warehouses buy them for.

6030 NOVUS CALCULATOR

Single key calculation of mean and standard deviation. Single key summation of n and y values for correlation and linear regression. Single key calculation of linear correlation coefficient and slope of curve. Single key calculation of y-axis intercept or any point on y-axis or trend line forecasting. Separate keys to remove incorrect x and y values. Single key to enter frequency for standard deviation of grouped data. Mean and standard deviation calculated without destroying summations, enabling additions or deletions. Single key to clear all statistical summations. Square root, and Change Sign Functions. Automatic constant in multiplication and division. Automatic repeat addition and subtraction. Full accumulating memory with M+ and M-. Floating entries and intermediate answers. "Live" percent key with automatic add-on or discount and net. Bright, 8-digit LED display low battery indicator.

NOVUS 6030 CALCULATOR. . $42.00 (inc. tax).

THE 4615 NOVUS CALCULATOR

Simple operation: You simply engage the "load" switch and perform a problem in the normal manner. The 4615 records the formula for later use with other variables to solve a problem while the calculator is in the learn mode, you can check and debug your program while it is being written.

100 Step Programming Capacity: Several different programs can be contained at the same time. Delete Feature: Lets you correct programs while you write them. Skip Key: Lets you select the program you want to use from within the 100 step capacity. All programs remain intact within the memory until new programs are written over them or until the calculator is turned off. You have total control over whether entries are keyed in as variables or formula constants. Automatic signal in display warns you when you exceed programming capacity. The 4615 comes complete with rechargeable NiCad batteries, AC Charger/Adaptor, vinyl carrying case, and operations manual.

NOVUS 4615. . . . . $84.00 (inc. tax)

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Project 070

ELECTRONIC TIE-BREAKER

project electronics

This system indicates which of any number of switches is pressed first, and constructing the project provides a simple introduction to the operation of the SCR.

THIS PROJECT IS A SIMPLE YET versatile scoring identification system that can be used with innumerable games, sports and even scientific and commercial activities.

In essence it a system for telling which one of any number of activities commenced first.

It can, for examplé, be used to tell which one of a number of quiz contestants first signalled that he/she knew the answer. In this example the 'quizmaster' would pose the problem then immediately close switch SW1. As soon as a contestant wished to register an answer he/she would press the appropriate pushbutton (PB1,PB2,PB3 etc).

The first person to press a button causes a related indicator lamp to become energised – thus identifying that person. This indicator lamp stays on even though the button is subse subsequently released – meanwhile every other contestant's indicator lamps are rendered inoperative. A light on the 'quizmasters' control unit indicates that a 'contestant light' has been activated.

In another application the device is used as a 'knock-out' reaction timing game. The first person to cause a light to come on after the 'quizmaster' has switched SW1 is the winner.

The various pushbutton switches PB1,PB2,PB3 etc can of course be replaced by relays, photo-cell beams, micro-switches etc. The system could readily be adapted for example to indicate which was the winning lane in a swiming race.

In our example shown the 'quizmaster's' unit has been built as a separate self-contained device – and each 'contestant station' has been shown separately. Nevertheless many permutious are possible.

As only a handful of components are used we suggest that the individual units are built up using tag strips. The component layout is not at all critical – except that occasional spurious triggering may occur if very long leads (20 metres or more) are run from the control unit to the individual stations.

Any number of individual units may be used – several thousand if you wish – hardly any current is drawn until a contestant energises a unit – and then only that unit is energized.

Several different types of SCR may be used. We recommend the C106 series but the system will work equally well with any SCR that can be triggered by a gate current of 2 mA or less.

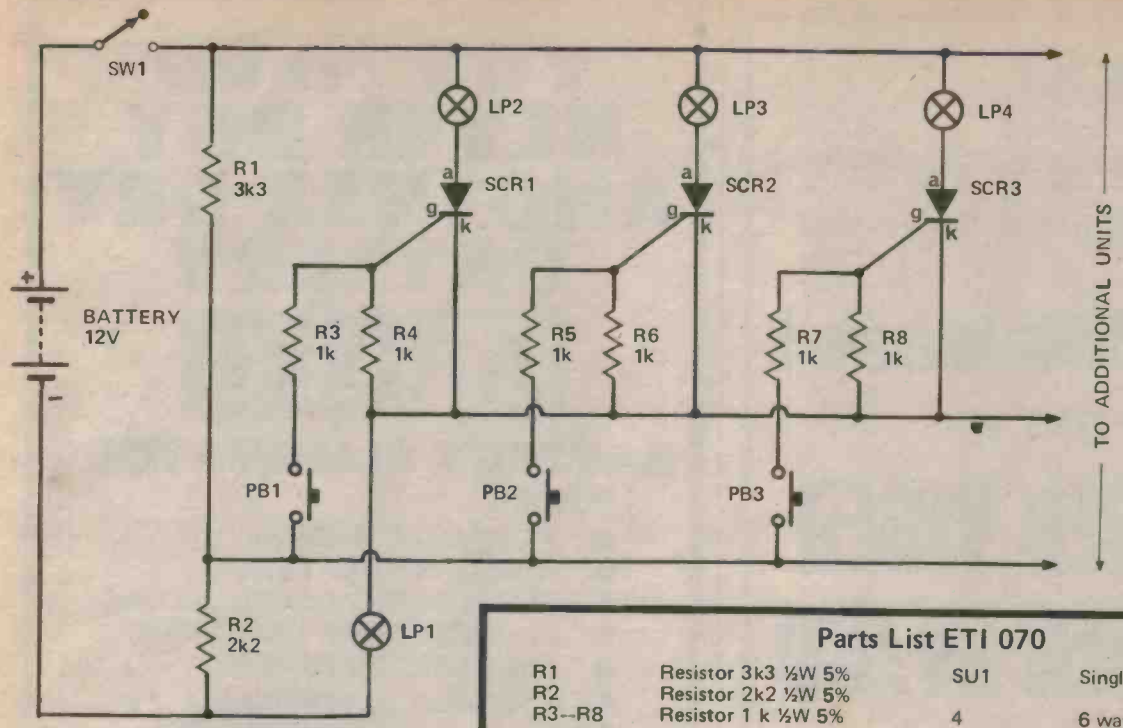
How It Works

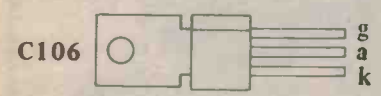
This system is based on an interesting electronic component called a silicon controlled rectifier (SCR). This device acts like a latching switch. Normally it is cool 'off' – however if a voltage above a certain minimum level is applied to its gate the SCR switches full on and stays on even though the triggering gate v voltage is removed. Once 'on' an SCR can only be effectively switched off by removing or reversing the voltage across it.

In the system shown here each individual indicating station consists of an SCR, an indicator lamp, biasing resistors and a pushbutton.

The system is initially 'off' – i.e. SW1 is open and no pushbutton is depressed. The 'quizmaster' closes SW1 to energize the system.

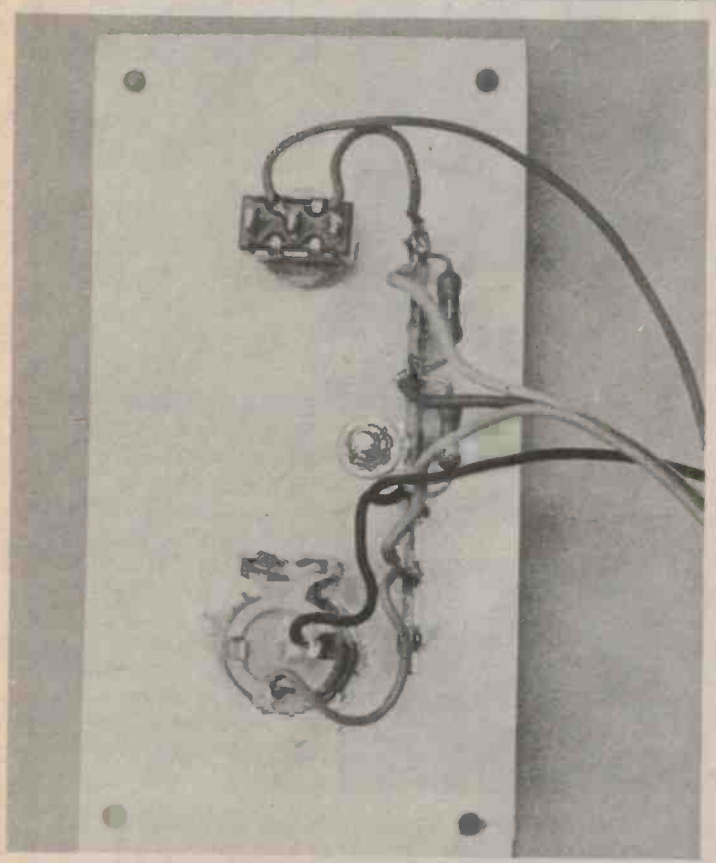
Each SCR cathode is held down effectively to zero voltage via the very low resistance of lamp LP1. The voltage divider, R1/R2, meanwhile provides for a voltage of 4.8V approx to be maintained on the rail linking the bottom ends of the various pushbuttons PB1,PB2,PB3 etc. The instant any one of the pushbuttons is closed this voltage will be applied to the appropriate SCR gate and the SCR will fire virtually instantaneously, illuminating the associated lamp. The current thus drawn will flow through lamp LP1 and this will cause the all SCR cathodes to rise to +6 volts. As this is now higher than the available gate voltage only the first button pressed can cause an indicator to light.



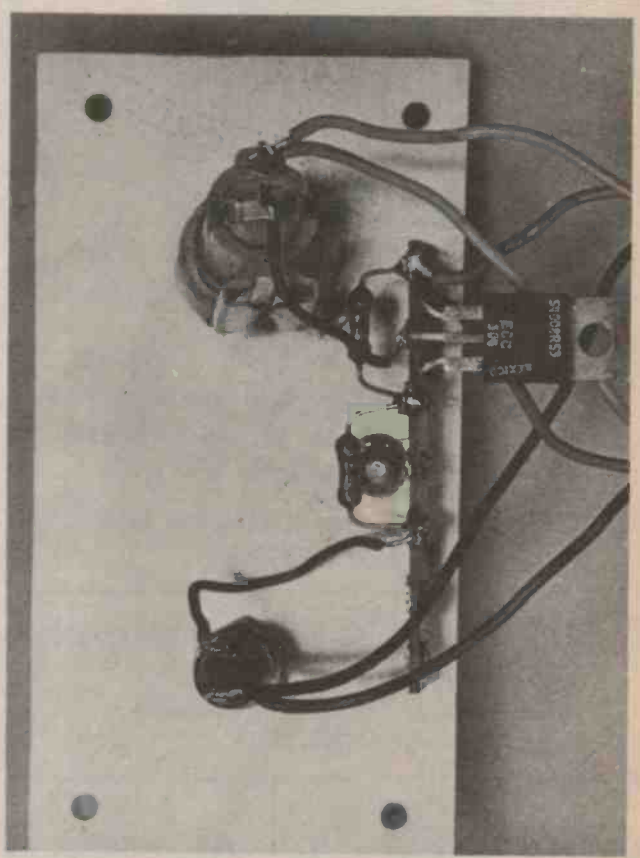


Parts List ETI 070

R1	Resistor 3k3 ½W 5%	SU1	Single pole on-off switch
R2	Resistor 2k2 ½W 5%	4	6 way tag strips
R3–R8	Resistor 1 k ½W 5%	1	12 V battery
SCR1–SCR3	C106 (any voltage)	Cases to suit	
LP1–LP4	Lamp 6V	If additional units are required add 1SCR, 1 globe and two 1 k Resistors per unit.	
PB1–PB3	Single make pushbuttons		

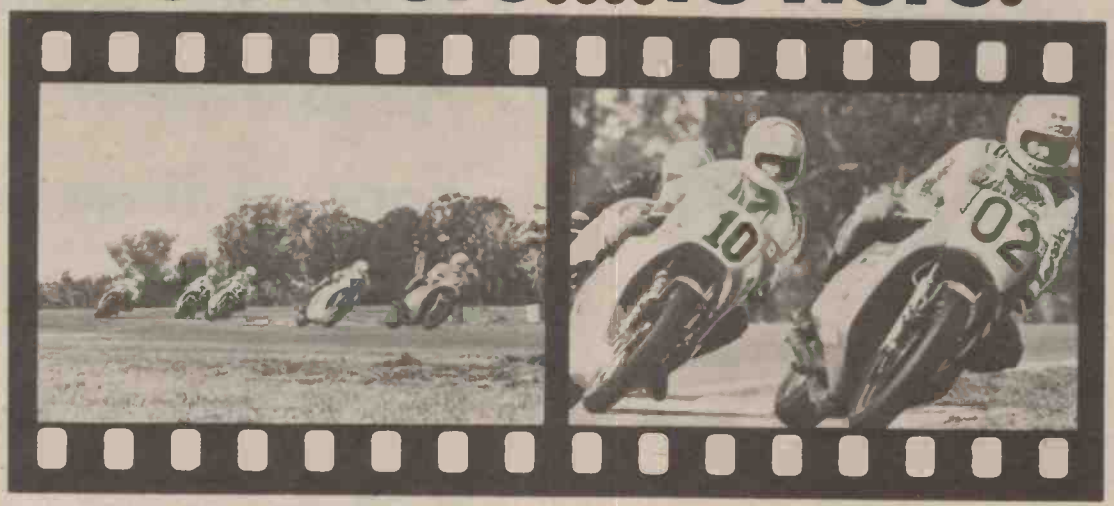


The 'quizmaster's' unit. The three wires connected to the tag-strip go to all the remote 'contestants" units. The other two wires go to the battery.



The 'contestant's' unit. Three wires go each of the two adjacent units in the chain. Note we built our prototype onto the front panel of a small plastic box.

In just a twist of the wrist, one Tamron lens zooms from here....to here.



(Tamron 70-350 zoom)

The incredible range of Tamron zoom lenses covers almost every conceiveable focal length between 38mm and 500mm. In seven incredible zoom lenses. They have precision optics, and Teflon-coated zooming mechanisms for longer life and smoother action.

FROM HERE

TO HERE

TO HERE

FROM HERE

TO HERE

(Tamron 200-500 zoom)

There's a Tamron zoom lens for every application. A wide angle to telephoto with close-focusing capacity; a compact medium telephoto zoom; a compact longer telephoto zoom; two fast medium-weight telephoto zooms; and extreme telephoto zoom; and the incredible Tamron 70-350 zoom with an unbelievable five times magnification! Just imagine that at a sporting event.

tamron

from here to infinity

(Tamron 38-100 zoom with close-focusing)

As well as zooms, there's a superb range of Tamron fixed focal length lenses. A 28mm wide angle, 105mm portrait lens, and 135mm, 200mm and 300mm telephotos. All of them would do justice to any camera system.

All Tamron lenses have Adaptall mounts, which means the same lens can be used on almost all 35mm cameras.

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WV.164.A.

STEREO AMPLIFIER

* 50W/channel
* CMOS switching
* rumble filter
* scratch filter
* modular

This amplifier is a redesign of our successful International 422 project incorporating modular construction, filters, and ultra-modern CMOS switching.

UNLESS THERE IS A GOOD REASON, we don't like to redesign an existing project just for the sake of it. The ETI 422 amplifier, which we designed back in May '74, has been very popular, but we would be the first to admit that construction is not easy (especially in the wiring of the heatsinks).

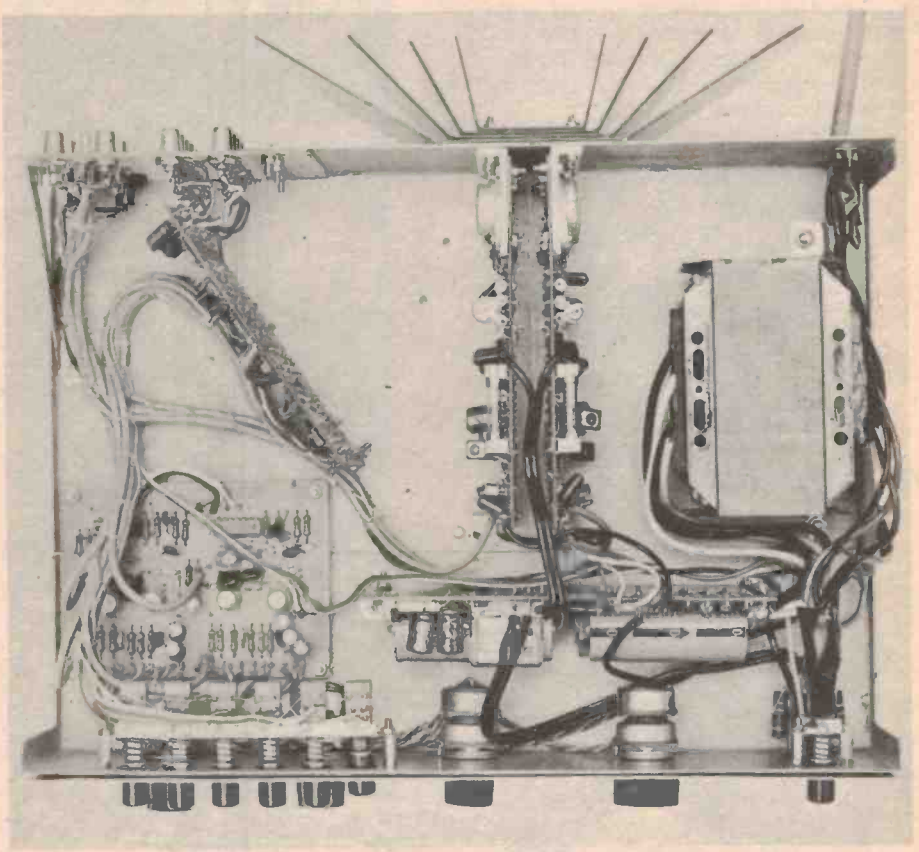
Last month we pre-empted this project by describing the ETI 480 50 W and 100 W power modules — in which the construction and wiring is very easy. The modules were based on the original 422 power amplifier design.

To use these modules in the 422 would mean at least new metalwork and a new internal layout. We therefore decided to go a little further and add a rumble and scratch filter and something new in audio amplifiers, at least in magazine projects, in solid-state switching of the audio inputs and filters. This simplifies wiring even more as the only wires connected to the selector switch are control wires — not shielded cable as before.

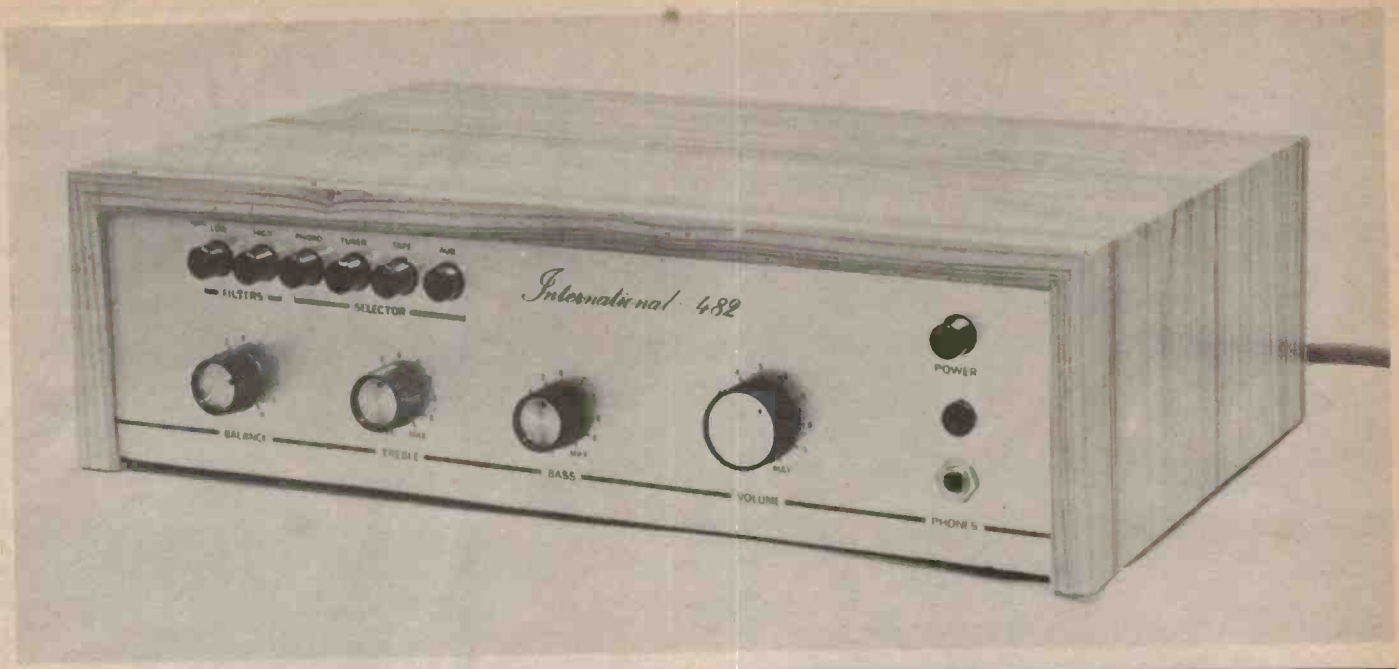
Construction

The details of the power amplifier and power supply boards were described last month so refer to that issue for construction details.

The preamplifier is built on two boards, one being the 'mag' preamp and selector board; the other being the tone control and filter board. These can be assembled with the aid of the appropriate overlay drawing. Note that the mag preamp board has tracks on both sides and must be soldered on both sides where applicable. If you use a small soldering iron and fine solder, this should not prove any problem. Use pc board pins for all external wires as this



Internal view showing preamp board pivoted forward to allow access to the rear



SPECIFICATION ETI 482

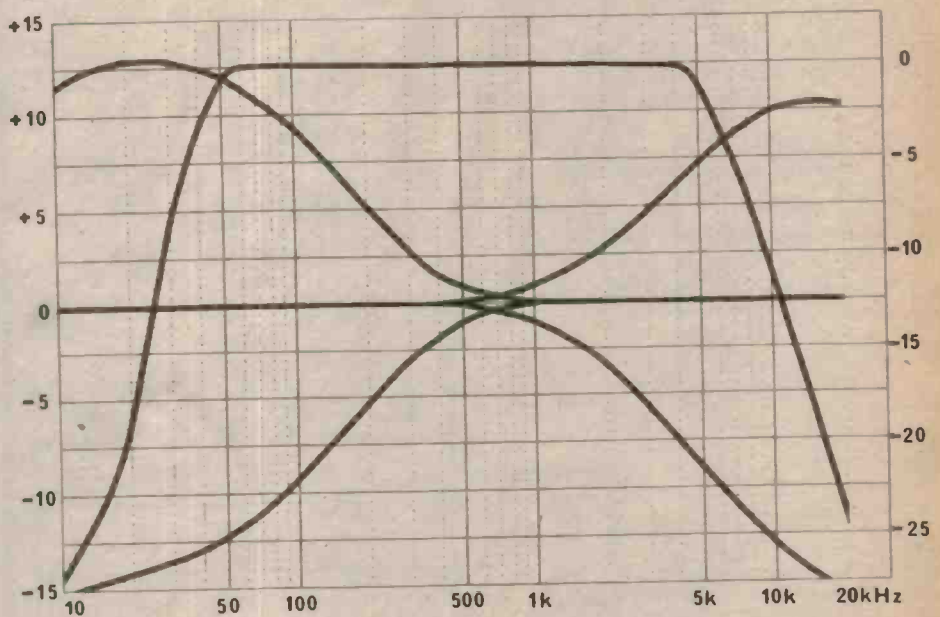
Output power	**50 watts into 8 ohms**
Frequency response 20Hz–20kHz	**± 0.5 dB**
Signal to noise ratio with 50 W output	
Tape, tuner and aux inputs	–79 dB
Disc input (re 10mV)	–63 dB
Input sensitivity	
Tuner and aux inputs	180 mV into 100k
Tape input	180 mV into 47k
Disc input	2.5 mV into 47k
Main amp input	500 mV into 10k

Total harmanic distortion at 1 kHz	
50 watts out	0.3%
10 watts out	0.08%
1 watt out	0.08%
Tone controls	**see graph**
Filters	**see graph**
Damping factor	**25**
Channel separation	**45 dB**

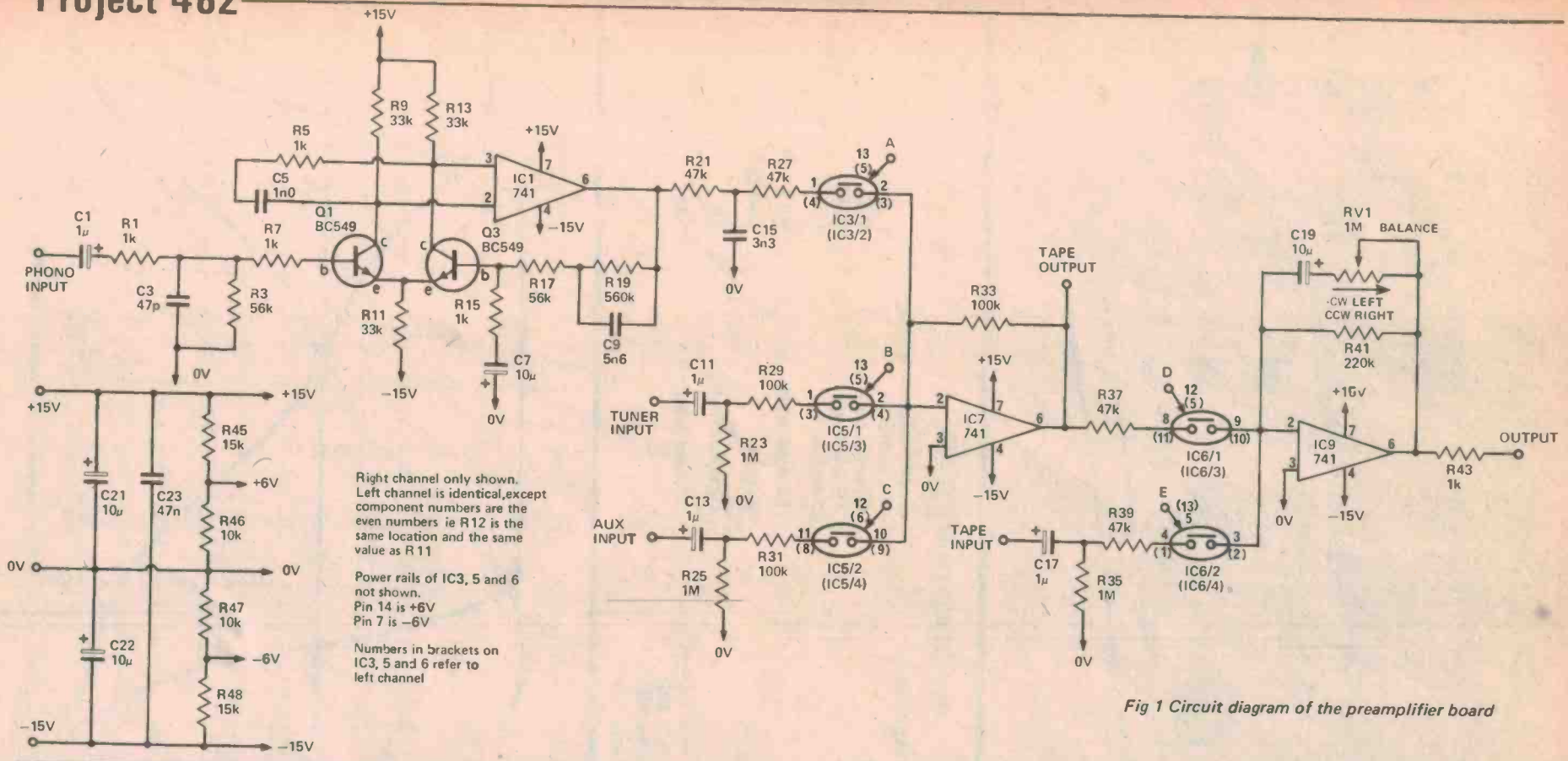
makes wiring much easier later.

Commence assembly of the chassis with the 12mm spacers for the selector switches and the power switch. Although the switches should not be fitted yet, the countersunk screws used to mount them are covered by the front panel and these will not be accessible later. The potentiometer and tone control board can now be installed and interconnected. The small rear panel can be assembled and fixed to the chassis.

Add wires about 40 mm long to each of the 10 inputs to the mag preamp board (it is neater if these are soldered to the rear of the board) and connect them to the appropriate RCA sockets. Also add an earth link from this board to a lug under one of the phono input sockets. Connection of all the commons of the RCA inputs is done on the panel itself (if you follow our construction method). The mag preamp board can now be installed.



Graph showing frequency response of tone controls and filters



Right channel only shown. Left channel is identical, except component numbers are the even numbers ie R12 is the same location and the same value as R11

Power rails of IC3, 5 and 6 not shown. Pin 14 is +6V Pin 7 is −6V

Numbers in brackets on IC3, 5 and 6 refer to left channel

Fig 1 Circuit diagram of the preamplifier board

How it Works – ETI 482

The output from a magnetic pickup has to be amplified and equalised before it can be used. This is achieved using Q1, 3 and IC1 to provide a gain of about 40 dB at 1 kHz and using C9 and C15 to provide the equalisation required to meet the RIAA curve. The transistors are used to reduce the noise of the 741 amplifier to acceptable levels.

Selection of the inputs is done by IC3, 5 and 6, which are CMOS analogue switches. If the control input to these devices is high (+6V) the switch appears as a 300 ohm resistor and if it is low (-6V), it appears as an open circuit. Therefore, IC3/1, IC5/1 and IC5/2 can select phono, tuner or aux inputs and IC7 buffers the one selected.

The output of IC7 is used as tape output for recording purposes. The tape input is fed with a second buffer, IC9, and IC6/1 disconnects IC7 when this is to allow monitoring (when recording) and this is selected by depressing both the tape button and the input required. Thegain of the second buffer, IC9, is variable by means of RV1, which is the balance control. The two channels are wired to the opposite way around on RV1, so that increasing gain on one channel decreases the gain on the other.

The filters used are two-pole active typea and CMOS switches are used to enable or inhibit the circuits. C27 and C29 determining the low filter cutoff frequency and the valus can be varied to suit your requirements. The values given give a cutoff at about 50 Hz and increasing the capacitance decreases the cutoff frequency, and vice versa. In the high cut filter C31 and C33 determining the frequency and these values can also be varied if required. The approximate ratio between these capacitons should be maintained.

The tone controls are conventional and we used the same values as in the 440 amplifier (they have a better range than those in the original 422). To reduce the effective noise level, the volume control is wired between the filter section and the tone control stage. This does mean, however, that the input levels are more critical than they would be if the control was further back in the circuit. Input levels should be kept below about 2 volts.

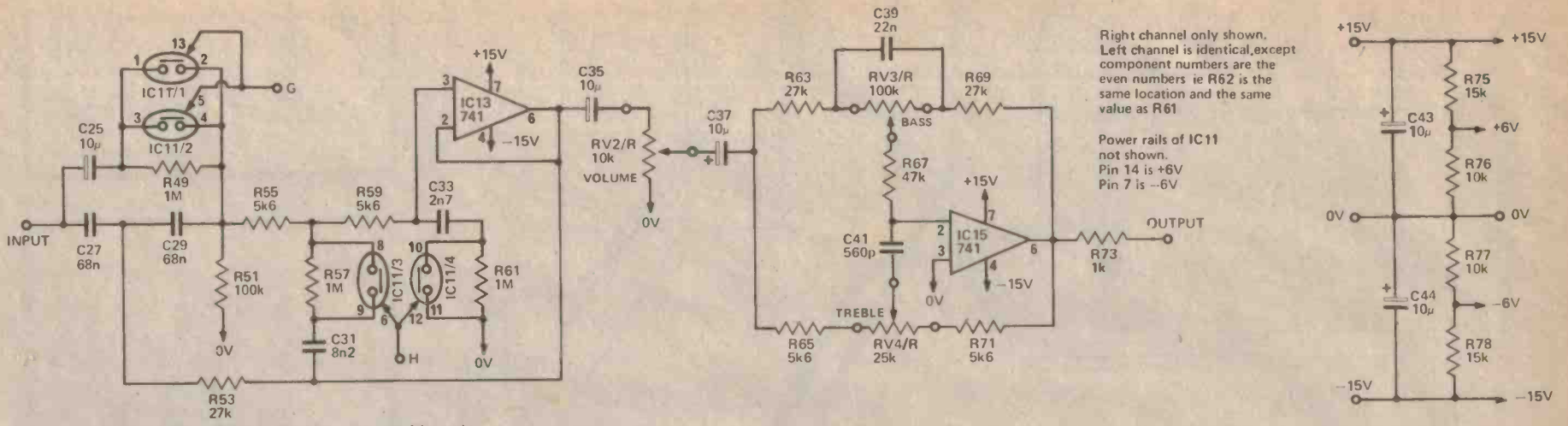


Fig 2 Circuit diagram of the filter and tone control board

Construction continued.

Before fitting the amplifier modules they should have the bias current adjusted. While this can be set later, if anything is wrong it is easier to fix before installation. Provided no load is connected, no heatsink is required at this stage. The module can now be fitted, along with the heatsink on the rear of the chassis. The chassis goes between the modules and the heatsink, but the heat loss is not great. While the heatsink described is not the only one which could be used, it must be about this size and it must be able to be clamped against the rear panel to ensure adequate cooling.

The power supply board and the selector switches can now be added and the complete amplifier wired with the aid of the diagram in Figure 4. We left the transformer out until this stage to keep the weight down. It can now be added and the wiring completed.

Mechanical drawings and PCB artwork will be published next month.

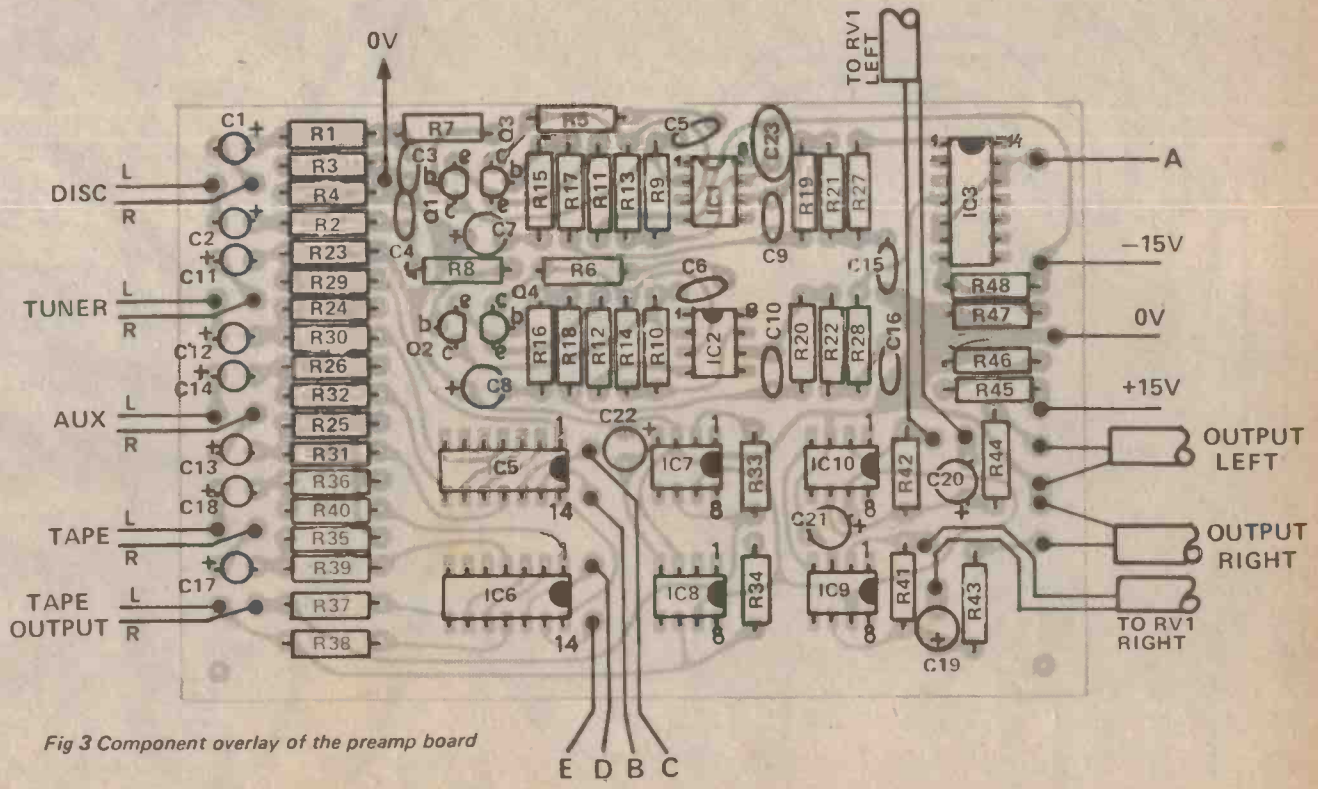


Fig 3 Component overlay of the preamp board

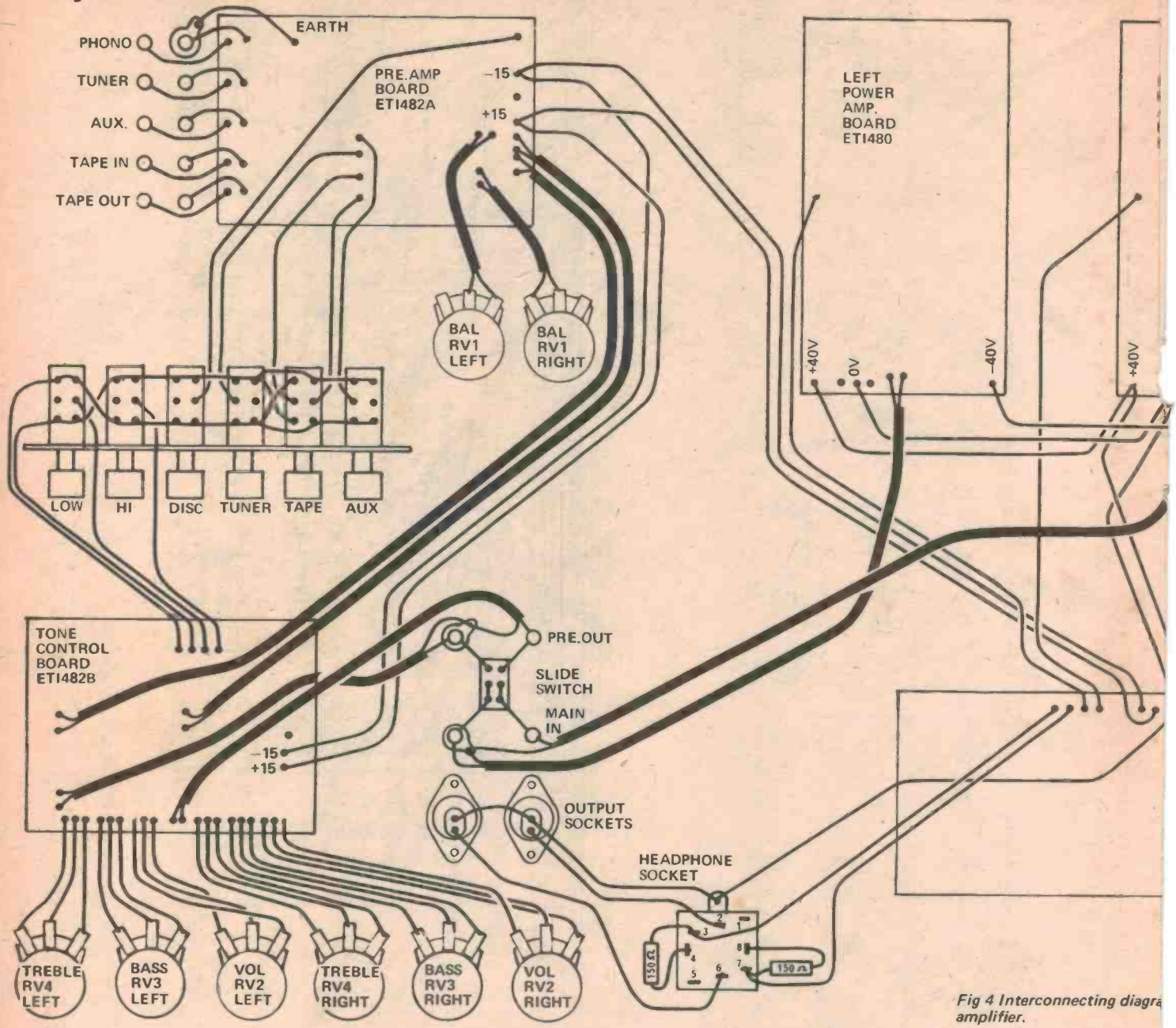


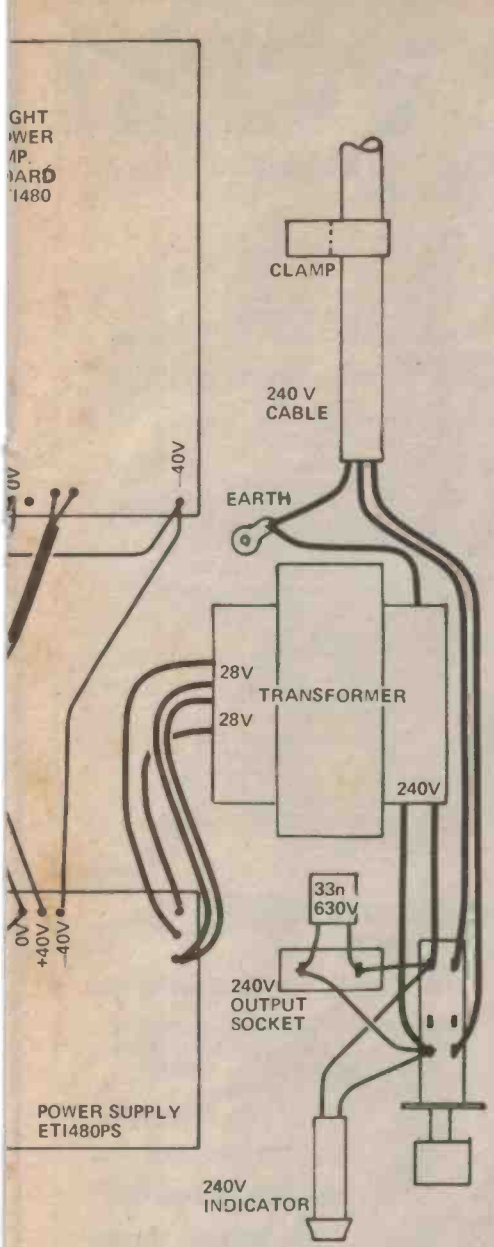
Fig 4 Interconnecting diagra amplifier.

PARTS LIST ETI 482A

Resistors all ½ W 5%		R37-R40	100 k	Potentiometer	
R1,2	1 k	R41,42	220 k	RV1	1 Meg Dual lin rotary
R3,4	56 k	R43,44	1 k	Capacitors	
R5-R8	1 k	R45	15 k	C1,2	1 µ 35 V Tantalum
R9-R14	33 k	R46,47	10 k	C3,4	47 p ceramic
R15,16	1 k	R48	15 k	C5,6	1n0 polyester
R17,18	56 k			C7,8	10 µ 16 V electro
R19,20	560 k	Semiconductors		C9,10	5n6 polyester
R21,22	47 k	Q1,Q2	Transistor BC549		
R23-R26	1 M	IC1, 2	Integrated Circuit 741	C11-C14	1 µ 35 V electro
R27,28	47 k	*IC3,5,6	Integrated Circuit 4016	C15,16	3n3 polyester
		IC7-IC10	Intergrated Circuit 741	C17,18	1 µ 35 V electro
R29-R34	100 k	*The number IC4 is not used		C19-C22	10 µ 16 V electro
R35,36	1 M	PC Board	ETI 482A	C23	47 n polyester

PARTS L

2	50 W ETI 480 Amplifi
1	ETI 480 P Power supp
	chassis
	cover
	Front panel
	Heatsink
	Rear panel
5	brackets
4	knobs
1	Isostat Selector switch
1	Isostat Power switch
1	2 pin power socket
1	33 nF 630 V capacitor



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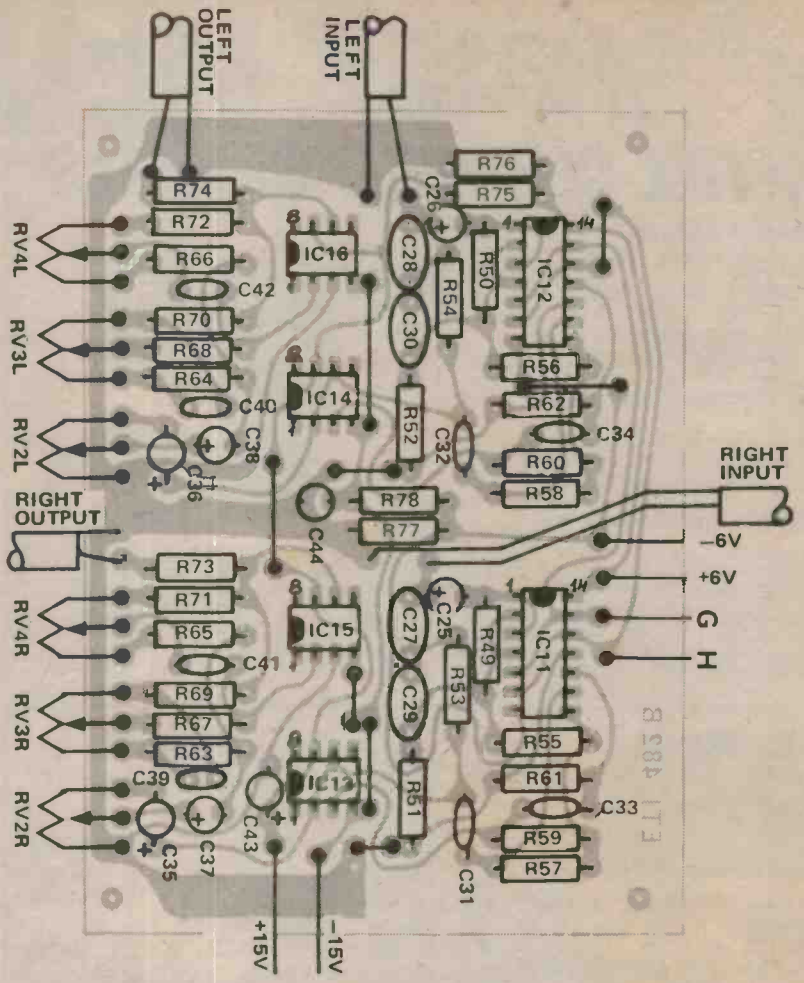

Fig 5 Component overlay of the filter and tone control board

PARTS LIST ETI 482B

Resistors all ½ W 5%	
R49,50	1 M
R51,52	100 k
R53,54	27 k
R55,56	5k6
R57,58	1 M
R59,60	5k6
R61,62	1 M
R63,64	27 k
R65,66	5k6
R67,68	47 k
R69,70	27 k
R71,72	5k6
R73,74	1 k
R75	15 k
R76,77	10 k
R78	15 k
PC board	ETI 482 B

Potentiometers	
RV2	10 k log dual rotary
RV3	100 k lin dual rotary
RV4	25 k lin dual rotary
Capacitors	
C25,26	10 µ 16 V electro
C27-C30	68 n polyester
C31,32	8n2 polyester
C33,34	2n7 polyester
C35-C38	10 µ 16 V electro
C39,40	22 n polyester
C41,42	560 p ceramic
C43,44	10 µ 16 V electro
Integrated Circuits	
IC11,12	4016 or 4066
IC13-IC16	741

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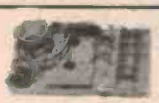

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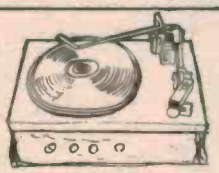

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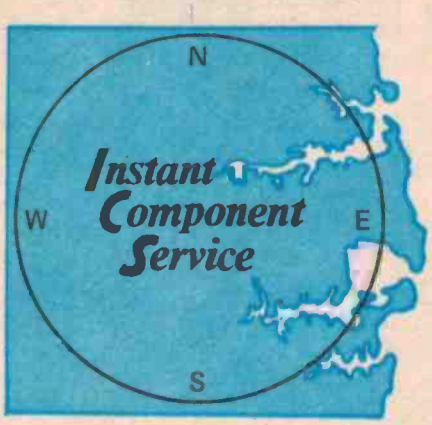

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TV SYNC GENERATOR

COMPUTER TERMINAL PROJECTS

This simple sync generator produces both line and frame pulses which are derived from a master clock. Intended for use with the VDU project it is also suitable for TV games and similar applications.

WITH THE CURRENT BOOM IN TV games and the general interest in video projects, there is a need for a general-purpose video board project which will provide, amongst other things, the line and frame sync pulses.

The ETI 633 generates these pulses along with 6 MHz, 3 MHz, 1 MHz and 500 kHz signals. Testing and alignment are easy – there is only one simple adjustment and an inbuilt bar generator, so you need only a screwdriver and a TV set.

Although designed initially for the VDU project we have given this unit a separate project number as it will be used in other projects in the future.

Design

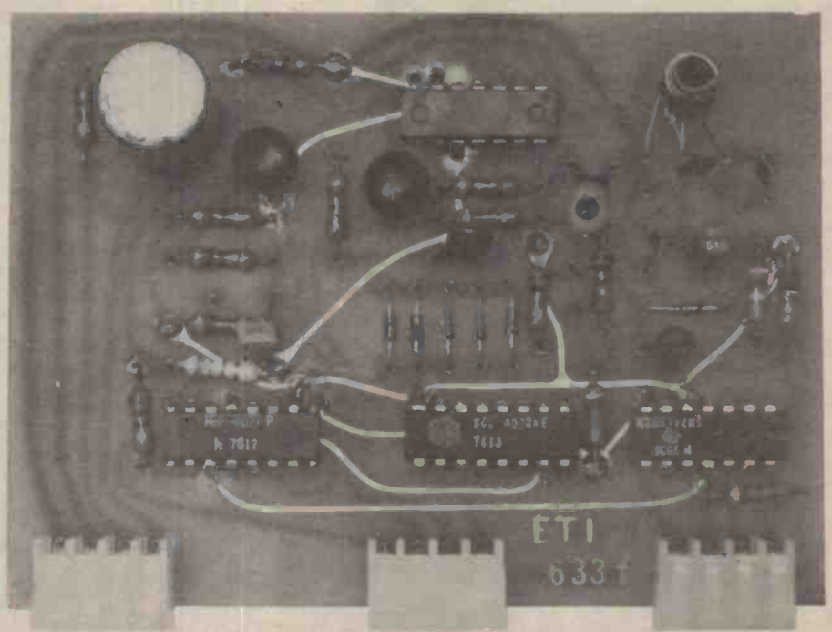
With the video display unit of the ETI terminal a frequency of about 6 MHz is needed to generate the dots for each character (32 characters are required along each line).

It was originally intended to use three separate oscillators, one at 6 MHz, one at 15625 Hz (line frequency) and the third at 50 Hz (frame frequency), and to lock them together in synchronism. This is how it was done in our crosshatch generator project and it is a simple and economical method. However with this method adjustment is difficult if a frequency meter is not available.

Text continues on p68.

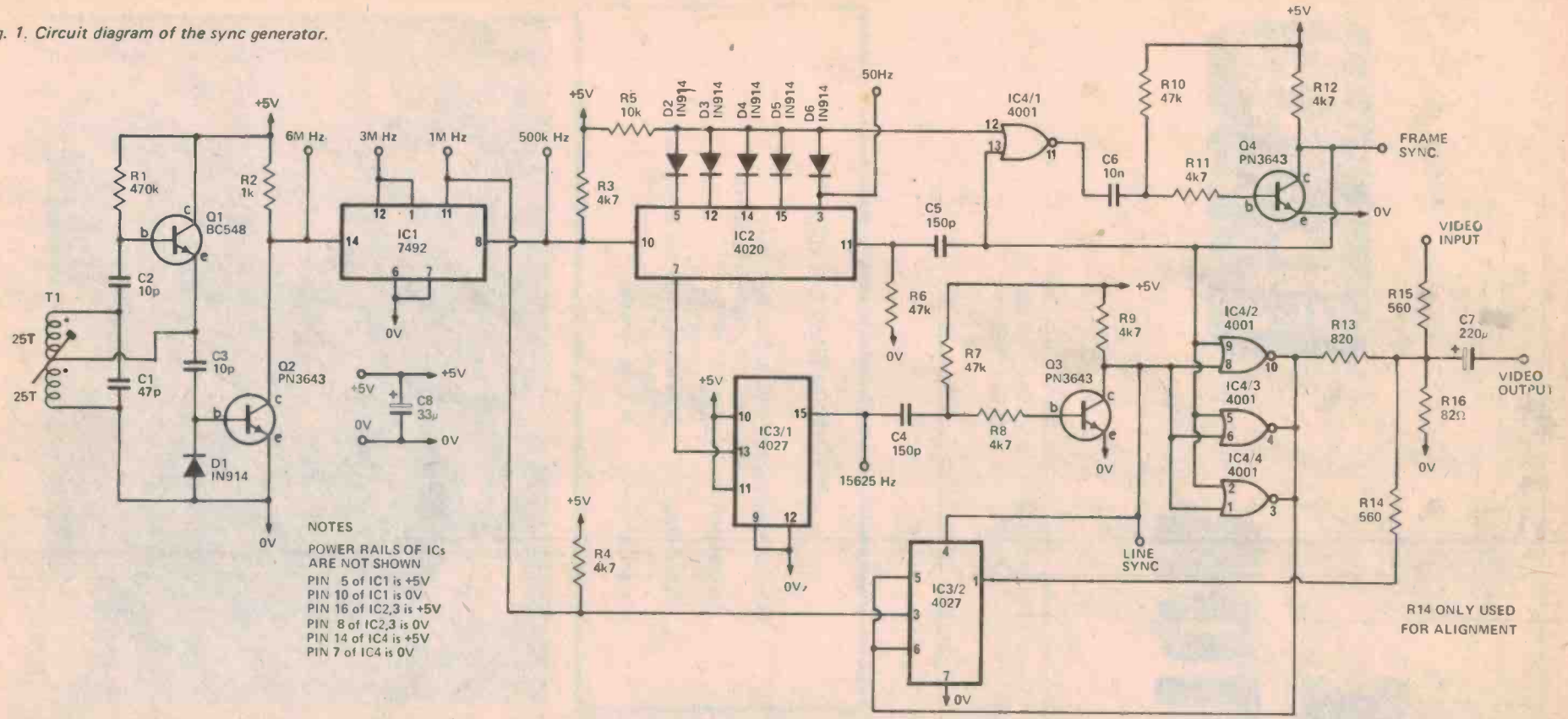
SPECIFICATION ETI 633

Output frequencies	**6 MHz, 3 MHz, 1 MHz 500 kHz, 15625 Hz, 50 Hz**
Output pulses	**5 μs at 15625 Hz 300 μs at 50 Hz**
Main Output	**Video line and frame sync pulses, 400 mV, 75 Ω**
Power Supply	**5 V dc, 40 mA.**



TV SYNC GENERATOR

Fig. 1. Circuit diagram of the sync generator.



How It Works — ETI 633

The oscillator is based on an LC tuned circuit which, with Q1, oscillates at 6 MHz. The frequency is adjustable by means of a slug in the coil.

The output of Q1 is coupled to Q2 which simply acts as a buffer, the output of which is a square-wave compatible with the TTL logic it drives.

The 7492 counter divides the 6 MHz to give outputs of 3 MHz, 1 MHz and 500 kHz.

IC2 then divides by 10,000 giving the 50 Hz output. This IC is a 14-stage ripple counter and outputs from stages 5,9,10,11 and 14 are gated, via diodes, into IC4/1. When all of these outputs go high a monostable, Q4, is triggered and the counter (IC2) is reset by C5 and R6.

The first time all these outputs go high is 10,000 or in binary notation 10011100010000. The output from the fourth stage is 31250 Hz, while the next stage is not exactly 15625 as it is reset by the reset pulse.

IC3 is a dual J-K flip-flop and we use half as a toggle flip-flop to give the 15625 Hz output.

This output triggers a monostable of 5µs which, with the 300µs pulse, is gated by IC4/2, 3,4 (which are paralleled to reduce the output impedance).

The output is then divided down to give a 400 mV signal of about 75 ohms impedance.

The second half of IC3 is used to divide the 1 MHz output and the resulting 500 kHz is added to the video sync output to generate vertical bars for alignment.

Counting is inhibited during the sync pulses and also is reset every line sync pulse.

With such a simple frame sync waveform (which lacks line sync pulses during the frame pulse) the line oscillator can drift and some tearing may occur at the top of the screen until it relocks. We reduced the sync pulse from 1.1 ms, which it normally is, to about 300µs which is adequate for lock but keeps the tearing (normally) above the top of the screen.

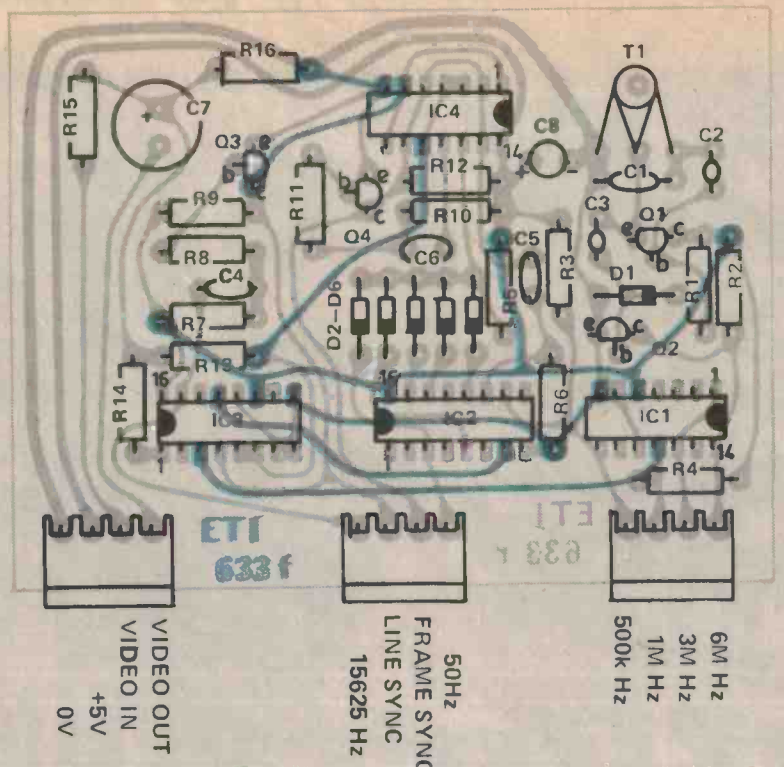


Fig. 2. Component overlay.

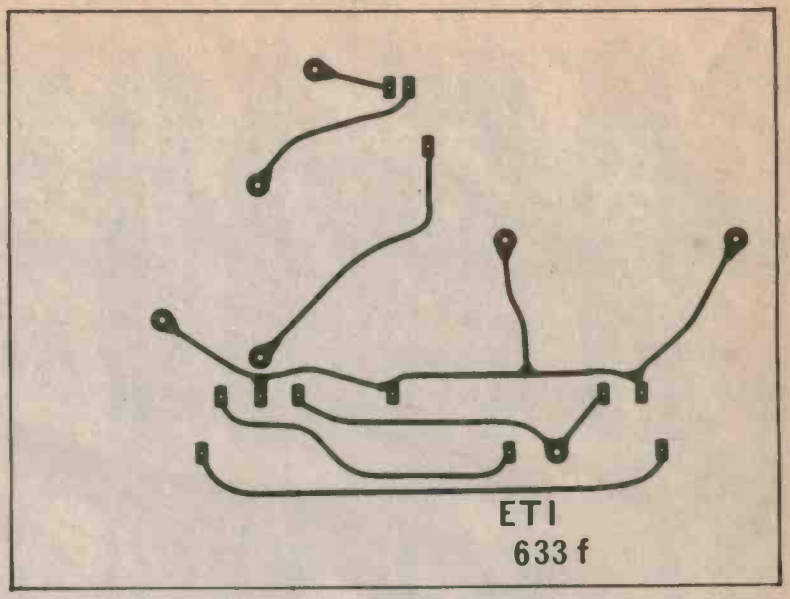
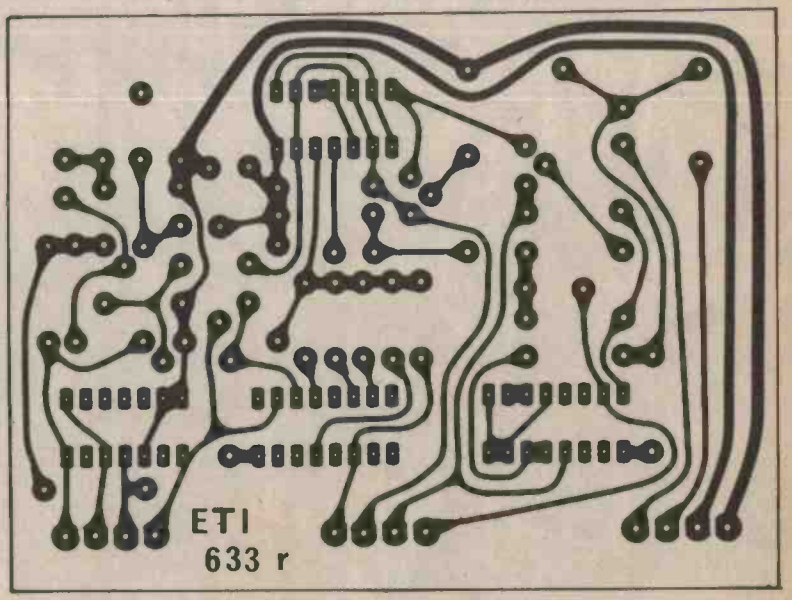


Fig. 3. Printed circuit layout (both sides). Full size 102 x 76 mm.



PARTS LIST ETI 633

Resistors all ½ W 5%

R1	470 k
R2	1 k
R3,4	4k7
R5	10 k
R6,7	47 k
R8,9	4k7
R10	47 k
R11,12	4k7
R13	820
R14,15	560
R16	82

Capacitors

C1	47 p ceramic
C2,3	10 p ceramic
C4,5	150 p ceramic
C6	10 n polester
C7	220 µ 10 v electro
C8	33 µ 10 v TAG

Semiconductors

D1–D6	1N914
Q1	BC548
Q2–Q4	PN3643
IC1	7492 or 74LS92
IC2	4020 CMOS
IC3	4027 CMOS
IC4	4001 CMOS

Miscellaneous

PC Board ETI 633
Coil Cormer Neosid 722/1B
Slug Neosid 4 x 0.05 x 6/f29
PTFE locking strip
1 metre 0.315 mm enamelled wire

We therefore decided to use a single 6 MHz oscillator and to generate the other outputs by frequency division.

To generate 15625 Hz a 384 division is needed and for 50 Hz the division is 120,000. However, 15625/50 is 312.5, not an even ratio, so a simple divider cannot be used.

We first divided the 6 MHz to 500 kHz using a TTL counter (7492), then we divided by 16 in a CMOS divider (4020) to give 31250 Hz. This frequency is an even multiple (625) of 50 Hz and the remaining part of the 4020 is used to divide down to this frequency.

The 31250 also has to be divided by two to give the 15625 Hz output.

To help with alignment, the 1 MHz output is divided (using a spare flip-flop) and mixed with the video sync output to give a vertical bar display. This is used only for calibration and is disconnected later.

Construction

We built the prototype on a double sided pc board and although the layout is not critical it is complex, so we recommend you use a board to make life easier. Commence assembly by inserting the coil former through the board from the copper side and epoxy it in place. When the epoxy dries it can be wound as follows:

Terminate the 0V end of the winding to the pc board and wind 25 turns in a single layer on the coil former and then bring the wire back along the length of the former to the centre hole (leading to the emitter of Q1).

Wrap a piece of Sellotape over the winding to give support for the second layer of 25 turns which starts from the centre hole, is wound in the same direction as the first winding and ends in the third hole (leading to C1 and C2).

The rest of the components can be assembled in any order making sure the ICs are orientated correctly, as removing them from a double-sided board can be difficult. IC sockets are not recommended with double-sided boards – the only ones which can be used are the wire-wrap type, standing about 6 mm off the board, and these are too expensive to be justified. Provided a small iron is used it is not likely the ICs will be damaged by soldering.

We used molex connectors as the unit is designed to plug into a motherboard in the VDU. However, it can be hard-wired if required.

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Part 6

CMOS-a practical guide

In this issue T Bailey completes his series on CMOS. Next month we hope to run an article on the latest IC technology, I^2L.

IN THIS FINAL ARTIGLE WE WILL take a brief trip back through several of the topics already covered, looking at some more sophisticated ICs in each group.

The first two devices in Fig. 1 share a common pin-out diagram. They are both dual counters (labelled "A" and "B") with reset operating when high. The 4518 operates in BCD and the 4520 works in binary. Both devices are capable of counting at at least 2.5 MHz when V_{DD} = 10 V. The clock and enable inputs are interchangeable in that a positive edge triggered counter may be realised by holding enable at "1" and using the clock input, or a negative edge triggered device may be obtained by holding the clock high and using the enable input.

The 4553 is altogether a more advanced I.C. It is a three stage decade counter with latches and it provides a multiplexed output. The counters advance on the trailing edge of the clock pulse providing that "disable" is low. It will also advance on the rising edge of a disable pulse if the clock is high. The outputs are multiplexed, which means that one digit is given at a time on the four BCD output lines. The three digit outputs show which digit is being presented (digit 1 is most significant). The BCD outputs are high when active, the digit-select outputs are low. The multiplexing is driven by an internal oscillator whose frequency is determined by the value of capacitor (1000 pF is about right) connected between pins 3 and 4. Alternatively, this can be overridden by leaving the capacitor out and driving the multiplexing by feeding pulses to pin 4. The carry out signal may be used to clock succeeding counters and in this case a capacitor may be used to control the multiplexing of the first counter and succeeding ones driven by connecting their pin 4 to pin 3 on the preceeding device. The reset input sets all the counters to zero and disables all the digit outputs hence blanking the display when it is taken high. The only other thing to note is the latch enable input. On the rising edge of the input to this pin the output from the counters is stored in latches and thus the conventional three decade counter ICs and three latch ICs are replaced by a single device. Use of this device is well illustrated by the ETI counter module and also by Fig. 2 which shows a six decade version.

The two seven segment decoders used in these two counters – the 4543 and the 4511 – have their pin-out given in Fig. 3. The 4511 is a straightforward device with Q1-Q4 BCD inputs and a-g segment outputs. The three additional connections are simply a lamp test which lights all segments when it is taken low, a blanking input which turns off all segments, when it is taken low (unless lamp test is low as well) and a latch which stores the current input when it is taken high. The segment outputs will source up to 25 mA.

The 4543 is more advanced, the latch operates when taken low and the blanking operates when high. The device operates conventionally when the phase input is low (i.e. is suitable for directly driving common cathode LEDs) but when phase is high, the outputs are all inverted which is useful for driving common anode LEDs. If this input is fed with a square wave which is also fed to the common connection of the segments, liquid crystal displays may be driven in the manner described in part

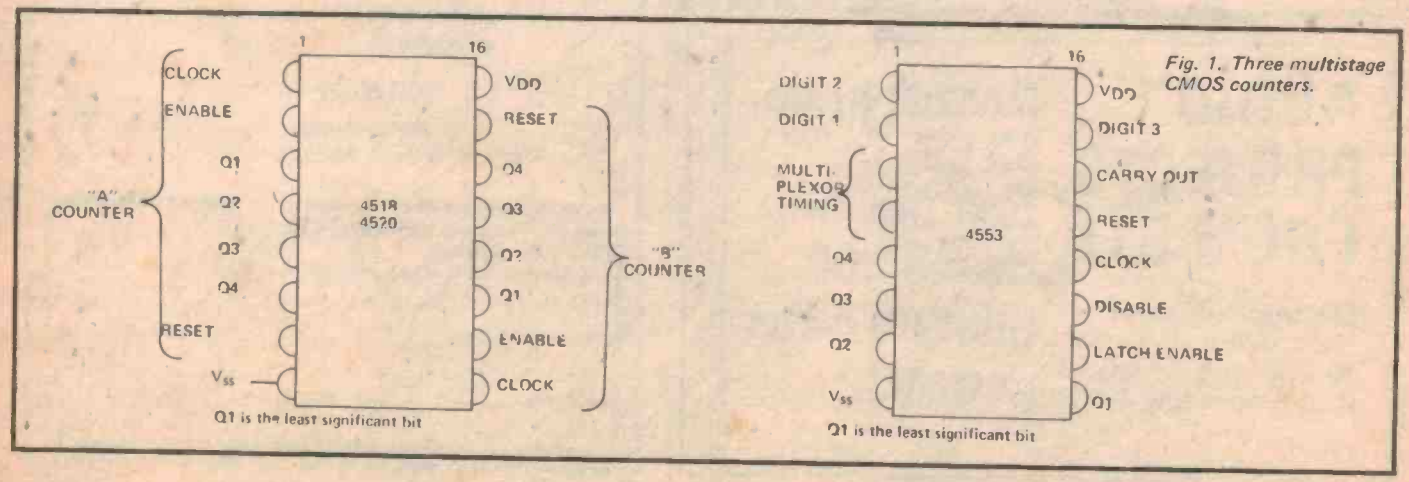

Fig. 1. Three multistage CMOS counters.

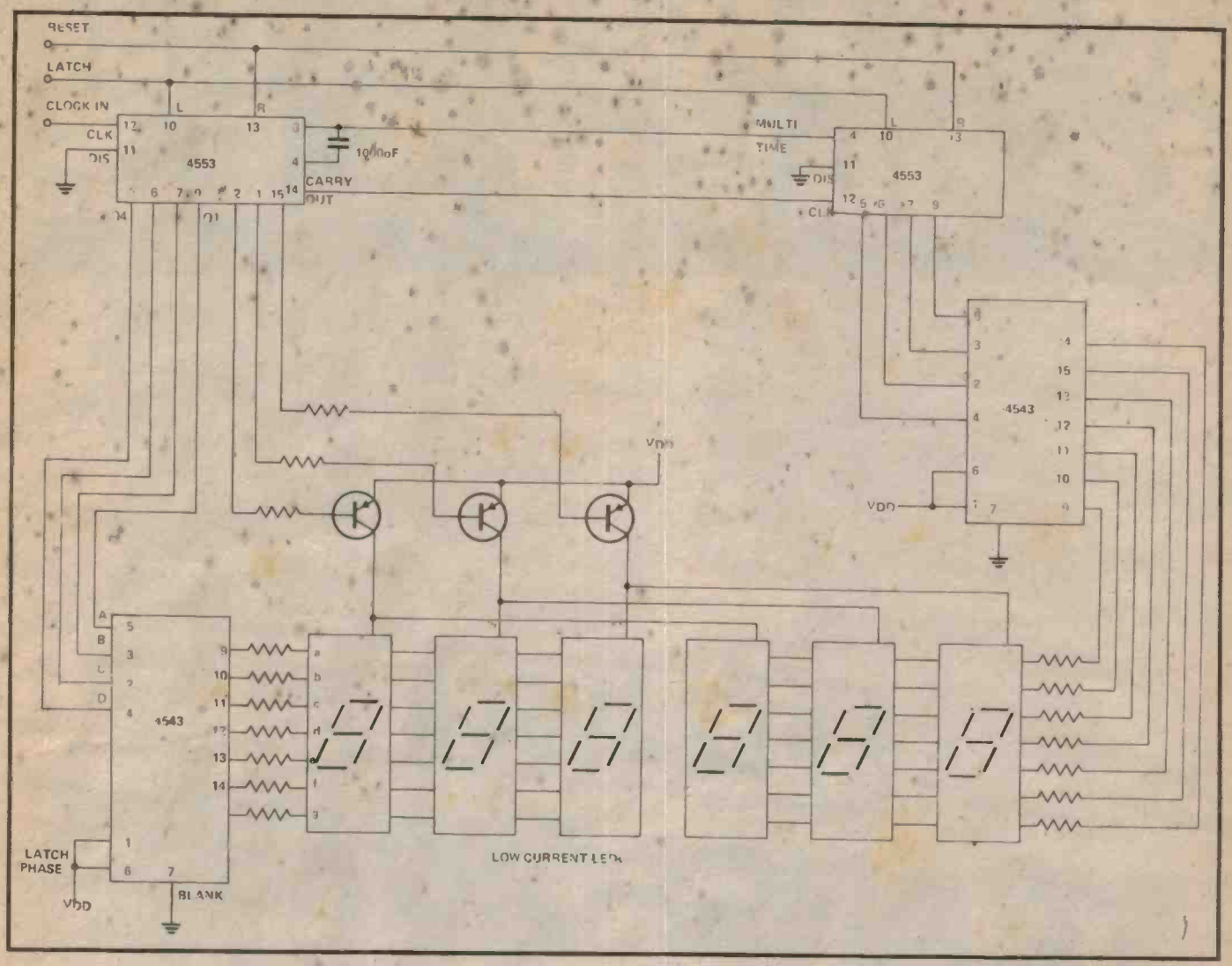

Fig. 2. A six decade counter using CMOS. It may be adapted for common cathode LEDs by changing the drivers and taking pin 6 on the 4543 s to V_{SS}.

one. The 4056A mentioned there is a pin for pin equivalent of this device except that the blanking is dispensed with and pin seven used as a second V_{ss} pin for the display output part of the circuitry. Thus pin 16 could be at 0 V, pin 8 at -3 V and pin 7 at -15 V giving maximum economy while still providing full drive at the output.

There is also a five decade counter of a similar type but there is not space to describe it here. Its type number is 4534 and it comes in a twenty-four pin DIL case.

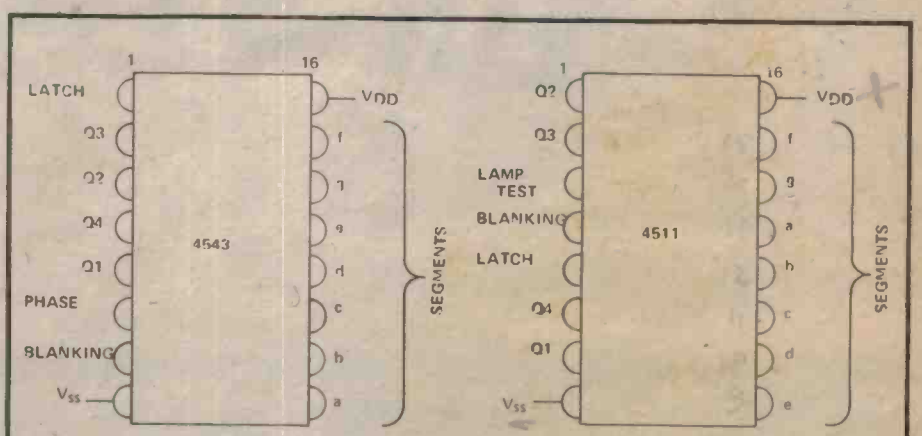

Fig. 3. Two BCD 7 segment decoders and drivers with latches. Q1 is the least significant bit.

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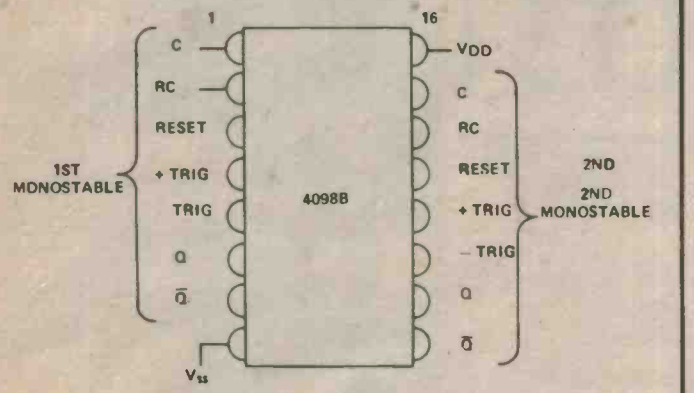

MODE OF OPERATION	CONNECT TO V_{DD}	CONNECT TO V_{SS}	INPUT PULSE TO	OTHER CONNECTIONS
+EDGE TRIG RETRIG	–TRIG RESET	–	+TRIG	–
+EDGE TRIG NON-RETRIG	RESET	–	+TRIG	–TRIG TO $\bar{Q}$
+EDGE TRIG RETRIG	RESET	+TRIG	–TRIG	–
–EDGE TRIG NON-RETRIG	RESET	–	–TRIG	+TRIG
UNUSED SECTION	–TRIG	RESET +TRIG	–	–

Fig. 4. The 4098B dual monostable multivibrator and method of achieving different modes of operation.

MONOSTABLE MULTIVIBRATOR

The 4098B is a dual monostable multivibrator. Its pin diagram (Fig. 4) is accompanied by a table showing the connections needed for every combination of edge triggering and retriggerability. The reset operates when low in this device whose period is, to a first approximation given by T = RC (ohms and farads), where C is connected between the RC and C pins and R is connected from RC to V_{DD}. The specification of the 4528 is similar except for minor details.

MORE GATES

We can now claim to have covered a fair cross-section of devices and so to conclude we shall say a little more on the subject which we started with, simple gates. As well as the NOR and NAND gates we mentioned at the time there is a range of AND and OR gates available at comparable prices. The 4071B, 4075B, 4072B are quad, triple and dual OR gates respectively with identical connections to the NOR gates (4001A, 4025A, 4002A) that were discussed in the first part of this series. Similarly, the 4081B 4085B, 4082B are the AND gates corresponding to the 4011A, 4023A, 4012A we mentioned then.

The 4030A quad exclusive-OR gate was also listed there and it is worth mentioning that types 4070B and 4077B are exclusive-OR and exclusive-NOR gates with identical pin connections. As the 4070B has slightly superior specification to the 4030A and is usually cheaper it may generally replace it. Also, for almost all purposes the 4507 is equivalent to the 4030A and 4070B.

The 4093B is a quad NAND Schmitt trigger with about 0.6 volts hysteresis (at V_{DD} = 5 V) and a pin-out identical to the 4001A. The 4583 is a dual Schmitt trigger in which the hysteresis may be adjusted by external resistors. There can be few uses for these which have not already been realised with the TTL SN7413N but it is worth noting that larger time constants could be used on the inputs.

Figure 5 shows a hex inverter and buffer with the extra options of an inhibit input which makes all the inverters have low outputs when it is taken high and an output disable which sets all the outputs in a high impedence state. This also operates when it is taken high. The chief use of these circuits is in applying one of two lines of data to an input. They are both wired in but only one disable is low at any one time. The disable overrides the inhibit.

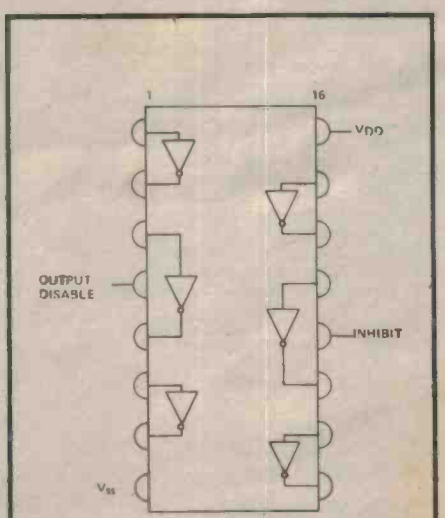

Fig. 5. Pinout of the 4502 strobed hex inverting buffer.

RANGES OF CMOS

Throughout this series, devices have been known by a four digit code number beginning 40 and ending with A or B, or beginning 45 and possessing no suffix. Most of the devices beginning 40 are available from RCA in the CD range with a type number CD40xxAE or CD40xxBE. The A signifies that the maximum supply voltage is 15 V, B signifies 18 V. In general, A and B versions are not both provided. Most of this range is also available from Motorola as the MC140xxCP range which will tolerate up to sixteen volts. The 45 devices are often available only in the MC145xxCP range. In general other combinations of suffices indicate a ceramic packages or the like. Generally these are more expensive and have slightly superior specifications.

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ETI 129 RF Signal Generator. . . . . L E
ETI 131 General Purpose power supply . E,N

ETI 206 Metronome . . . . . E
ETI 218 Monophonic Organ . . . . . E,D
ETI 219 Siren. . . . . E
ETI 220 Siren. . . . . E
ETI 222 Transistor Tester. . . . . E
ETI 232 Courtesy Light Extender . . . . . E
ETI 234 Simple Intercom . . . . . E
ETI 236 Code Practice Oscillator. . . . . E
ETI 239 Breakdown Beacon . . . . . E

ETI 301 Vari-Wiper . . . . . E
ETI 302 Tacho Dwell . . . . . E
ETI 303 Brake-light Warning . . . . . E
ETI 309 Battery Charger . . . . . E
ETI 312 CDI Electronic Ignition . . . . . E
ETI 313 Car Alarm. . . . . E,D

ETI 401 Audio Mixer FET Four Input . . . E
ETI 403 Guitar Sound Unit. . . . . E
ETI 406 One Transistor Receiver. . . . . E
ETI 407 Bass Amp . . . . . E
ETI 408 Spring Reverb. Unit . . . . . E
ETI 410 Super Stereo . . . . . E
ETI 412 Music Calibrator . . . . . E
ETI 413 100 Watt Guitar Amp . . . . L E J,D
ETI 413 x 2 200 Watt Bridge Amp. . . . . E
ETI 414 Master Mixer . . . . . E,J
ETI 414 Stage Mixer. . . . . E
ETI 416 25 Watt Amplifier . . . . . E
ETI 417 Amp Overload Indicator . . . . . E
ETI 419 Guitar Amp Pre-Amp . . . . . L E,D
ETI 420 Four-channel Amplifier. . . . . L E
ETI 420E SQ Decoder . . . . . E

ETI 422 International Stereo Amp. . . L E,D
ETI 422B Booster Amp . . . . . E
ETI 422 50 Watt Power Module . . . . . E
ETI 423 Add-On Decoder Amp . . . . . E
ETI 424 Spring Reverberation Unit . . . L E
ETI 425 Integrated Audio System . . . . . E
ETI 426 Rumble Filter . . . . . E
ETI 427 Graphic Equaliser . . . . . L E,J
ETI 430 Microphone Line Amp . . . . . E
ETI 433 Active Crossover. . . . . E,J
ETI 435 Crossover Amp. . . . . E,J
ETI 436 Dynamic Noise Filter . . . . . E
ETI 438 Audio Level Meter. . . . . L E
ETI 440 Simple 25 Watt Amp . . . . . L E
ETI 441 Audio Noise Generator . . . . . L E
ETI 443 Compressor-Expander. . . . . E,J
ETI 444 Five Watt Stereo . . . . . E,N
ETI 445 Preamp . . . . . E,N,D
ETI 446 Audio Limiter . . . . . E,N
ETI 447 Phaser . . . . . E,J

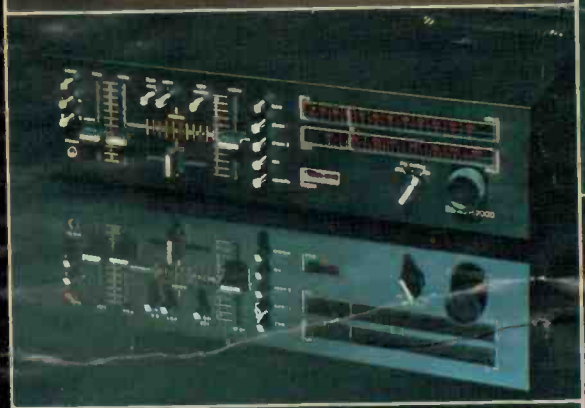
ETI 502 Emergency Flasher . . . . . E
ETI 503 Burglar Alarm . . . . . E
ETI 505 Strobe. . . . . L E,D
ETI 506 Infra-Red Alarm . . . . . E
ETI 509 50-Day Timer . . . . . E
ETI 512 Photographic Timer . . . . . E
ETI 513 Tape Slide/Synchroniser . . . . . E
ETI 514 Flash Unit — Sound Operated . . . E
ETI 515 Flash Unit — Light Operated . . . E
ETI 518 Light Beam Alarm . . . . . E
ETI 522 Photographic Timer . . . . . E
ETI 523 Sweep Generator. . . . . E
ETI 525 Drill Speed Controller. . . . . E
ETI 526 Printimer . . . . . E
ETI 527 Touch Control Light Dimmer . . . E
ETI 528 Home Burglar Alarm . . . . . E
ETI 529 Electronic Poker Machine E
ETI 533 Digital Display . . . . . L E,A
ETI 534 Calculator Stopwatch . . . . . A,D
ETI 539 Touch Switch . . . . . E
ETI 540 Universal Timer . . . . . E
ETI 541 Train Controller . . . . . E

ETI 601
4600 Synthesiser . . . . . J
3600 Synthesiser . . . . . J
ETI 602 Mini Organ . . . . . E,A,D

ETI 701 TV Masthead Amplifier. . . . . E,D
ETI 702 Radar Intruder Alarm . . . . . D
ETI 703 Antenna Matching Unit. . . . . E
ETI 704 Crosshatch/Dot Generator . L A,D,E
ETI 706 Marker Generator . . . . . E
ETI 707 Modern Solid State Converters. C,E
ETI 740 FM Tuner. . . . . A
ETI 708 Active Antenna . . . . . E
ETI 710 2 metre Booster . . . . . C,E
ETI 780 Novice Transmitter . . . . . E
ETI 804 Selecta-Game. . . . . A,D

Taste: *The power of discerning and appreciating beauty, order, congruity, proportion, symmetry, or whatever constitutes excellence.*

Webster



Sonab of Sweden

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When you dance around the room can you hear all the music?

Some very heady stuff is bandied about when it comes to discussing the pro's and cons of various speakers.

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Unless you stand practically right in front, the sound you get will never be all that clearly defined.

This of course brings us to our speakers. The Epicure Tens.

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While the concave air spring tweeter produces nearly hemispherical dispersion across most of the audible range.

The Epicure Tens also contain a rather unique low-mass woofer.

This gives a smoother, more accurate bass, enabling you to hear the individual bass instruments, and not just the bass.

In fact so proud are we of our speakers, we even go so far as to give them a ten year warranty.

And that's an awful lot of dancing around any room.

EPICURE

AUR21

PMI announces two new Op Amps that really work!

Op-02 High performance 741

If your design requires premium 741 performance the PMI OP-02 is for you. A high performance general purpose OP AMP that really fills the gap between standard 741's and precision 725's. The OP-02 fits all 741 sockets. It's even better than the PMI SSS 741! Input offset voltages are guaranteed better than the 725, but the speed of the 741 is retained. MIL STD 883 processing is available.
Prices run higher than standard 741's, of course, but well below standard 725's. For a little bit extra you get guaranteed better performance across the board, low noise, low drift, low TCVos, low TCIos, and insensitivity to output load conditions. Check the table opposite. Phone CEMA for complete specifications.

	Input Offset Voltage mV MAX		Input Offset Current nA MAX		Input Bias Current nA MAX	
	MIL	Comm.	MIL	Comm.	MIL	Comm.
Industry Standard 741	6.0	7.5	500	300	1500	800
PMI SSS741	3.0	7.5	10	50	100	200
PMI OP-02	1.0	3.0	5	10	50	100
Industry Standard 725	1.5	3.5	40	50	200	250
PMI SSS725	0.18	1.6	4	25	120	180

New 108 A

Do you want to know the real inside story of our new 108A/308A precision low power op amp? PMI were approached by a large user of 108A's to supply 108A's that met 108A specifications. PMI tried but couldn't. PMI found out why nobody else could either. It was simply designed wrong.
PMI have redesigned the 108A. Corrected the unbalance which caused the high TCV$_{os}$. Gave it the PMI zenner zap treatment. Plus ion implantation, and the kind of pricing high volume production parts deserve.
Check with CEMA for complete specification Up to MIL-M-38510/101B-04 specs. Processed to Mil-std-883A Level B Vos 0.5mV Max; TCV$_{os}$.5uV/°C Max.

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No. 1 rated!

Please note price reductions despite devaluation.

In US by "Consumer Report"

CORVUS

Thoroughly recommended in Australia by a major electronics publication. Electronic Concepts Pty. Ltd. is proud to introduce the exclusive Corvus 500.

With MOSTEK* single chip technology, the new Corvus 500 is the first non-Hewlett-Packard calculator with Reverse Polish Notation. 10 addressable memories, 4 level roll down stack to be introduced. If you compare the Corvus 500 feature by feature with the HP45, you will find striking similarities. There are also some important differences.

**MOSTEK* Is one of America's advanced LSI (Large Scale Integration) chip manufacturers.*

	Corvus 500	HP 45
RPN (Reverse Polish Notation)	Yes	Yes
Memory Store and Recall 10 Registers	Yes	Yes
4 Level Stack, Rotate Stack	Yes	Yes
10 MEMORY EXCHANGE WITH X	Yes	No
Log, LN	Yes	Yes
Trig (Sine, Cosine, Tangent, INV)	Yes	Yes
HYPERBOLIC (SINH, COSINH, TANH, INV)	Yes	No
HYPERBOLIC RECTANGULAR ↔	Yes	No
y^x, e^x, 10^x, $\sqrt{x}$, $1/x$, $x!$, $x \leftrightarrow y$. π, CHS	Yes	Yes
$\sqrt[y]{x}$ through INVERSE	Yes	No
GRADIANS	No	Yes
DEGREE-RADIAN CONVERSION	Yes	No
Degree Radian Mode Selection	Yes	Yes
DEC DEG MIN-SEC	No	Yes
Polar to Rectangular Conversion	Yes	Yes
Recall Last X	Yes	Yes
Scientific Notation, Fixed and Floating	Yes	Yes
Fixed Decimal Point Option (0-9)	Yes	Yes
DIGIT ACCURACY	12	10
DISPLAY OF DIGITS	12	10
%, Δ %	Yes	Yes
GROSS PROFIT MARGIN %	Yes	No
Mean and Standard Deviation	Yes	Yes
Σ +, Σ−	Yes	Yes
Product - Memories	Yes	Yes
C.F. DIRECT CONVERSION	Yes	No
F.C. DIRECT CONVERSION	Yes	No
LIT-GAL. DIRECT CONVERSION	Yes	No
KG-LB. DIRECT CONVERSION	Yes	No
GAL-LIT. DIRECT CONVERSION	Yes	No
LB-KG. DIRECT CONVERSION	Yes	No
CM-INCH DIRECT CONVERSION	Yes	No
INCH-CM DIRECT CONVERSION	Yes	No

As you can see, the Corvus 500 is a lot more calculator for $79.95

Price	**$95.00**
Mail charge	**$2.50**
Sales Tax exempt	**$72.50**

For sales tax exempt purchases, please supply number or certificate.

We have listed some of the many features, but let's amplify on some highlights:

1. RPN (Reverse Polish Notation) "COMPUTER LOGIC" and 4 LEVEL STACK.

Your problem is solved the way it is written, left to right sequence, eliminating restructuring, unnecessary keystrokes, and the handicap of having to write down intermediate solutions. And all information is at your disposal — just roll the stack (R) to any intermediate information desired. You arrive at your solution faster, more simply and, therefore, more accurately.

Perhaps at this point we should address ourselves to the controversy between algebraic entry and RPN. One question we must ask is why proponents of algebraic entry always use an example of sum of products and never an example of product of sums:

(2+3) × (4+5) =

Algebraic 2 + 3 = MS 5 + 4 = XMR =

TOTAL 12 keystrokes (SR51, add 2 more keystrokes)

RPN: 2 Enter 3 + 4 Enter 5 + x

TOTAL 9 keystrokes

2. THE CORVUS 500 and HP-45 HAVE 10 ADDRESSABLE MEMORY REGISTERS, 4 LEVEL OPERATIONAL STACK, and a "LAST X" REGISTER (10th Mem. Reg.). With 10 addressable memories, you have access to more entries, or intermediate solutions; less remembering, or writing down. YOU have to do. And less chance for error. The stack design also permits X and Y register exchange, and roll-down to any entry to the display for review or other operation. The "last x" register permits error correction or multiple operations when a function is performed, the last input argument of the calculation is automatically stored in the "last x" register, which can be quickly recalled to correct an error, or to perform another operation using the same number.

3. DIRECT HYPERBOLIC and HYPERBOLIC RECTANGULAR to POLAR, and INVERSE. For those of you electronic and computer science engineers who require access to this specialised application, the Corvus 500 solves "your" problems.

4. A WORD ABOUT CORVUS 500 12-DIGIT DISPLAY AND ACCURACY. Finally you have displayed 12 digit accuracy in business format and 10 + 2 in scientific notation. LED is manufactured by Hewlett Packard.

FOR THE FIRST TIME you can raise the number 10 to 199th power or calculate Factorial (x!) of up to 120. Unbelievable!

5. DIRECT FROM AND TO METRIC CONVERSION SAVES VALUABLE KEYSTROKES.

WHAT ABOUT CONSTRUCTION? With so many features, the next most obvious question must be in regard to the quality of the unit itself. We are proud to report the Corvus 500 to be double injected moulded, with "tactile" feedback keyboard. The compact, contoured case is 5½" long by 3" wide by 1¼" high and weighs just 8 oz.

The COMPLETE CORVUS 500 for **$79.95** includes:

- Rechargeable and replaceable Nickel Cadmium batteries. Optional 3AA batteries.
- Adaptor/Charger.
- Owner's Handbook.
- Soft carrying case.

The Corvus 500 is warranted by the manufacturer against defects in materials and workmanship for one year from date of delivery.

For those of you who have the HP-21 or 45 or any other advanced calculator on order, aren't you glad you still have the opportunity to take advantage for the release of the Corvus 500 for **$79.95** Hurry! Order yours today.

AN INVITATION:

Electronic Concepts is proud to offer this exciting Corvus 500 as well as other Mostek based calculators and digital watches as exclusive importer of Corvus Brand products for Australia.

You, our discerning reader will no doubt recognise the tremendous price/ performance value on offer. By mailing the order coupon today we can assure you of early delivery — and should you not be satisfied, you may return the unit to us with full money back guarantee within seven (7) days.

Or better, convince yourself of the real quality and value of our Corvus range, just visit our conveniently located showroom in Cambridge House, Clarence Street, just behind Wynyard exit (York Street), or phone 02-29-3755 for more information.

Other Corvus models on offer:

Corvus 600 Financial Genius $69.95

Corvus 615 Business Statistician $19.95

Corvus Digital Watches — but more about these in our next advertisement.

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Yes! I'd like to try the Corvus 500 for 7 days

CASH payment: Cheque or money order enclosed. $79.95 plus $2.50 postage.

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bankcard 1st time offered for your convenience BANK CARD mail order facility. Please complete

☐ Please charge my bankcard.

BANKCARD NO .....

EXPIRY DATE .....

SIGNATURE .....

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ESCRAFT

	Price
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6.SB 6ft. Balun Fly Lead	3.65
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4.75.T/S 4-way 75 ohm Transformer Splitter	8.94
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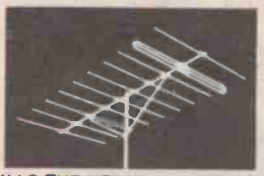
17el Colour Crossfire 3613A	61.98
21el Colour Crossfire 3612A	71.40
24el Colour Crossfire 3617A	90.77
28el Super Crossfire 3617A	125.73
Super Coloray the 3111 Ghost Killing Aerial	38.17
2el Small Coloray 3110	25.42

HILLS E.F.C. RANGE 75 ohm

E.F.C. 1 75 ohm	$28.58
E.F.C. 2 75 ohm	37.91
E.F.C. 3/24 75 ohm	55.13
E.F.C. 4/24 75 ohm	69.37



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All Australia V.H.F. Channels & F.M.

6el	TL1	$19.52
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9el	TL3	32.70
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HILLS AERIALS

2010 Airways	$51.15
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HILLS AMPLIFIERS

D5/26 Dist: 26dB gain	$67.10
D4/16 Dist: 16dB gain	$59.37
MH2/75 Mast Head 20dB gain 75 ohm	$72.44
MH1/300 Mast Head 20dB gain 300 ohm	$54.90

FM AERIALS

Hills	2EL FM1	$8.54
HILLS	3EL 353	12.71
Hills	3EL FM3	16.61
HI-Q	4EL	17.05
HI-Q	Gutter clip	11.55
Matchmaster	G2FM	17.54
Austenna	FM3F	19.96

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	Attenuation per 100ft at 200MHz	Reel Size	Price
Belden 9242 Double screened with	4.0 dB	500 ft	$42.28
Belden 9248 Duofoil and Braid Aluminium	3.1 dB	500 ft	58.61
TVM1A Concordia Copper Screened	4.4 dB	100 metre	30.15
Hartland WH89 Copper Braid	3.3 dB	100 metre	36.92
Hartland WH87 Copper Braid	6.0 dB	100 metre	26.65
Hartland WH86 Copper Braid	6.5 dB	100 metre	19.25
300 ohm Feeder Cable	1.8 dB	100 metre	8.80
Open wire line 300 ohm	1.5 dB	100 ft	9.90
Open wire line 300 ohm	1.5 dB	300 ft	29.80

LAB GEAR AMPLIFIERS

VHF

	Price
Mast head 22 dB 75 ohm	$72.43
CM 6014/DA 20 dB	60.25
CM 6034/DA 4 outlets 8 dB each	54.90
CM 6036/DA VHF 30dB UHF 28dB	84.63
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	Price
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THEY HAVE TO BE!

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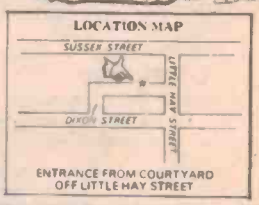

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ETI by jaycar PTY LTD.

445 General Purpose Preamp $6.50, P&P $1.00. • Stereo Preamp for Phono, Tape or Mic. Inputs.

446 Audio Limiter $9.00, P&P $1.00.

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433-2 2-Way Active Crossover $14.50, P&P $1.00. • Board & components only.

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3600 Synthesiser $585.00.

4600 Synthesiser $869.00.

All components for the above kits are available separately. All modules from the Synthesisers are available separately. Please send S.A.E. for price list.

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PRINT-OUT

ETI's COMPUTER SECTION

FROM THE EDITOR'S CONSOLE looks at 1976 and ponders what to expect for 1977..... Page 83

MICROBIOLOGY Les Bell completes his discussion begun last month on the internal workings of the 6800..... Page 84

CLUB REPORT There's a report on the first meeting of Sydney area computer club as well as news of clubs in Newcastle and New Zealand..... Page 85/90

HARDWARE APPLICATIONS has final details of the I/0 port for SC/MP users ..... Page 86

PRODUCT REVIEW looks at SCMPIO, an alternative terminal for the SC/MP evaluation kit....Page 91

NEWS A look at the local and overseas scene ..... Page 90

VIDEO TERMINAL The second project in the computer terminal trilogy..... Page 95

FROM THE EDITOR'S CONSOLE . . .

With this the first issue of 77 it is appropriate to extend to all the readers of Print-Out the best wishes for the next 365 days and to add the hope that 77 will be a better year. Now is also the traditional time to reflect on the happenings of the year gone by and to speculate about what will happen in the year to come. One thing that could be said about the semiconductor industry is that it is always breaking new frontiers and in 76 this was brought home to me on a number of occasions.

The first time was back in February when the first samples of the long awaited 16K RAMS became available and I visualised holding a 12 cm by 30 cm pc board in my hand that held 32K of memory just waiting to be plugged into my system and used. But unfortunately samples are just too expensive. Now with production begun, the 77 volume production price is expected to be about $12. Even with an inflated local price of say $18, a set of RAM for 32K would cost only $288, add $100 for a refresh controller, buffering and a pc board, and it should be possible to put together a 32K memory for around $388. Not bad, but who would want 32K or even 16K? Well it seems quite a few do.

The designers of the early microprocessors never conceived of LSI computers as anything more than a controller in a dedicated application. Well history has since proved them wrong and the experience of the last 18 months has demonstrated that a large proportion want to run programs written in the higher order languages (like APL, LISP and especially BASIC). But to get the full advantages of these your computer needs lots of memory, like 16 or 32K. Of course you could compromise and use a weak subset of the language (say like that version of BASIC called Tiny BASIC residing in 1.75K), but with memory so cheap why not go all the way and enjoy the benefits of a 12K version?

Another use for lots of memory is with a graphic display. Such a display lets you show pictures, lines and symbols on a TV screen and so adds another dimension to your system. For example, chess characters, video art, printed circuit layouts, charts, light pens and so on can all be displayed. One process to produce a 4K static device which outperforms some MOS types.

Another big event in 76 was the announcement that Texas has started the first commercial magnetic bubble-memory production line with a 92K device. Destined to be a solid state replacement for the presently used commercial design recently released offers a 40 character by 20 row alpha-numeric display, complete with a 100 by 160 dot display, all on one pc board for $288 in kit form.

Of course there were other firsts in 76, one has to be the release of the industry's first I^2L RAMs. I^2L is a new technology offering benefits common to both MOS and BIPOLAR and it is causing a major rethinking of the traditional role of these technologies. Fairchild have apparently used an isoplanar version, which they call I^3L, to produce the first bipolar dynamic memory, while Texas has used the mechanical disk, the bubble-memory should go a long way in providing fast mass storage for small systems.

On the local scene the most remembered happening was the big push of micros onto the Australian market and the very substantial plunge in price

that accompanied the push. One device priced in January at around $75 was finally purchased in November for just less than one third of its January price.

What caused the price drop? Firstly the increased competition between different microprocessor types as new devices became available in production quantities (in the States, not locally). The second reason occurred towards the end of 76 when manufacturers started second sourcing each others microprocessors. Here competition between manufacturers of the same type of microprocessor increased and forced prices even lower. With a bit M6799 — a dedicated chip containing memory and I/O, the M6802 — an of luck this competition should continue throughout 77 and I do expect most microprocessors to have a one off cost of less than $20 by the end of 77.

Of course this prediction does not include all the new microprocessors destined to appear during 77. Both Motorola and Intel have leaked news that they intend to release a broad line of new devices this year. For example, from the Motorola stable you can expect the following chips, the expandable single chip version of the 6800, the M6809 — a high performance version of the 6800, supposedly also planned is the M6900, a master control chip with 16 bit handling capacity.

From Intel you can expect the 8085 chip — a high performance 8080 promising five times greater throughout, also 8040 and 8748 chips each containing the CPU, ROM, RAM and I/O. One report also claims that the ROM in one of the Intel chips is UV-erasable. So all in all, 77 should be quite a year, one that we at ETI intend to make even more interesting for you through Print-Out.

microbiology

The internal operation of a microprocessor.

Les Bell completes his look at the Motorola 6800. part two

Pin Connections

Figure 2 shows the signals which let the MPU communicate with the other parts of the microcomputer system. The 8-Bit *Data Bus* is bi-directional, that is the MPU can either send data out on the bus or it can input data from other devices. The MPU will normally indicate to the other devices just what it is doing by putting the Read/Write (R/W) line low when it is writing and high when it is reading. The MPU will also put out on the Address Bus, the address of the memory location it is reading or writing to or from. However, some ambiguities could arise when the MPU is changing the address being output on the bus, and so another signal, *Valid Memory Address, (VMA)* is used which only goes high when the Address Bus has stabilised and read/write operations can take place.

The *Interrupt Request Signal (IRQ)* is used by peripheral equipment to signal to the MPU to stop whatever it is doing in order to perform a more urgent task. When the IRQ line goes *low*, the micro will complete the current instruction, store away the Current contents of the registers at a location given by the stack pointer, and then go to an interrupt service program. When it has finished executing this program, it will reload its registers and start again from where it left off. If the Interrupt Mask bit of the CCR is set, however, it will ignore an interrupt request, unless the *Non-Maskable Interrupt* line is pulled low, as this bypasses the 1 bit of the CCR and the MPU *has* to respond to this request.

The 6800 MPU can execute an instruction in a couple of microseconds, while a teleprinter can input a character every 100 milliseconds for example, so that it does not make sense for the micro to hang around spending most of its time waiting for a character to be input. Instead it can be executing a program until an interrupt stops it to input the character and store it, when it can return to the main program again until it is once more interrupted.

Data Bus Enable (DBE) and *Three-State Control (TSC)* are both inputs which cause the MPU to go into a high-impedance state and, effectively, disconnect itself from the busses so that other devices can use them without affecting the MPU. The *Halt* instruction also forces the MPU into its three-state mode. *Bus Available (BA)* will go high when this happens to indicate that the MPU has stopped and the address bus is available.

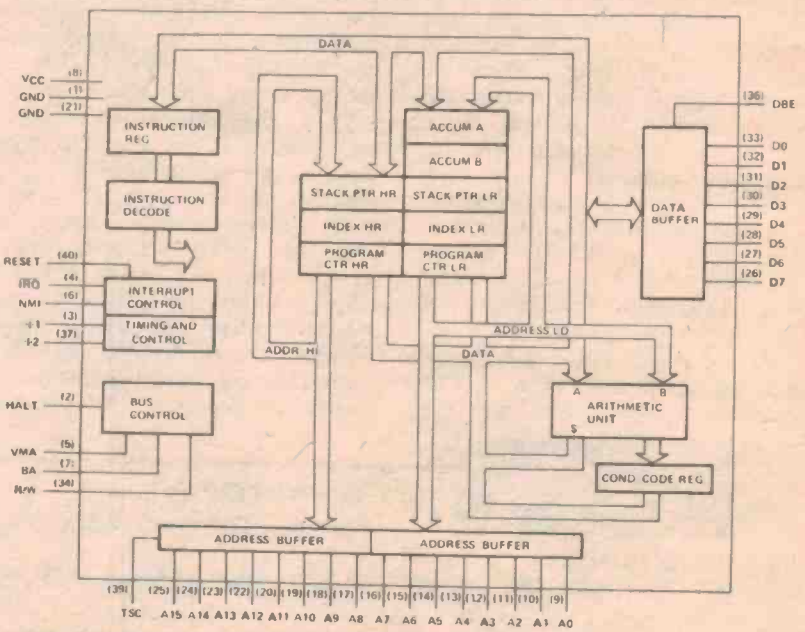


Fig. 2. Internal data flow of the 6800 with pin numbers shown in brackets.

Reset is used when the MPU is started up. A positive going edge on this input will cause the MPU to execute a special restart sequence which will initialize outputs and prevent the entire system from going randomly haywire.

ϕ 1 and ϕ 2 are the two phases of the system's clock, which can operate at up to 1 MHz, at which speed it can execute the shortest instruction in 2 μS. ϕ 1 and ϕ 2 are non-overlapping square wave complements and are the only inputs to the MPU that are not at standard TTL levels. All data transfers take place during the ϕ2 clock cycle, and so this signal can usually be used to drive DBE and also to enable memories and interfaces.

The Instruction Set

We have discussed how certain pins are used to control the MPU, but of course the essential basic concept of the microprocessor is that its operation is, for the most part dictated by patterns of 0's and 1's on the data bus. There are 107 such patterns, which are variations on a basic set of 72 instructions. For instance, the binary pattern 10001011 (or hex 8B) will cause the MPU to perform an addition in the following manner: If, while executing a program, the MPU increments the Program Counter to read out the next program step and then reads in the code 8B, which is already in ACCA, it will increment the PC so that it can read in the contents of the next location in memory and add that number to the contents of ACCA. Thus the complete instruction takes up 2 *bytes* (eight-bit words) of memory and takes 2 clock cycles to execute. Each clock cycle has two halves – during ϕ 1 the address bus is being changed, and the internal logic of the MPU is in operation while ϕ 2 is used to read/write data while everything is (hopefully) stable.

All of the instructions are executed in a basically similar manner. For instance, if the instruction in the example above had been BB, the MPU would have read in the instruction, which is a similar additional instruction, and would then have read in the contents of the next two bytes of memory. This would give it an address in memory which it would go to find the actual number which should be added to ACCA. We shall return to this principle of *addressing,* which is of key importance, later.

The operation 'add to ACCA' is given a shortened, mnemonic form to assist in the writing of programs. Similarly 'add to ACCB' is given the mnemonic ADDB, 'load accumulator A' becomes LDAA, 'increment' is INC and so on.

Addressing Modes

We've already looked briefly at two different types of ADD instruction, (i) *immediate* mode, where the value to be used follows the instruction in the body of the program, and (ii) the *extended* mode, where the two bytes following the instruction give an address where MPU can find the value to be used. In fact, there are 5 different addressing modes, or 6 if you include the case where no address or value is given, such as CLRA, which clears ACCA.

In the immediate mode, the byte following the instruction is the value which is to be added, subtracted, loaded etc. This is useful for handling constants in a program.

Direct addressing contains an 8-bit address in the byte following the instruction and hence can only address memory locations 0 through 255, so that this area can be conveniently used for scratch-pad storage. *Extended* addressing uses the two bytes following the instruction to give a 16-bit address so that the MPU can read data from any address.

Indexed addressing uses the index register in combination with the address following the instruction. If the processor encountered the instruction LDAA 05 in the indexed mode it would look in the address given by the value of the index register plus 05 and then load the contents of this location into ACCA. The indexed addressing mode is particularly useful for jumping about in a program since instructions such as LDX, INX, DEX provide ways of altering the index register value.

The *relative* mode is used only with branch instructions and enable the processor to branch ± 127 locations relative to the present value of the Program Counter. These instructions are particularly useful in setting up loops and iterative processes, as well as subroutines.

Detailed information on the instruction set and addressing modes is contained in the M6800 Systems Reference and Data Sheets, and is far too detailed to go into in any great depth here.

CLUB REPORT

ON Friday night, the 26th November, more than 20 people of all ages crowded into the function room at the Olympic Hotel Paddington, to discuss setting up a microcomputer club in Sydney. They were the enthusiasts who had written to the magazines saying they were interested in participating in the activities of a microcomputer club, and subsequently, had been invited by letter to attend that informal meeting.

Steve Braidwood, ETI's esteemed Editor, acted as temporary chairman and soon got the meeting into full swing by outlining some of the decisions he thought needed to be made that evening. I then attempted to enthuse everyone with reasons why there should be a computer club.

As it turned out, there was no need for my soapbox stand as enthusiasm was already very high. This was demonstrated when Steve asked everyone for their general comments and two and a half hours of hectic discussion followed.

So when 'Time gentlemen time' rang through the building several decisions had been made.

Firstly, everybody agreed that the interest was certainly high enough for a workable club and that a general meeting be called about the middle of January. The date of the meeting subject to finding a suitable place, and secondly, that a second informal meeting be held on the 13th of December to prepare for the January meeting.

A general call was then made for those who would be willing to offer their time to come along to the December meeting and help to get the club going.

A steering committee of four was appointed and charged to 1) locate a suitable hall for the January meeting; 2) to formulate a statement of aims of the club based on the views expressed in the letters so far received by the magazines, and to present it for general discussion at the January meeting.

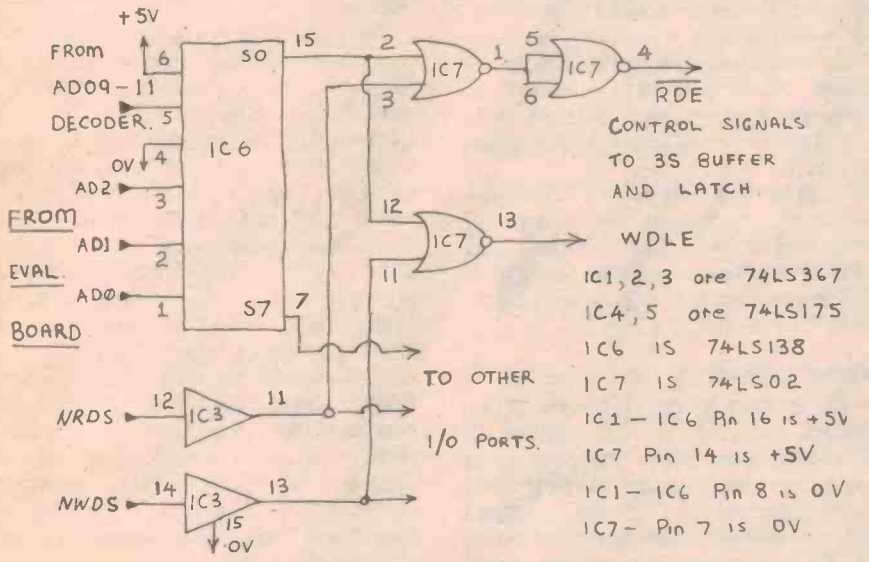
So as we go to press, I am happy to announce that a hall has been found, and the 1st general meeting of the Sydney area computer club will be held at 8 pm on Monday the 17th January, and thanks to the kind actions of the NSW Division of the Wireless Institute of Australia, the meeting will be held in the WIA Hall, 14 Atchison St., Crows Nest, NSW. Hope to see you there.

– K.B.

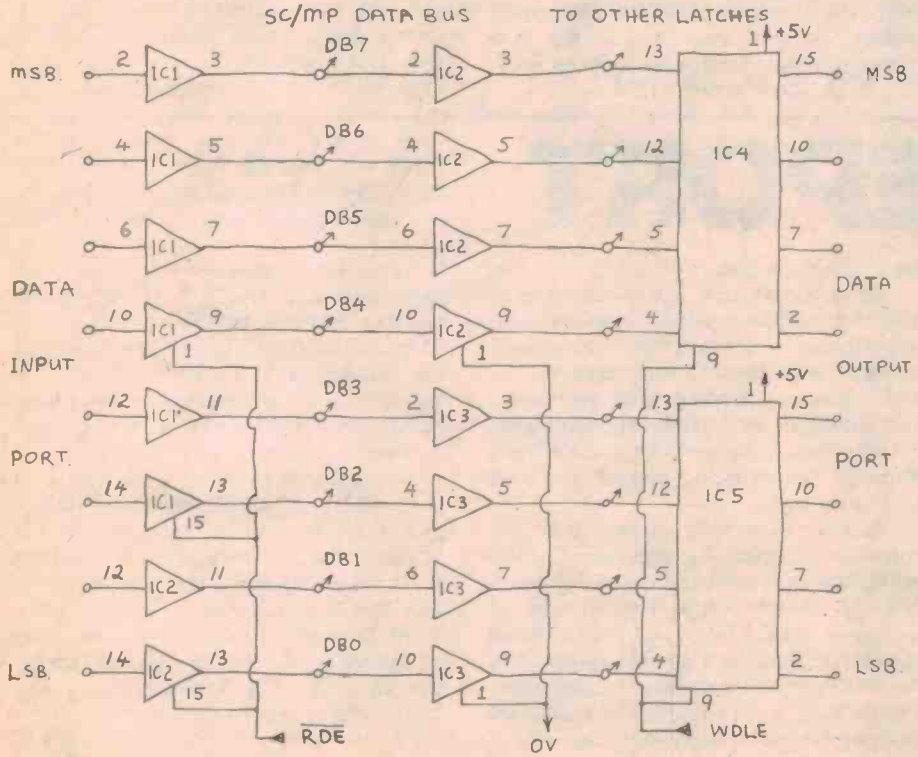
HARDWARE APPLICATION

AN I/O PORT FOR THE SC/MP: PART TWO

This month, we present the remaining details needed to complete an 8 bit parallel I/O for the SC/MP.



Circuit diagram of I/O port, address decoder shown above, data buffers shown below.



OPERATION

The I/O port appears to the SC/MP as a memory location. So to input data to the accumulator, the SC/MP executes a load (LD) instruction, and to output data to the I/O port, the SC/MP executes a store (ST) instruction with the correct memory address.

This address depends on how you configure the address decoder IC6. For example, by taking S2 from IC1 (on last month's circuit) and connecting it to Pin 5 on IC6 (address decoder given in this month's circuit) and using the circuit given this month, the designated address would be 0400. That is, the top byte depends on which output of IC1 (last month's cirbuit) is used and the bottom byte depends on which output of IC6 (this month) is used. Of course, SO, 1 and 7 of IC1 are already committed and can not be used as I/O addresses.

CIRCUIT DESCRIPTION

DB0-DB7 is the SC/MP data bus on the evaluation board. When a valid load I/O is executed, RDE goes low with NRDS and enables the 3S buffers IC1-2, transferring data from the data input port to the SC/MP data bus. When a valid store I/O is executed, data buffered by IC2-3 is loaded into IC4-5 by WDLE, with WDLE occuring as a result of NWDS.

EXPANSION

Adding more latched outputs is easy with provision of connecting up to seven more sets of latches to the outputs of IC2-3. For each added output, you also need a nor gate and this should be wired as is IC7. For each output use one of the remaining outputs of IC6 (i.e., S1 thru S7). More inputs can be added by connecting more 3S buffers parallel to IC1 and IC2. However, be careful of the outputs of these buffers exceeding the loading rules of the SC/MP data bus.

CONSTRUCTION

No constructional details are given except to say that the original circuit was built on Vero board and it worked ok, remember to keep the lead going to the evaluation board as short as practicable. A pc board layout is already under way, and should be finished by January. If any one is interested in copies of the artwork, they should be available by writing to Kevin Barnes, c/- the Magazine.

NEW FOR '77

MATCHING FM TUNER FOR TWIN 40 / TWIN 25

Based on the International 740 (ETI March 1976) the RX7400 has been redesigned to incorporate a really good looking 10 gauge front panel and a new LED tuning indicator. The unique LED "electronic dial" and precision tuning potentiometer have been retained. The AP2157 preassembled varicap front end means the RX7400 is easily constructed and aligned without special equipment. Optional AM module available.

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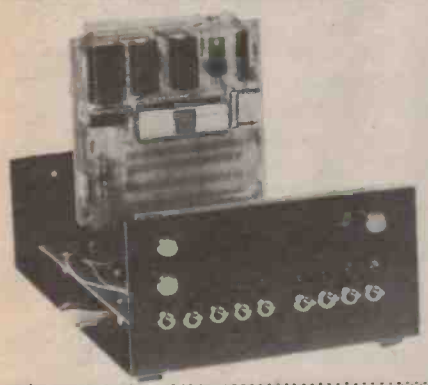

SCMPIO — LOW COST I/0 KIT FOR SC/MP

The SCMPIO kit now provides SC/MP users with a low cost input output capability. This is a great kit if you don't have ready access to a Teletype. It is an ideal teaching aid, learning and development tool for hobbyists, professors, students and electronic entrepreneurs at all levels.

Housed in an attractive anodized aluminium cabinet, SCMPIO features a user front panel function and LED displays. Using these facilities it is an easy matter to execute programs, examine or modify the contents of memory and the SC/MP registers and to run programs.

SCMPIO kit
$49.50
plus $2.50 post pack & insurance

$139.50
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CORRESPONDENCE

Confusion

I am somewhat confused so I hope you can help me. I have seen references to using the BASIC language on both the 6800 MPU and on the SC/MP, but how can this be, I thought each MPU has its own language?

T.A. Wagga.

Yes each MPU does have its own machine language. BASIC will not run directly on any MPU, it has to be translated into machine code first by a program written for that particular MPU. Such a program is called a compiler. The beauty of BASIC and other high order languages is that to run somebody else's program on your computer, all you need is a compiler suitable for your particular processor, even if your computer uses a different MPU chip to his computer.

Raising the Standard

Let me take this opportunity to congratulate you and your staff at ETI for an excellent magazine and on the timely introduction of Print-Out.

Since this is the beginning of the hobby in Australia, how about starting off on the right foot with some form of standardization? It could be applied to both hardware and software. Everyone it seems will go the cassette route for mass storage, so how about a standard data rate and modulation method?

Articles on scientific applications would be nice. The computer was designed as a scientific tool; we don't all want to play super space electronic hangman life — "war pong".

S.E. Newcastle

Standards are nice to have, but, who selects them? The magazine can set things going by publishing only good designs, however, we don't have the right to dictate them to you. I would be interested to hear from anyone who has ideas on possible standards.

When?

I have really enjoyed Print-Out and cannot wait for the next issue. When is the magazine going to publish the constructional details for a micro-computer? I think such a computer should not need a terminal, but use a method similar to the Micro 68.

H.W. Strathfield.

That would be giving away secrets.

Space War

Let me first add a word of appreciation to all the others you must be receiving. ETI is a great magazine.

The other item I would like to bring up is, what is spacewar and what is it to do with computers?

T.J. Melbourne.

Spacewar is a war game that simulates a battle between opposing space ships or fleets. Like most war game it can be played on paper but, playing it on a computer adds another dimension to the game, real time action! There are many different versions now available, the latter ones have a tendency to be called Star Trek. To quote from one ad, "Your mission is to rid the galaxy of the enemy using your warp engines, phasers, photron torpedoes and shield control.

Beware of enemy attacks, supernovas and space storms". This version is designed to run on a 6800 and needs about 4K of memory, cost is $10.

CONTRIBUTIONS — WHY NOT MAKE SOME MONEY WITH YOUR SPARE TIME ACTIVITIES. ETI is continually seeking high quality manuscripts written by individuals with personal experience in the computing field or who have knowledge that would be of benefit to our readers.

Payment is based upon manuscript presentation, technical quality and suitability for ETI readership and is between $20 to $50 per typeset magazine page. For more details refer to the back inside page.

NEWS

VKs' MPUs

Ray Rodwick VK2ZTZ reports that microcomputers are becoming a very common topic on the airways around Sydney. Ray goes on to say that a number of amateurs already have microcomputer kits, and that many others have them on order.

Because of this interest, discussion about microcomputers has become quite regular on the 2 metre FM nets, especially during the breakfast sessions on Channels 8 (repeater) and Channel 40.

However this situation is expected to change following a recommendation from the NSW Division of the WIA.

Because of the popularity of microcomputers, the NSW Division of the WIA was approached with the view to allocating a pair of two metre channels for microcomputer use. They replied by recommending that Channel 71 (147.55 MHz) and 72 (147.60 MHz) be used, 72 as a voice channel for general discussion and co-ordination and 71 for data transmission between computers.

Ray also reminds us that for data transmissions other than the standard RTTY format, a special licence is required from the Radio Branch.

NEWCASTLE COMPUTER HACKERS TAKE NOTE

Dr. Peter Moylan rang through the other day to say that a computer club has been formed in the Newcastle district. The first meeting was held on October 26th and already they have a club project going — a SC/MP system that can be built for $50.

The club meets at the Newcastle University twice monthly and is looking for new members.

Anyone interested in joining can get further details by phoning Peter on 68-5256 (049).

NEW ZEALAND COMPUTER CLUB

News reached ETI last month of a computer club now operating in Auckland, NZ. Very few details are available except that club members are interested in both 6800 and 8080 systems.

The club invites new members and those interested can obtain further details by sending an SAE to Box 27, 206, Mount Roskill, New Zealand.

UV COMPETITION HOTTENS UP

Texas Instruments, Motorola, and Advanced Micro Devices are expected to release their versions of 8K UV-erasable. programmable ROMs in the first quarter of 77.

At present Intel practically owns this $30 million market with its 2708.

NEW LSI FAMILY

Texas Instruments about to release a new family of bipolar large scale integrations. At its heart this new family has two versions of a 4-bit microcomputer slice, they are the SN54/74LS481 and a I^2L SBP 0400.

ITT TO SELL CP1600

General Instruments and ITT have signed an agreement for ITT to become an alternate source for GI's CP1600. Plans call for ITT to manufacture the chip in Germany primarily for the European market.

It is also reported that GI have reduced the one off US price of the CP1600 by 50%.

PRODUCT REVIEW

A LOOK AT SCMPIO

After paying 80-odd dollars for a SC/MP evaluation kit, it comes as a bit of a shock to find you have to pay out an extra $1,500 for a teletype to drive the evaluation board. A situation like this is a perfect cue for some enterprising person to step forward with a very simple solution, and it looks like Owen Hill is that person.

Owen's Company, Applied Technology, is now offering a device he calls SCMPIO. Acting as a serial interface operating at 110 band, it can be used in place of a teletype. Unlike the front panel mentioned earlier in ETI, SCMPIO makes use of the kitbug monitor program, this means the contents of the microprocessor internal registers can be easily examined and changed, and the three kitbug commands utilised by the operator.

Using SCMPIO

Data or commands are entered via the 8 switches visible in the photo. Data out or kitbug promptings are displayed by 8 leds also on the front panel. When using kitbug all inputs (data and commands) are in ASCII, so to enter M for example, 4D (hex) is set up on the switches and the load button pushed. Similarly when SC/MP issues the familiar illegal character prompt, the ? is displayed as 3F (hex). To use SCMPIO then, each action of pressing a key on the teletype's keyboard is replaced by setting up the ASCII code on the switch register and pressing the load button.

The key to SCMPIO's successful operation however, is its ability (when in the 'step' mode) to go into the Halt mode each time it finishes outputting a character. A teletype leaves a string of characters printed on paper as a record, but in the 'run' mode SCMPIO leaves no such record and relies on your memory or a pencil and paper for a permanent record. Since the characters are outputted at the rate of 10 per second, some means is needed to give a delay long enough for the operator to decode and take note of the output. This SCMPIO does by providing circuitry that halts the microprocessor (when it is switched from 'run' to 'step'). After noting the output operation is continued by pressin the Run or Load buttons, putting the microprocessor into run mode.

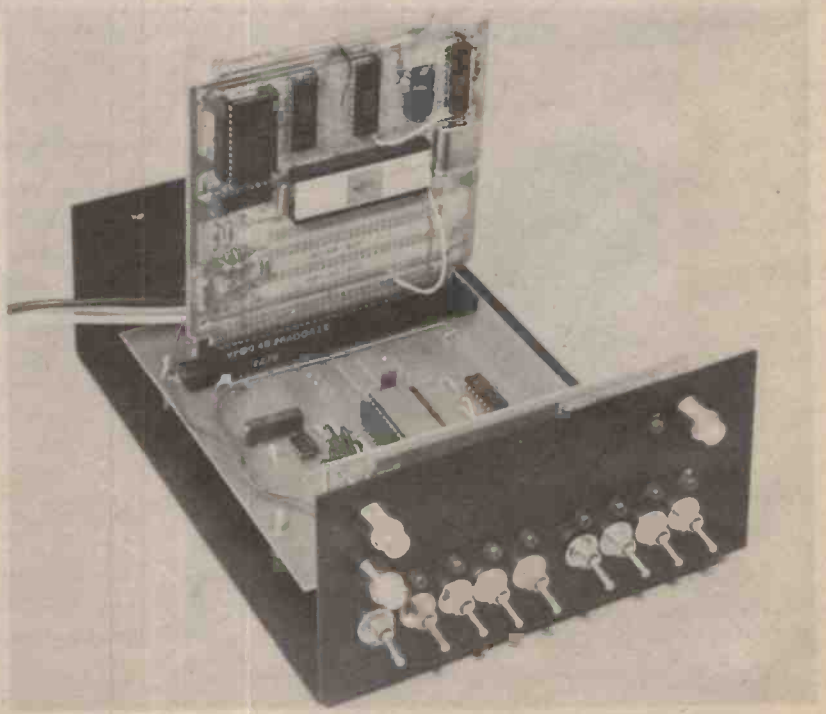
The SCMPIO evaluated was supplied assembled and came with a modified SC/MP evaluation board so we can only guess how long it would take to assemble the kit, probably less than 2 hours from the number of components in the finished design.

There are two pc boards, a main board with a socket for the SC/MP evaluator board, plus holes for a second 72 way socket. The second board is fitted with leds and switches, and is held in place by the switches being mounted on the front of a U shaped chassis. The leds poke through holes punched in the front of the chassis. Flying leads interconnect the two pc boards and three other leads go off to an external +5, −12 volt power supply (not provided, we used one of Applied Technology's AT1250 supplies).

Operating SCMPIO

Operation proved simple, if not a little tedious, once the operating rules were memorized. Having to change up to 8 switches for each inputted character certainly takes longer than pressing keys on a teletype, but then the one and half-odd thousand dollars that was not paid out also stays in your pocket longer. A simple program to flash the display was coded and loaded without difficulty. Needless to say, it bombed first go, but the problem was traced to unfamiliarity with expressing ASCII as hex; once this was fixed, the display flashed nicely. The only slight concern was with the switches: they are high quality C&K toggle switches with a quite positive action that requires finger and thumb.

While using SCMPIO, the thought occurred of how to fit a simple hex keyboard in place of toggle switches. When this was mentioned to Owen Hill, he revealed that a similar idea had occurred to him and was already being investigated. He also advised that an optional display could be used in place of the 8 leds, namely the ETI 630 hex display. Apparently the SCMPIO kit is proving popular, so much so that Applied Technology is considering exporting them to the States. This proposition was recently made more attractive with the recent devaluation.



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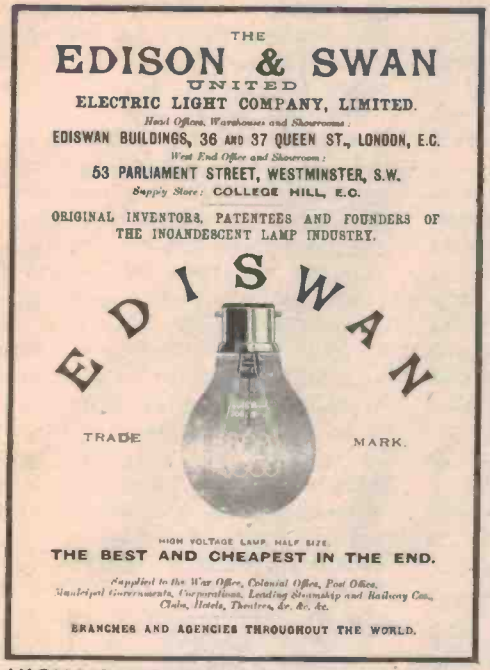

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Model SR4148R Portable

A 48 key, 14-digit rechargeable scientific notation electronic calculator.

14 Digit Display

Dimensions
1¼" H x 3" W x 5¾"L

The display capacity of this machine is able to show values ranging from 1.0 x 10^{-99} up to 9.999999999 x 10^{99}. This represents a precision capability which exceeds those known to most of the physical constants in the universe. There simply is no limit to the value of the angles you can enter for trigonometric functions.

The exponent key lets you make an entry in the exponent field of the display.

Logic

The logic of the SR4148R has been designed for practical, easy entry. The system is algebraic so that computations are indexed into the machine just as you would write them onto paper.

Outstanding and Exclusive Features

For students, numerous fundamental math principles have been programmed into the logic of the machine. Among these tenets are:

— Any number raised to the-zero power equals one
— Zero raised to any power equals zero
— All results are precise for immediate comprehension.

EE↑ EE↓ For professionals, such exclusives as the exponent integer increase and decrease keys **EE↑ EE↓** greatly facilitate complex calculations. Engineers, for example, commonly work with familiar values as 10^{-6} for microseconds. If, after a computation an exponent reads: 10^{-4} and the operator wishes to express this in microseconds, merely pressing the **EE↓** key permits him to step down the exponent accordingly.

Performance Categories

Memories Two independent storage registers:
STO 1 RCL 1
STO 2 RCL 2

Σ1 Sigma or automatic memory summation key.

Special Keys

d/r Degree/Radian Mode Key

( ) Parenthesis Keys

→P Converts Rectangular Coordinates to Polar

→R Converts Polar Coordinates to Rectangular

Log Keys

e^x Calculates natural antilogarithm of x

log Calculates common logarithm of x

Ln Calculates natural logarithm of x

10^x Calculates common antilogarithm of x

Statistical Keys

x_n The distribution key is pressed after each numeric entry in a mean/standard deviation example

$\bar{x} \leftrightarrow \sigma$ To find the average distribution Σ1 press the statistical key. Finally, to see the standard deviation σ press the exchange register key x↔y

Trigonometric Keys

arc used when determining inverse trig calculations

sin Calculates the sine of x

cos Calculates the cosine of x

tan Calculates the tangent of x

Power Keys

y^x Raises the base y to the x power

x^2 Squares x

$\sqrt{x}$ Obtains the square root of x

$\sqrt[x]{y}$ Determines the x root of y

π Pi is an automatic constant which is recalled when this key is pressed

Standard Keys

x↔y Exchange register key

+/− Sign change key

1/x Inverse or reciprocal key

CE/C Clear Entry and Clear All

× − + − · = ...And last but not least the standard four function and arithmetic keys.

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Last Year the first TV sets appeared on the market with INFRA-RED sound transmission for earphones. Apparently, in the near future, sets with INFRA-RED remote control will follow. In addition, it can be expected that INFRA-RED transmission will be applied shortly in the Hi-Fi sector. Already, during last year's radio exhibition in Berlin a model of an INFRA-RED stereo system for earphones reception was demonstrated.

W.H.K. has now available a 26 page report on this subject with the following :-
General remarks on INFRA-RED Transmission,
Effect of ambient light,
Photo Components,
INFRA-RED Sound Transmission,
Mono Sound for Television Receiver
INFRA-RED Stereo Sound Transmission
Remote Control with INFRA-RED Light,
Remote controlled TV Sets,
Graphs,
Circuit "Transmitter for INFRA-RED Sound Transmission,
Circuit "Receiver for INFRA-RED Sound Transmission,
Information Transmission System for TV Remote Control,
Signal Wave Forms,
Input Amplifier for INFRA-RED Remote Control
INFRA-RED Transmitter with high FM Linearity,
INFRA-RED Receiver for Narrow-band FM Audio Tansmission,
INFRA-RED Transmitter for wide-band FM Audio Transmission,
INFRA-RED Transmitter for wide-band FM Audio Transmission,
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For People working with computers we have a very useful book: "MICROCOMPUTER DESIGN". Microcomputer Design contains a wealth of detailed design information. The insight gained from this book will be of use to designers and experimenters alike. Topics include: 8008, 8080, Microprocessor comparisons, Bus Structure, Input/Output instructions, Input design approaches, Output Techniques, Combined Input/Outputs, Adding 8008 instructions, Expanding 8008 capabilities, Random AccessMemory, Read only Memory, Direct Memory Access, Interrupts, Saving Status during Interrupts, etc, etc.

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Perhaps it is a little late to wish you all a Merry Christmas, but at least have a Happy New Year.

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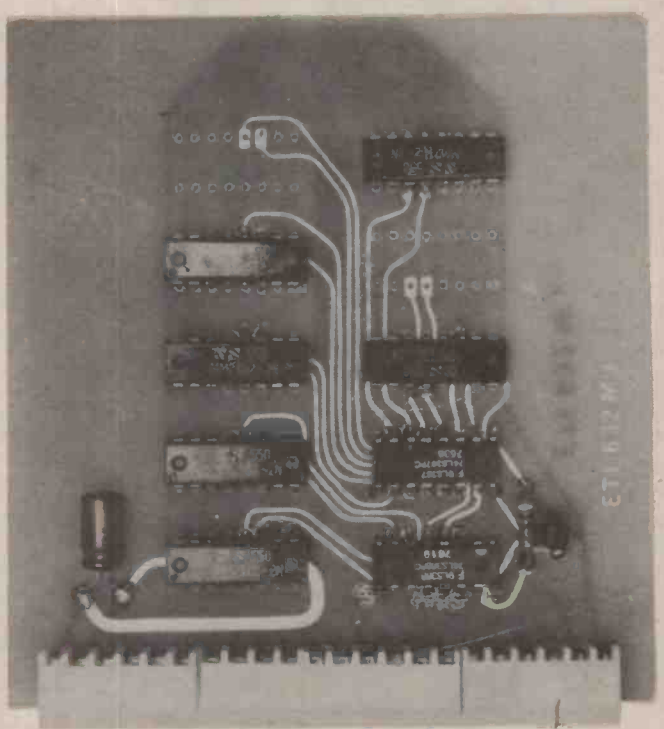
VIDEO DISPLAY UNIT

COMPUTER TERMINAL PROJECTS

This project will allow you to put text onto your TV screen. Although primarily designed as part of the ETI Microcomputer Terminal, it can be modified for other display or captioning applications.



THIS VDU PROJECT COMBINES with the ETI 632 keyboard (published last month) and a serial-parallel converted (yet to be published) to give you a cheap substitute for a teletype. The ETI terminal will enable you to use the monitor programs in the evaluation kits from microprocessor manufacturers, and it can be used with any 8-bit microcomputer.

This month we are describing three of the five boards to be used in the VDU. When designing the unit, we have tried to compromise cost with utility. Our modular approach facilitates customising by the experienced experimenter.

The characters are generated within a 5 x 7 dot matrix (see Fig. 2), arranged in seven horizontal rows of five dots. The seven five-bit words are produced by a ROM (read only memory) which can generate 64 different characters (including a blank space).

Format

When deciding on the number of characters which can be fitted on the TV screen, the limitation is that there are only about 300 TV lines (forgetting the interlaced line). There are seven lines needed for each character plus some more to give a space between lines. This limits us to about 28 or 30 character lines.

The number of characters in each line is set by the format required for each character, and the space between characters. Between 30 and 50 characters per line can be used.

The final arrangement we chose was 24 lines of 32 characters – giving 768

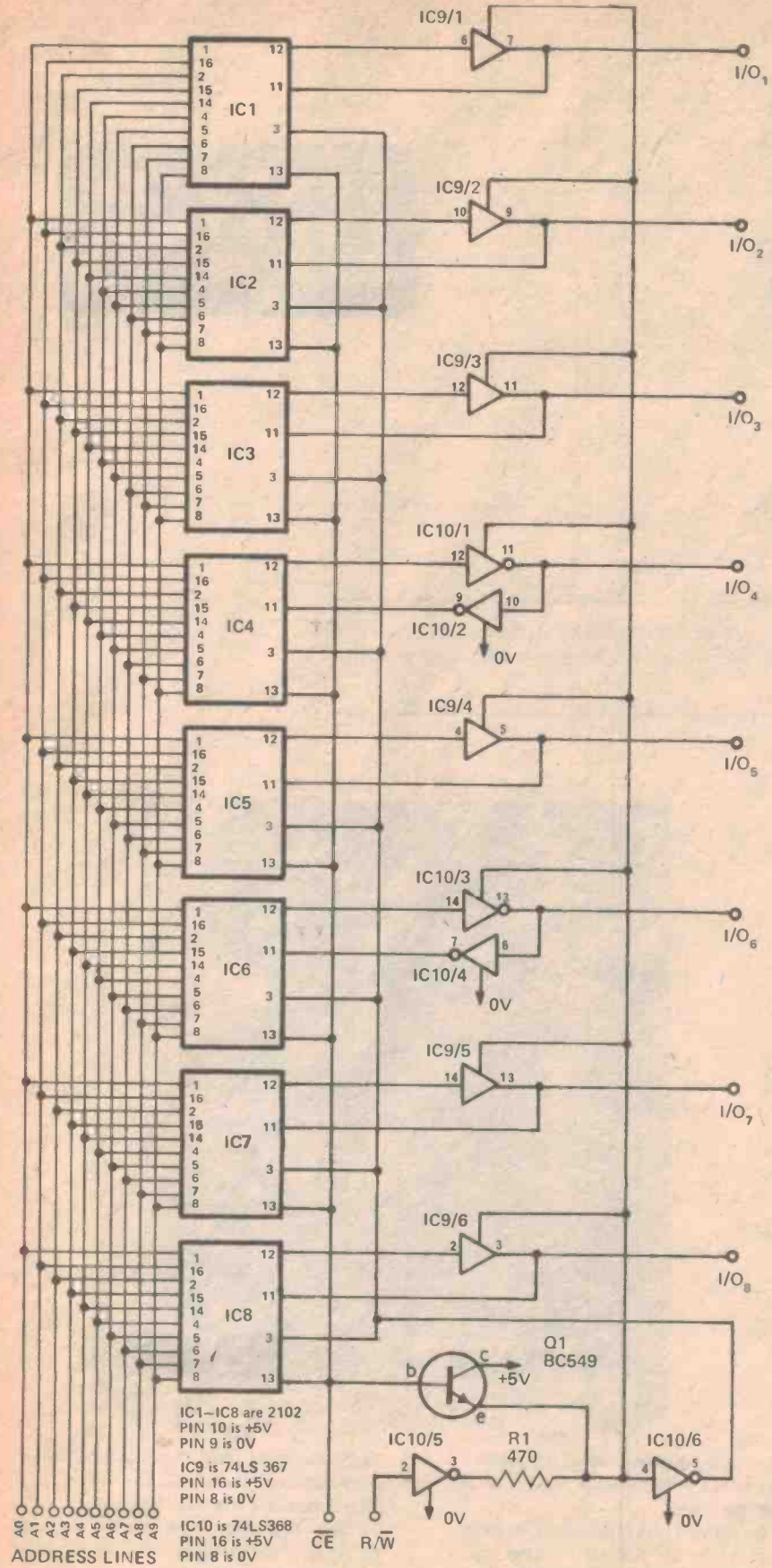


Fig. 1. Circuit diagram of the memory board.

How It Works ETI 632

Power Supply — The positive power rail is derived by a full wave, centre tapped, supply which is filtered and regulated by an LM309 IC. This can provide +5 V at up to one amp. The negative supply, which is needed for the 2513 character generator ROM, uses a simple half-wave rectifier and zener regulator.

Memory Card — The RAMs we use are 2102 types which are organised in a 1024 x 1 format. Each of these has 10 address lines, an enable input, a read/write control, and separate input and output ports.

We use eight of these on one board to form a 1K x 8 memory — the address lines, the enable and the read/write inputs are simply paralleled. However, to make the input and output terminals common (creating an eight-line input/output bus), we must use tristate buffers between these lines on each IC.

The read/write input is inverted by IC10/5 and this controls the tristate lines. This is then reinverted to drive the R/W line of the 2102s. If the enable line is taken to a "1", Q1 ensures that the tristate line is also taken to a "1", disabling the outputs.

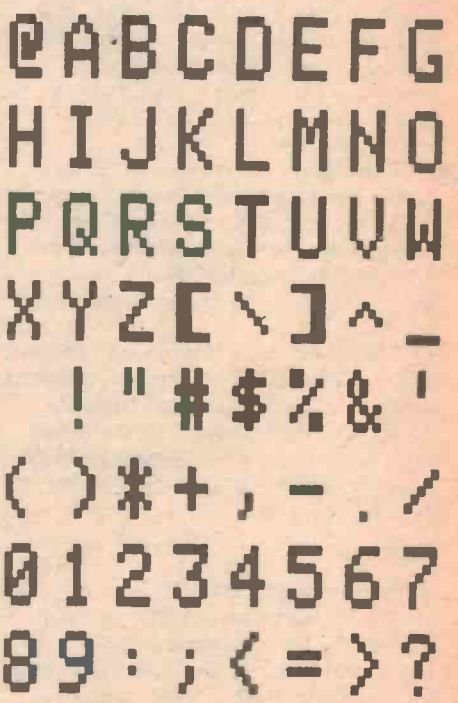


Fig. 2. The 64 characters available from the ROM.

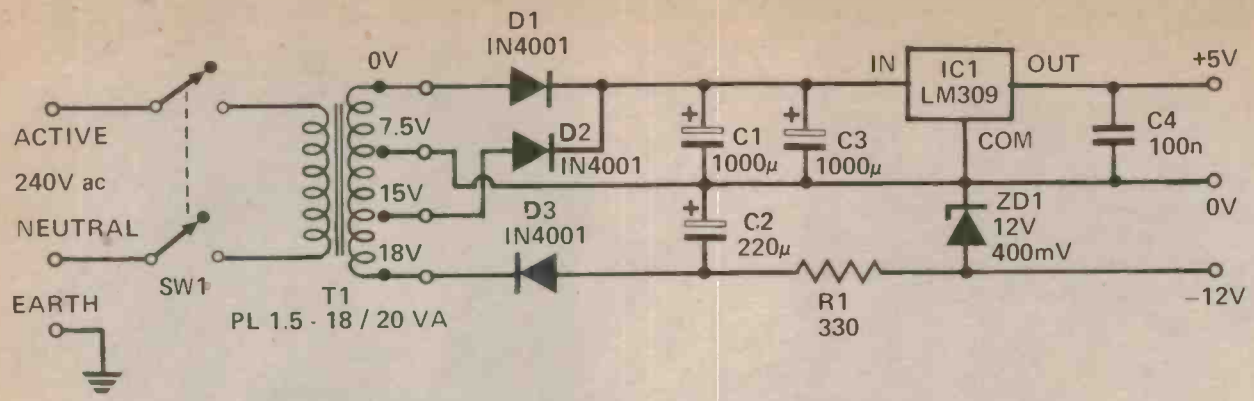


Fig. 3. Circuit diagram of the power supply.

characters in all. At 32 characters per line, the memory can hold 32 lines (1,024 characters) – this means that only 75% of the characters in memory appear on the screen. The "hidden" lines can be put to good use, as we shall see later.

Video

Each line sweep of the TV set is completed in about 64 µs including the flyback. To fit 32 characters which use five dots and five dots space each, the time allocated to each dot is only about 170 µ This means that the modulation frequency required is about 6 MHz.

While an RF generator and modulator can work at that frequency, the band width of the TV set, especially black and white sets, could limit the performance. Therefore, we decided to leave the output as a video signal and add a video input socket to the TV set. An article on how to convert the TV set was published last month.

Sync Generator

As said earlier, we are describing three boards this issue: the power supply, the sync generator and the memory card. The sync generator is a universal design and it is described as a separate project elsewhere in this issue.

Memory Card

Initially we were going to describe a general-purpose 2K x 8 RAM card with all the appropriate input-output buffering, etc., but it was finally decided that for the VDU this would be wasteful. Consequently, we designed a 1K x 8 board with input-output buffering, but not address buffering.

In the VDU only six bits are used to specify one-of-64 characters – so we can leave out two ICs to give a 1K x 6 memory. The full 1K x 8 is available just by soldering in two more chips.

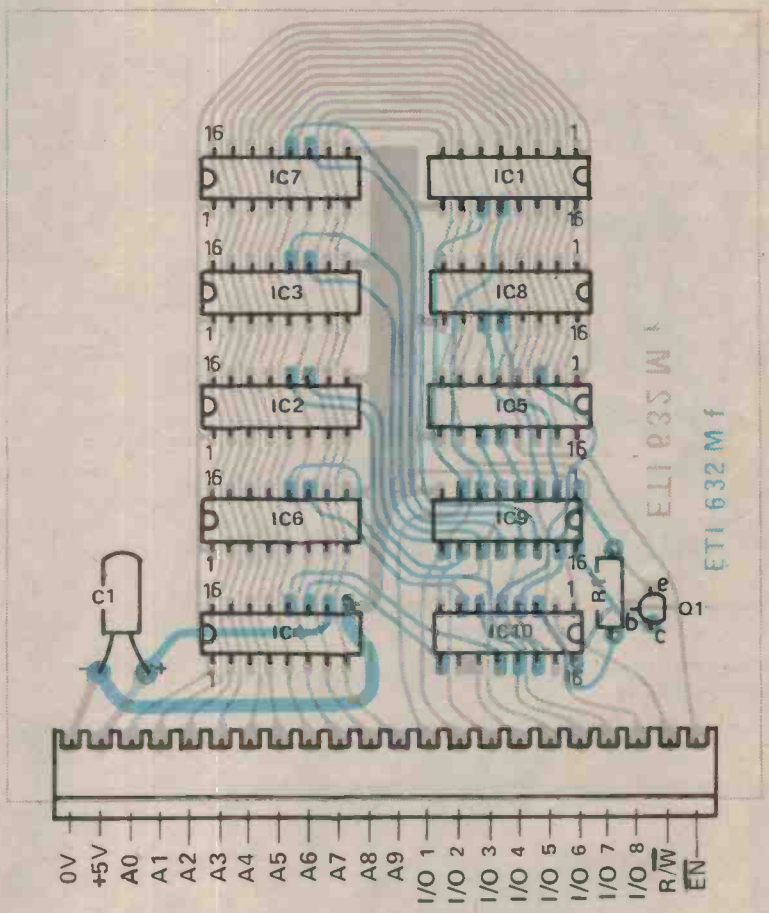


Fig. 4. Component overlay of the memory card.

Construction ETI 632

Assembly of the power supply is simple and the only point to watch is that the pins of the IC do not touch the heat-sink – use pieces of tubing over the pins. No insulation is needed between the IC and the heatsink.

With the memory card, first check the board very carefully for breaks in the tracks, etc. These tracks are thin and on double-sided board a broken track under an IC can be difficult to find later.

PARTS LIST ETI 632 MEMORY CARD

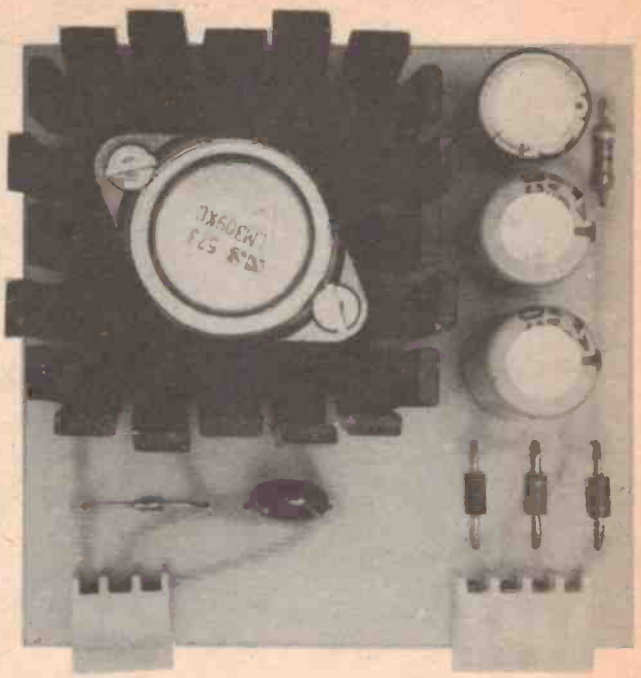
R1	Resistor	470 ohm ½ W 5%
IC1-8	Integrated circuit	2102*
IC9	Integrated circuit	74LS367
IC10	Integrated circuit	74LS368

*IC7,8 not needed for VDU.

Q1	Transistor	BC549

PC board ETI 632 M
Molex connectors type A2145A to a total of 22 pins.

With double sided boards without plated-through holes it is necessary to solder on both sides of the board. Unless wirewrap sockets are used (and these are expensive) don't use sockets at all. Use a small soldering iron and fine solder. Be especially careful in checking that the tracks are not bridged on the board.



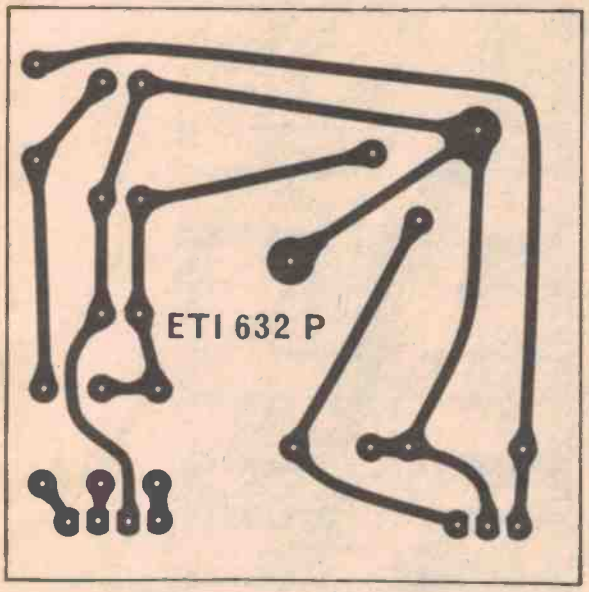


Fig. 5. Printed circuit layout of the power supply board Full size 76 x 76 mm.

PARTS LIST ETI 632 POWER SUPPLY

R1	Resistor	330 ohm ½ W 5%
C1,3	Capacitor	1000 µ 16 V electro
C2	Capacitor	220 µ 35 V electro
D1-D3	Diode	IN4001 or similar
ZD1	Zener diode	12 V 400 mW
IC1	Regulator	LM309

Transformer PL1.5–18/20 VA
PC board ETI 632 P
One Molex connector A2145A 3
One Molex connector A2145A4
Heatsink DSE H-3400

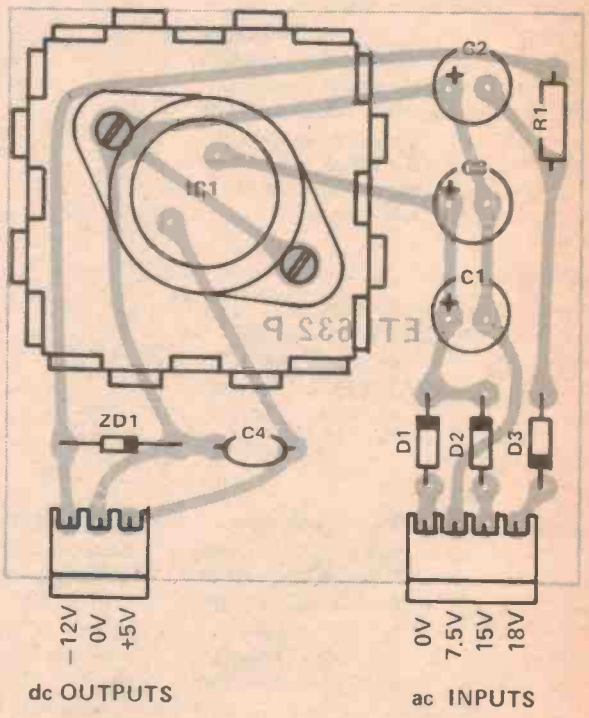


Fig. 6. Component overlay of the power supply board.

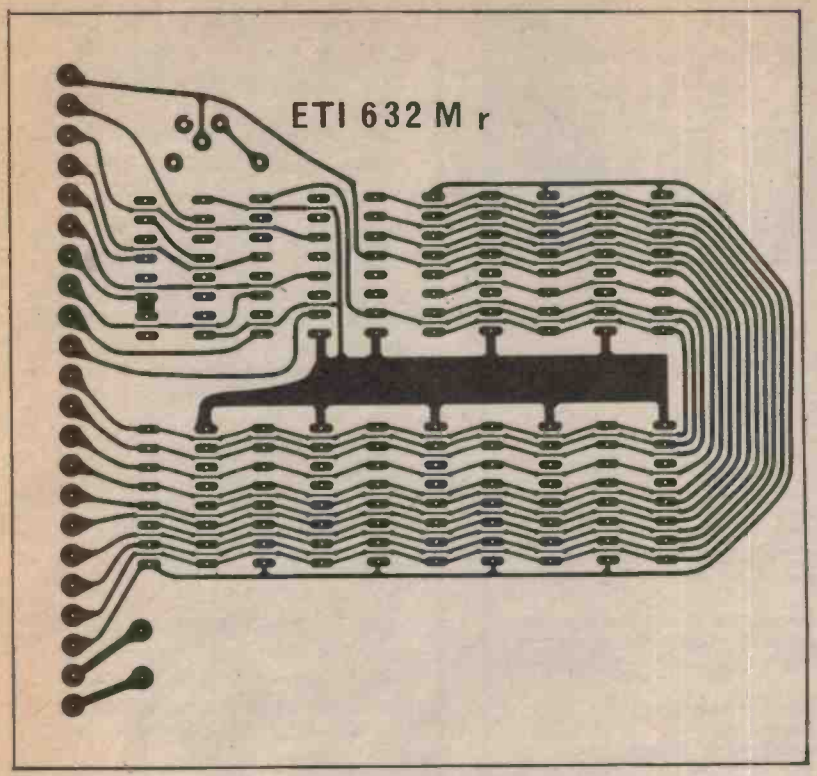
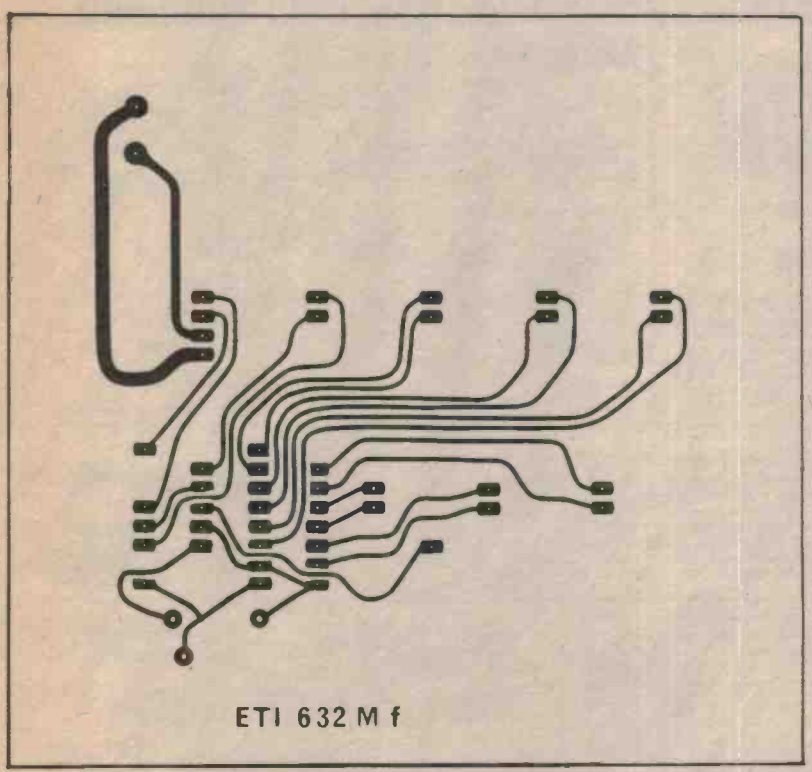


Fig. 7. Printed circuit layout of the memory board (both sides) Full size 100 x 105 mm.



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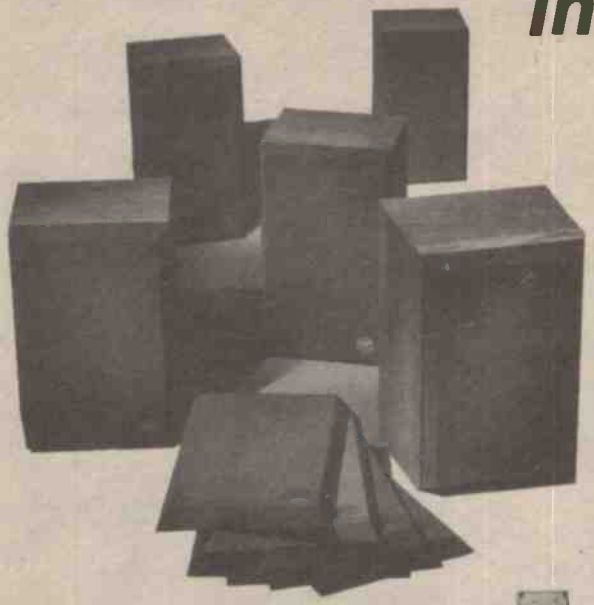

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HIGH FREQUENCY:	4" frame cone driver	4" frame cone driver	2 each 4" frame cone drivers	4" frame cone driver	5" frame cone driver
NOMINAL IMPEDANCE:	8 ohms	8 ohms	8 ohms	8 ohms	8 ohms
CROSSOVER FREQUENCY:	3000 Hz	1500 Hz	1500 Hz	850 Hz, 8 kHz	800 Hz, 7 kHz
ENCLOSURE TYPE:	Sealed	Vented	Vented	Vented	Vented
FREQUENCY RESPONSE:	50 Hz - 20 kHz	50 Hz to 20 kHz	45 Hz to 20 kHz	45 Hz to 20 kHz	40 Hz to 20 kHz
OPERATIONAL POWER RANGE: Recommended for use with amplifiers between these levels	12 watts to 75 watts, 30 watts continuous	10 watts to 100 watts 35 watts continuous	12 watts to 150 watts 45 watts continuous	15 watts to 200 watts 50 watts continuous	12 watts to 250 watts 60 watts continuous
FINISH:	Hand-rubbed oiled oak	Hand-rubbed oiled oak	Hand-rubbed oiled walnut	Hand-rubbed oiled walnut	Hand-rubbed oiled oak
GRILLE:	Acoustically transparent brown knit fabric mounted on removable frame	Acoustically transparent black knit fabric mounted on removable frame	Acoustically transparent black knit fabric mounted on removable frame	Acoustically transparent foam mounted on removable panel. Choice of black, brown, blue, or burnt orange	Acoustically transparent foam mounted on removable panel. Choice of black, brown, blue, or burnt orange
DIMENSIONS:	53.3cm H x 29.2cm W x 26.4cm D	60.9cm H x 31.8cm W x 29.2cm D	64.8cm H x 36.8cm W x 30.5cm D	63.5cm H x 40.6cm W x 35.9cm D	67.3cm H x 44.5cm W x 38.1cm D
WEIGHT:	10.4 kg	12 kg	14.5 kg	20 kg	25.4 kg

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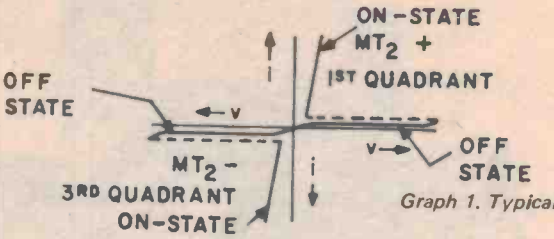
ETI data sheet

SC141 & SC146, 6A & 10A

The triac is a silicon ac switch which may be gate triggered from an off-state to an on-state for either polarity of applied voltage.

The SC141 and SC146 are molded silicon plastic triacs.

Data reproduced by permission of GE, for further information consult their Semiconductor Data Handbook.



Graph 1. Typical E-I Characteristics

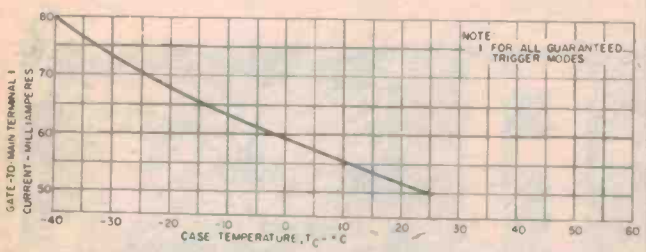
MAXIMUM ALLOWABLE RATINGS

Type	RMS On-State Current, I_T (RMS) Amperes	Repetitive Peak Off-State Voltage, V_{DRM} B Volts	D Volts	E Volts	M Volts	Peak One Full Cycle 50 Hz Surge (Non-Rep) On-State Current, I_{TSM} Amperes	I^2t For Fusing For Times At 1 Millisecond	8.3 Milliseconds
SC141B,D,E,M	6	200	400	500	600	74 A	18 A^2s	26.5 A^2s
SC146B,D,E,M	10	200	400	500	600	90 A	20 A^2s	41.5 A^2s

Critical Rate-Of-On-State Current, di/dt:
Breakover voltage triggered operation . . . . . 10 A/μs
Peak Gate Power Dissipation, P_{GM} . . . . . 10 W for 10 μs
Average Gate Power Dissipation, $P_{G(AV)}$ . . . . . 0.5 μs
Peak Gate Current, I_{GM} . . . . . .see Graph 3
Peak Gate Voltage, V_{GM} . . . . . .see Graph 3

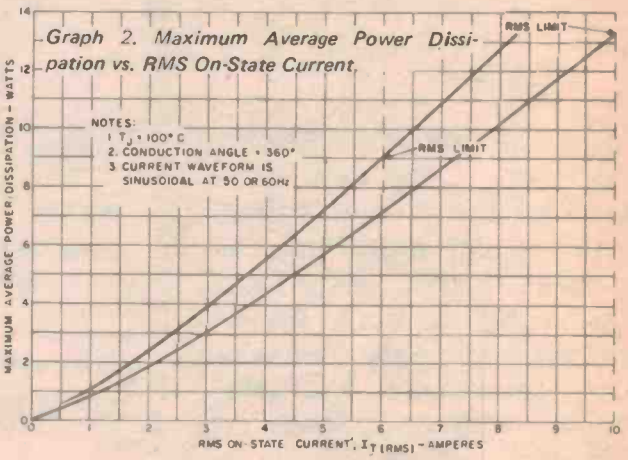
CHARACTERISTICS – SC 141/SC146

Test	Symbol			Units
Peak On-State Voltage	V_{TM}			
SC141		max.	1.83	Volts
SC146		max.	1.65	
Critical Rate of Rise of Off-State Voltage (Higher values may cause device switching)	dv/dt	typ.	50	Volts/μs
Critical Rate of Rise of Commutating Off-State Voltage (Commutating dv/dt)	$dv/dt_{(c)}$			Volts/μs
		min.	4	
D.C. Gate Trigger Current	I_{GT}	max.	50	mAdc
D.C. Gate Trigger Voltage	V_{GT}	max.	2.5	Vdc
		min.	0.20	
Holding Current	I_H	max.	50	mAdc
Latching Current	I_H			mAdc
MT2+ Gate+		max.	100	
MT2– Gate–		max.	100	
MT2+ Gate–		max.	200	
Steady-State Thermal Resistance Junction to Ambient	$R\theta JA$	max.	75	°C/watt
Junction to Case				
SC141	$R\theta JC$	max.	3.0	
SC146		max.	2.2	

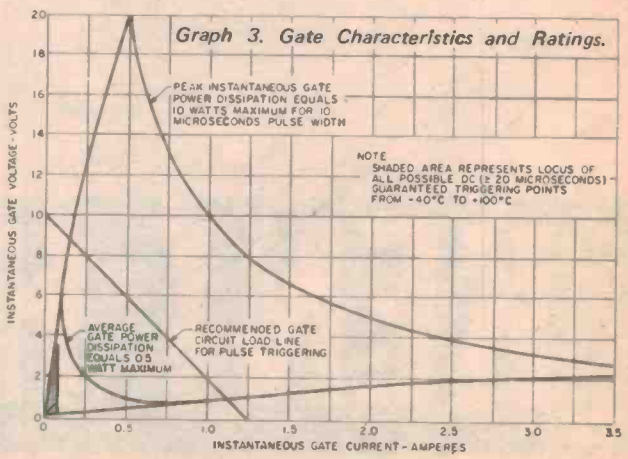


Graph 4. Maximum DC Gate Current to Trigger vs. Case Temperature.

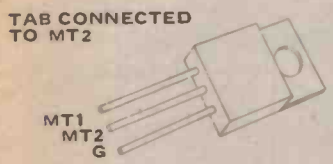
Graph 2. Maximum Average Power Dissipation vs. RMS On-State Current.

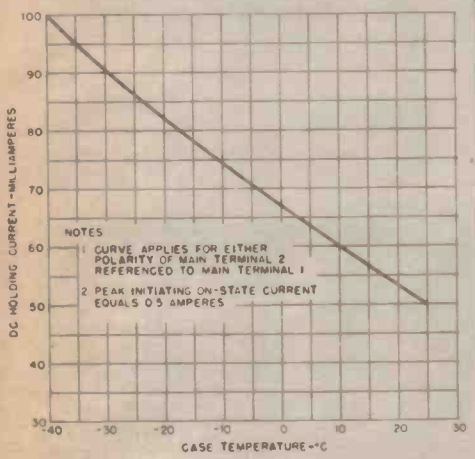


Graph 3. Gate Characteristics and Ratings.



A Triacs

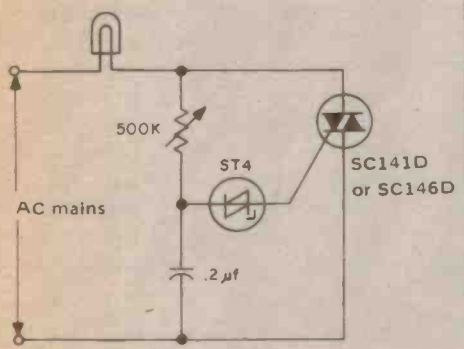




Graph 5. Maximum DC Holding Current vs. Case Temperature.

TYPICAL CIRCUITS

Triacs are especially useful in lamp dimming because of their ability to conduct in both directions.



This circuit uses the ST4 IC to trigger the triac (see p105 for data on this device). The ST4 reduces snap-on effects that occur in symmetrical trigger circuits and minimizes control circuit hysteresis. This performance is possible with a single RC time constant, whereas a symmetrical circuit of comparable performance would require at lease three additional passive components.

ETI data sheet

SC142, 8A Triac

The triac is a silicon ac switch which may be gate triggered from an off-state to an on-state for either polarity of applied voltage.

The SC 142 is a molded silicon plastic triac.

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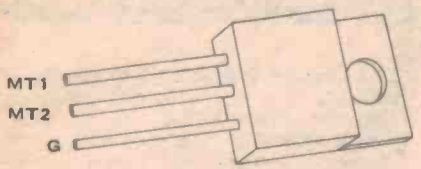


TAB ISOLATED
MT = Main Terminal

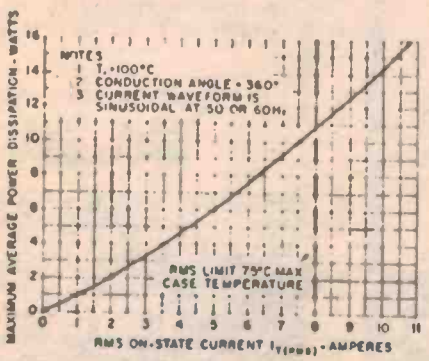
MAXIMUM ALLOWABLE RATINGS – SC 142

RMS On-State Current, It (rms)	Repetitive Peak Off-State Voltage VDRM		Peak One Full Cycle (50 Hz) Surge (Non-Rep) On-State Current ITSM Amperes		I^2t for Fusing For Times At	
	SC142B	SC142D	SC142E	SC142M	1 Millisecond	8.3 Milliseconds
8 A	200V	400 V	500 V	600V	18 A^2s	26.5 A^2s

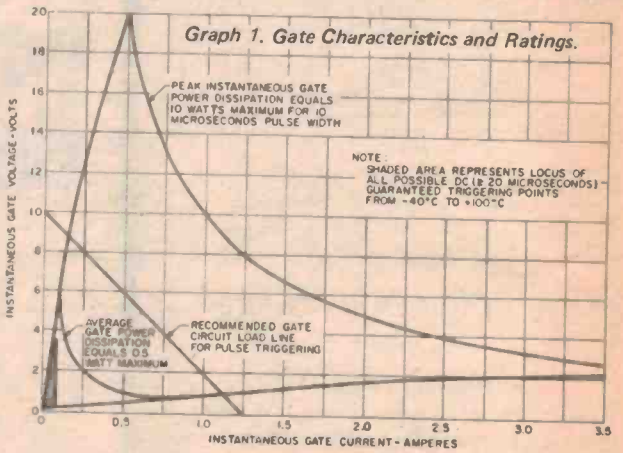
Critical Rate-Of-Rise of On-State Current, di/dt:
Breakover voltage triggered operation . . . . . 10 A/μs
Peak Gate Power Dissipation, RGM. . . . . 10 W for 10 μs
Average Gate Power Dissipation, PG(AV) . . . . . 0.5 W
Peak Gate Current, IGM . . . . . see Graph 1
Peak Gate Voltage, VGM. . . . . see Graph 1

CHARACTERISTICS – SC 142

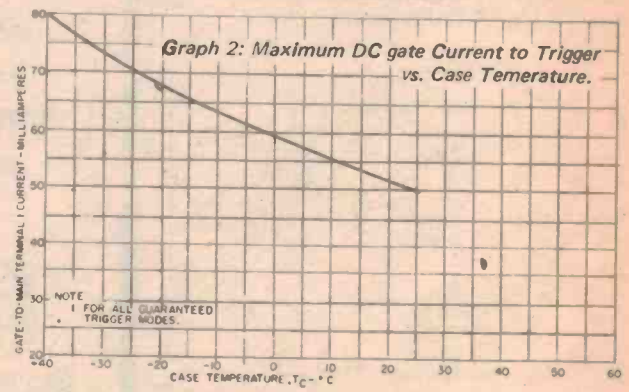
Test	Symbol			Units
Peak On-State Voltage	V_{TM}	max.	1.75	V
Critical Rate of Rise of Off-State Voltage (Higher values may cause device switching)	dv/dt	typ.	50	V/μs
Critical Rate of Rise of Commutating Off-State Voltage (Commutating dv/dt)	$dv/dt_{(c)}$	min.	4	V/μs
D.C. Gate Trigger Current	I_{GT}	max.	50	mAdc
D.C. Gate Trigger Voltage	V_{GT}	max.	2.5	Vdc
		min.	0.20	
Holding Current	I_H	max.	50	mAdc
Latching Current	I_L			mAdc
MT2+ Gate+		max.	100	
MT2– Gate–		max.	100	
MT2+ Gate–		min.	200	
Steady-State Thermal Resistance Junction to				°C/W
Ambient	RθJA	max.	75	
Junction to Case	RθJC	max.	3.3	



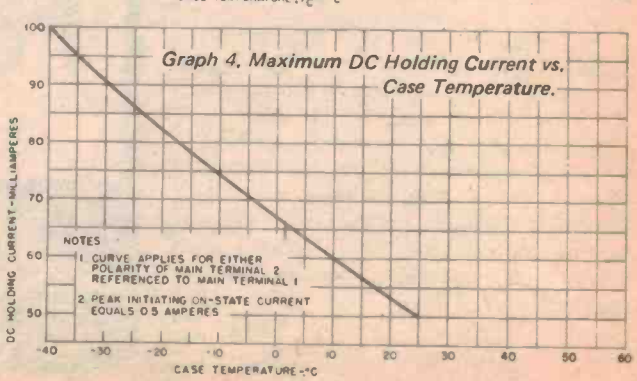
Graph 3. Maximum Average Power Dissipation.



Graph 1. Gate Characteristics and Ratings.



Graph 2: Maximum DC gate Current to Trigger vs. Case Temerature.



Graph 4. Maximum DC Holding Current vs. Case Temperature.

ST2, Diac

The ST2 diac is a diffused silicon bi-directional trigger diode which may be used to trigger triacs or Silicon Controlled Rectifiers. This device has a three-layer structure having negative resistance switching characteristics for both directions of applied voltage.

MAXIMUM RATINGS ST2

Peak Current (10μsec duration, 120 cycle repetition rate)	I_p	±2 Amperes Max.
Peak Output Voltage	e_p	±3 Volts Min.

CHARACTERISTICS – ST2

Test	Symbols	Min.	Typ.	Max.	Units
Breakover Voltage	$V_{(BR)1}$ and $V_{(BR)2}$	28	32	36	Volts
Breakover Currents	$I_{(BR)1}$ and $I_{(BR)2}$	–	–	200	μamp
Breakover Voltage Symmetry	$V_{(BR)1} - V_{(BR)2}$	–	–	3.8	Volts

ST4, IC Diac

The ST4 is an asymmetrical ac trigger integrated circuit for use in triac phase controls. This device greatly reduces the snap-on effects that are present in symmetrical trigger circuits and minimizes control circuit hysteresis. This performance is possible with a single RC time constant, whereas a symmetrical circuit of comparable performance would require at least three additional passive components.

The ST4 is available in a two-leaded TO-8 type in-line epoxy package.

ABSOLUTE MAXIMUM RATINGS – ST4

Current

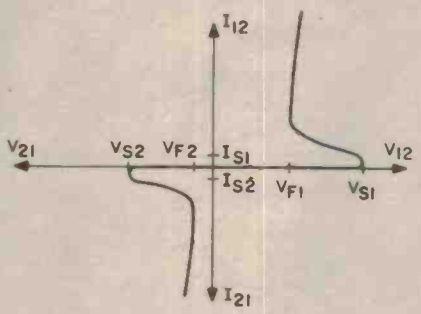
I_{21} Continuous . . . . . 200 mA

I_{21} Pulsed (PW = 2μs, Duty Cycle ≤ 10%) . . . . . 500 mA

I_{12} Pulsed (PW = 2μs, Duty Cycle ≤ 10%) . . . . . 175 mA

Power

Total Average . . . . . 350 mW



ST4 ELECTRICAL CHARACTERISTICS

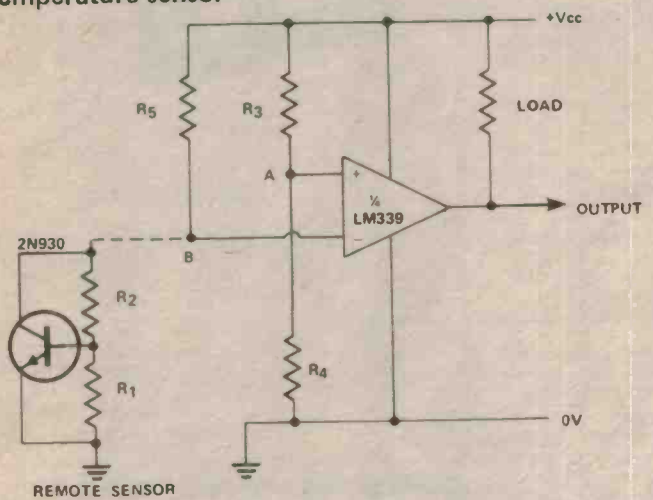
ELECTRICAL CHARACTERISTICS

Test	Symbol	Min.	Max.	Units
Switching Voltage	V_{S1}	14	18	V
	V_{S2}	7	9	V
Switching Current	I_{S1}, I_{S2}	–	80	μA
	I_{S1}, I_{S2}	–	160	μA
Voltage Drop	V_{F1}	7	10	V
	V_{F2}	–	1.6	V
Off-State Current	I_{12}	–	100	nA
	I_{21}	–	100	nA
Temperature Coefficient	T.C.	–	.05	%/°C
Turn-on Time	t_{on}	–	1	μs
Turn-off Time	t_{off}	–	30	μs
Output Pulse	V_o	3.5	–	V

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.

Remote temperature sensor



The circuit shows a temperature sensing device which can be used to indicate at a remote point when the temperature passes through a certain value or to give an alarm when this occurs.

The sensing unit itself contains a 2N930 transistor. The base-emitter voltage of this device appears across R1 and (as the base current is far less than the collector current) the voltage at the upper end of R2 will be the emitter-base voltage multiplied by (R2+R1)/R1. The base-emitter voltage changes with a temperature coefficient of −2.2 mV/°C and this change is multiplied by the same factor before being applied to the LM339 circuit.

The potential at point A is set by the resistors R3 and R4. As the temperature of the sensor transistor rises, the voltage at point B falls. At the time this voltage falls below that at point A, the output of the LM339 voltage comparator will go 'high'. If, however, the input connections to the LM339 are reversed, the output will go 'low' when the temperature of the sensor falls below the preset point.

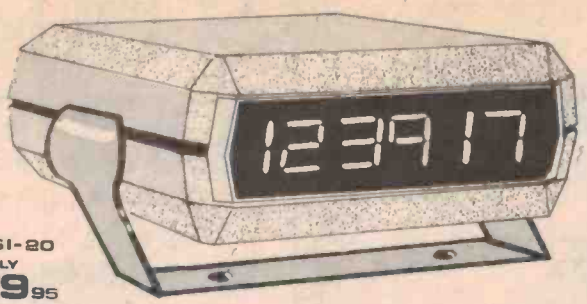
The LM339 contains four separate voltage comparators in one package; only one of these comparators is used in the circuit shown. The other three comparators could be used with another three temperature sensing transistors so that an indication is given when the temperature passes through three other preset values.

The value of R5 should be chosen so that the current passing through the remote sensor unit is about 10 μA. If the temperature range over which operation is required is narrow, the ratio R2/R1 may be large so that the system is very sensitive to small temperature variations. A potentiometer may be substituted for R3 and R4 so that the temperature at which the comparator switches is variable. The voltage at point B is highly linear over a very wide temperature range (about −65°C to +150°C) and therefore the potentiometer which replaces R3 and R4 can be given a linear calibration.

A feedback resistor may be connected from the output to the non-inverting input to provide a small amount of hysteresis (so that the temperature at which the output changes when the temperature is rising is different from that when it is falling); one then has the basis of a thermostat.

The output current has a maximum value of about 15 mA.

DIGITAL AUTO CLOCK



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Complete kit includes all parts, displays, etched and drilled PC Boards, Case and mounting bracket (less 9V transistor battery).

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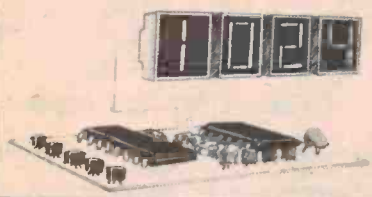
4-DIGIT DECADE COUNTER



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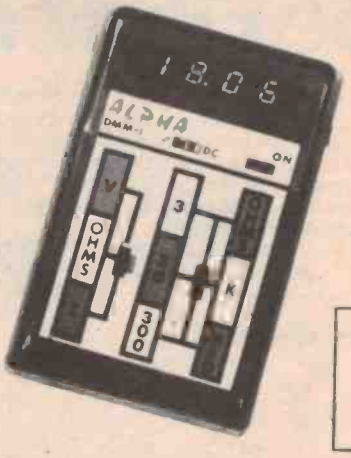

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- DC CURRENT
- RESISTANCE

specifications

AC VOLTAGE
1 millivolt to 300 volts in three ranges. Input impedance: 10 megohms. Accuracy: 1. Frequency Response: 0 to full scale voltage between 40 and 100 Hz, 0 to 2.4 volts between 100 and 10,000 Hz, 0 to 1.5 volts between 10 KHz and 50 KHz.

RESISTANCE
2 ohms to 6 megohms. Accuracy: 0.1

CURRENT
DC current: 1 microamp to 2 amps. Accuracy: 1. AC current: 1 microamp to 300 milliamps. Accuracy: 1.
AC Frequency Response: Same as for AC voltage.

DC VOLTAGE
1 millivolt to 600 volts in four ranges. Input impedance: 10 megohms. Accuracy: 0.1 % to 300V, 1% to 600V.

RESOLUTION
1 millivolt, 1 microamp, 1 ohm.

GENERAL
Readout: 3 digit LED. Power Source: four AA (penlight) size batteries (Ni-Cad, alkaline or carbon zinc). Over-range Indication: display flashes when input exceeds value of range selected. Polarity Indication: automatic. Negative voltage and current indicated by display. Size: 5.1" x 3.4" x 1.5". Weight: 8 oz. Case: high impact Cycolac. Color: Red.

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Output Power: 100 milliwatt with 9 volt
Max Output Power*: 1 watt with 50 volt
Current Consumption: 10 mA to 50 mA max.
Input Impedance: Maximum 22 K ohms.
Size: 1.5 in. x 2.0 in.
*Intermittent

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FND-510	C.A.	.50" red	1.60 ea.	5/$ 7.55
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FND-810	C.A.	.80" red	3.95 ea.	5/$18.75
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XAN-654	C.C.	.60" grn.	2.95 ea.	5/$14.25
XAN-664	C.C.	.60" red*	2.75 ea.	5/$12.95

* Denotes device has no decimal point.

C.C. Common Cathode C.A. Common Anode

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Description	Fig.	5	10	100
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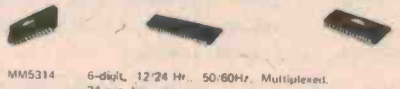
Submini Green	1	0.90	1.70	10.00
Mini Red	2	0.60	1.10	10.00
Mini Green	2	0.80	1.50	13.50
Jumbo Red	3	0.80	1.50	13.50
Jumbo Orange	3	1.25	2.40	22.00
Jumbo Yellow	3	1.25	2.40	22.00
Jumbo Green	3	1.20	2.30	21.00

CLOCK CHIPS



MM5314	6-digit, 12/24 Hr., 50/60Hz, Multiplexed, 24-pin dip.	$3.95
MM5316	4/6-digit, 12/24 Hr., 50/60Hz, Alarm, Snz., 40-pin dip.	$4.50
MK50252	6-digit Alarm, Snz., 12 Hr./60Hz, 24 Hr./50Hz, 28-pin	$3.95
MK50381	4-digit direct LED drive, Alarm, Snz., Radio timer, non-multiplex, 40-pin	$6.95
PCB for MK50252, etched and drilled		$3.95
PCB for MK50381, etched and drilled, also accommodates 4 x FND70		$3.95

All clock chips supplied with data sheets.

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709	Op Amp	0.25	10/$ 2.25
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7805	5V Regulator TO-220	0.95	10/$ 9.00
7812	12V Regulator TO-220	0.95	10/$ 9.00
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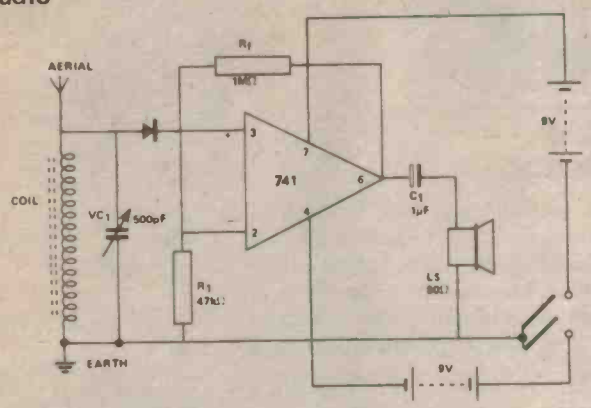
Ideas for experimenters

Op-Amp radio



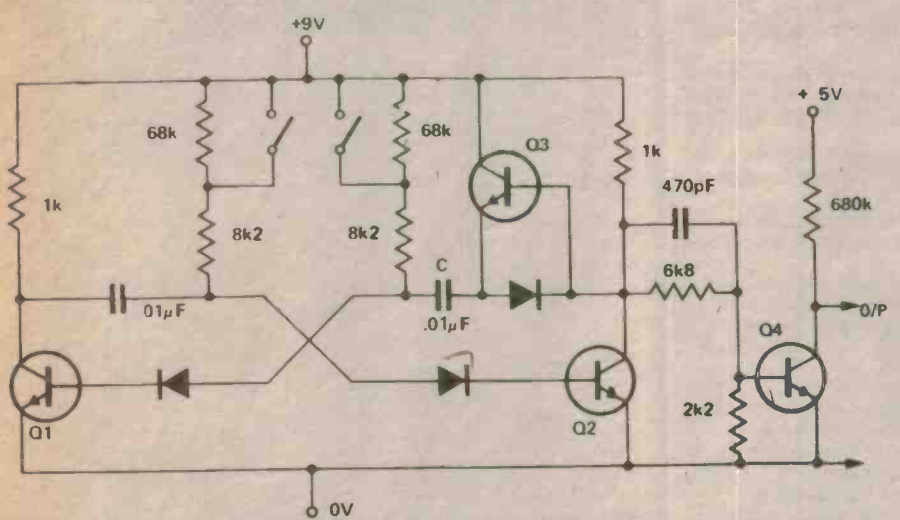
The figure shows how to wire an op-amp so that it amplifies the voltage generated across a tuned circuit in order for the circuit to operate as a simple radio receiver. The '741' op-amp is suitable.

Note that the signal is applied to the non-inverting input of the op-amp so that good selectivity is provided due to the high input impedance of this connection which provides neglible loading of the tuned circuit.

A 2000 ohm earpiece may be used directly at the output of the op-amp but, as shown, an 80 ohm speaker can be driven via a capacitor whose value should be selected for optimum results.

Should the signal suffer from distortion, this may be due to high frequency noise generated by the op-amp and can be cured by connecting a 470 pF capacitor across the feed-resistor R_f. The values of the components are not critical.

Fast-edge square-wave generator



The circuit shown above generates a clean square-wave with very fast rise and fall edges; such a signal is essential for some applications such as the testing of amplifier transient responses, and the reliable driving of TTL.

The multivibrator circuit shown is unusual in that it produces a waveform with fast risetime as well as fast fall time. The standard astable multivibrator has a slow risetime as capacitor C is charged relatively slowly through the collector load of Q2; in the modified circuit C is charged very quickly through Q3. Diode D ensures that Q3 is only turned on when Q2 is off. The final stage (Q4) increases rise and fall speed still further; at the output the rise time is 100 nanosec and the fall time 300 nanosec. When the output is used for driving TTL the collector load must be returned to a voltage no greater than +5 V.

The two-pole switch gives an output at about 1 kHz when open and about 10 kHz when closed; these two frequencies being standard for checking the stability of audio amplifiers.

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10	330 mfd	50VW Electros	3.00
10	330 mfd	35VW Electros	2.50
10	330 mfd	16VW Electros	1.50
10	4.7 mfd	500 VW Electros	2.50
10	1000 mfd	10VW Electros	2.50
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10	0.1 mfd	400VW Poly Caps	1.00
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The company has recently established itself in Australia – as Bozak Australia Pty Ltd (Bozak Australasia Pty Ltd Moorabbin, Vic, 3189 Tel. 95-6447).

FOUR CHANNEL AND THE BBC

Although a substantial number of American broadcasting organisations transmit four channel (using either SQ or QS matrix systems) the concept has never caught on in either Britain or Australia.

Nevertheless the BBC has thoroughly investigated all modes of four channel broadcasting – and has apparently come to the conclusion that it doesn't like any of them!

Their latest Engineering Information bulletin (dated December '76) tells us that the 4-2-4 matrix systems 'failed to satisfy the BBC that any of the existing proposals were opti mum'.

Subsequently, the BBC Research Department developed a transmission encoding matrix which they claim gives stereo and mono compatibility very much superior to any of the systems previously examined.

The new system is called Matrix H and – whilst the BBC say they have no specific plans to start four channel broadcasting now or at any time – if they do it will be in the Matrix H format.

Just where this leaves owners of receivers equipped to decode QS or SQ transmissions is unclear. The BBC say that they have chosen Matrix H to give the best compatibility, and as all 4-2-4 decoders are necessarily a matter of compromise, the choice of decoding equipment is best left to the manufacturers of receiving devices.

The BBC add that they do not manufacture equipment for sale nor seek royalties in respect of receiving apparatus associated with Matrix H broadcasts. It is concerned only with the quality of the reception of its broadcasts and would invite any manufacturer of receiving equipment to use his judgement and skill to obtain the best results from the transmission.

In its early experiments in the laboratory, the BBC used, as an expedient, commercial decoders modified to suit Matrix H. Superior results have more recently been obtained with a decoder designed specially for use with Matrix H transmission, This decoder uses the 'logic-enhanced' principles associated with Sansui Variomatrix equipment.

It is, however, emphasised that the BBC has not conducted any exhaustive investigation into the design of decoding devices for Matrix H. Having established that it is possible to obtain satisfactory quadraphonic reproduction from Matrix H, by one means or another, the BBC wish to leave it to the receiver manufacturing industry to progress this part of the research.

DIRECT DISCO

Direct Disco is a direct-cut disc – that is the original recording is made directly onto a master disc rather than via a tape recording process. There is no re-mixing, equalizing, re-recording, re-mixing etc. What there was is what you hear.

The process is difficult and demanding but if well done the end result is generally dramatically superior to conventional recordings.

Direct Disco, produced by Crystal Clear Records, is no exception. It is in fact probably the best recorded disc we have listened to so far. It looks a bit odd at first sight as it's pressed out of a milky white vinyl – a bit like Nestles white chocolate in appearance – it's also meant to be played at 45 rpm.

Acoustically it's excellent. Dynamic response is limited largely by one's equipment, surface noise is negligible, transients are magnificent. It's brilliant.

Interestingly the producers tell one nothing at all about the music content itself except the names of the perpetrators who are Gino Dentie and The Family.

Direct Disco is an expensive recording – but it's probably the best (technical) recording made so far.

Electronics Today International

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Please Explain

This new feature is our response to the many requests we get from readers who want explanation or information on topics they read about in the magazine. If you have a question please send it to Please Explain, ETI Magazine, 15 Boundary Street, Rushcutters Bay, NSW. 2011.

Intermodulation Distortion

Please explain intermodulation distortion.

K.F., Melbourne.

An amplifier's function is to provide gain and if two signals are fed into the same amplifier one should not interact with the other (the output voltage ought to be an 'addition' of the two input voltages).

On the other hand, a modulator's function is to amplify one signal at a variable rate under the control of a second signal (the gain of the stage being a direct function of the second input signal). Thus two input signals interact and the output voltage should be a product of the input voltages.

Intermodulation distortion is a fault found in amplifier stages with a non-linear transfer characteristic (which causes modulation). Because the slope of the characteristic varies, the gain of the amplifier varies as the input voltage changes. Imagine what effect this can have on a high-frequency signal of sufficiently small amplitude as to be normally within the linear section of the amplifier's characteristic curve. When this is the only input signal there is no distortion. Now introduce a second input signal – a low frequency waveform of such an amplitude as to drive the amplifier into nonlinearity. On its own this signal would suffer harmonic distortion , but when we input both of the signals described we get further distortion – intermodulation distortion. The high amplitude signal shifts the high frequency signal up and down the characteristic curve – across sections of different slope – and thus the amplification of the high-frequency signal varies according to the low-frequency signal; one modulates the other.

The effect of intermodulation can be visualised another way. When we modulate one sinewave (f1) with another (f2), we get f1,f2, f1+f2, f1-f2, 2f1 + f2, 2f1-f2, f1+2f2, f1-2f2, etc. In an amplifier we should only have f1 and f2 present in the output – if there are sum and difference frequencies these are unwanted products caused by intermodulation.

Video Game Problems

I have been having trouble getting the ETI804 video game to work and a friend says that some of the ICs don't work in this country because of the different TV line format. Could this be so?

K.M.,Adelaide

The IC we specified, the AY-3-8500 is designed to work on 625-line, 50 Hz TVs. However General Instruments made a special version of the IC for the American market and this is designated AY-3-8500-1. Most Australian TVs will not work on the output from these American chips and so your friend could be right – check the type number and see.

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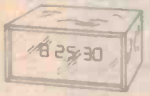

6 Digit Clock Kit

MM5314 with 6 NS71 .27" displays 2 P.C. boards — Display board may be remote. Internal or wall transformer can be used. 50-60 Hz, 12-24 hour. Includes all necessary transistors, resistors, capacitors, diodes, 3 switches and complete assembly instructions.

CK6-3 ..... **$14.95**

Mark I

A six digit clock kit with one double sided P.C. board accommodates MM5314 clock chip and 6 FND359 .375" displays. 12-24 hour, 50-60 Hz. Contains all necessary components. 3 switches and complete assembly instructions with schematics. Connections for remote displays.

Mark I **$13.95**

4 Digit Clock Kit

MM5312 and 4 NS71 .27" displays 12-24 hours, 50-60 Hz. One P.C. board accommodates clock, displays, and all necessary transistors, resistors, capacitors, diodes, 2 switches, complete instructions and schematics for assembly.

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A great gift idea or for your own family entertainment center. We have available in kit form **Electronic Roulette** and **Electronic Craps**. Both kits contain P.C. boards, LED's, all necessary components, case and instructions for easy assembly, (except transformer, 7-15 VAC 300 ma). Included with each kit is a 55 page booklet explaining the entire game.

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311	Hi perf V Comp mDIP TO-5	.95
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WANTED. Preferably complete and working ASR33 or Baudot teletype with tape reader and punch. Phone (051) 671498. C. Stockdale, P.O. Box 871, Morwell, 3840. Vic.

MELBOURNE TAPE FANS the recording soceity of Australia meets monthly for lectures and demonstrations for further information and syllabus ring A.H. (03) 994185 or (03) 4591717.

SELL two army radios PRC10 backpack one not working also Vinten Vantage EX-Taxi radio not working. $55 lot. Gough 24 Virginia Street Newtown. Geelong.

FOR SALE 31 LP records if anyone is interestedTelephone Bowaraville 21 or write to Mr Barry Paton, Macksville Rd, Bowraville NSW 2449. All in good condition.

SANSUI PA-100 Public Address Amplifier, as new, six inputs, V.U. meter, bass and treble controls, suit microphone, guitars, etc. 40WRMS $330. Michael Beaudoun 43-2647.

TWO ONLY DV0M Electronics Aust. Jan.1973. Fully assembled all metalwork, IC's socketed, need de-bugging. $75 o.n.o. each Noller (02) 861-554 9am to 12 noon week days.

WANT TO BUY or copy circuit and instruction handbook for B&K capacitor-analyst model 801. Lamont 3/12 Woodland St. Marrickville N.S.W.

WANTED maintenance manual and or operators book for A.R.8 ex RAAF Comm Receiver. M.J. Kearney, 370 St. Kilda Rd. Melbourne. Vic. 3004.

STARTING MINI EDVC-8 CLUB Feb. 77 to solve problems collect ideas etc. mail now orring after Jan.30. D. Zemdegs 51 Sedgehill Road, Eliz. Nth. Adelaide. 2554582.

FOR SALE extra H.D. 240/32V A.C. ikVA Transformer fitted with ACCT fuseboard $45. P. Hassett 54 Sackville St. Maroubra (02) 34-6179.

WANTED L.P. RECORD: City of Westminster-Carnaby Street, by Carnaby Street Pop Orchestra. Will buy disc or tape copy. Contact Robert Allan (02) 692-2831 (BS.HRS).

SELL 100PF. 5kV disc capacitors 10 for $2. J. Ryan, 26 Underwood Crescent, Toowoomba. 4350.

WANTED Y.L.F. Convertor, tuner or ex-naval disposal comm. Radio to receive GBR Rugby on CW 16kHz Sloman 82 Powerav Chadstone Vic. 3148. 277-3317.

WANTED to buy. Lafayette Hagoo General Coverage receiver in reasonable condition. Please address replies to D. Ellison c/- Pukehou P.O. Hawke's Bay, New Zealand.

MM5203Q 256 x 8 Eprom found with present project band new $16.00. Rob Ward c/- Botany School, Melbourne University Ph. 3417150 W6H.

WANTED someone to make and drill one PCB design. Alex Patison, 7 Sunshine St., Manly Vale 2093 NSW.

REALISTIC DX160B Communication-Receiver as new $150. Also VOX 30 Wrms Guitar amplifier $100. Bert Tassoni, 4 Quarry St, Upper F.T. Gully. After 6.30pm. 758-4086 Melbourne.

SELL Mica Capacitors, packs of 10 values from 10 pF to 1000 pF 50c. Pack T. Sangster, 87 Wattle Valley Rd, Canterbury. (03) 832597.

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The fabulous accuracy of Quartz PLL without having to hock the family jewels.

PL-550

When you've been in the business as long as we have, you know how to create a turntable that sets the standard for rotational accuracy without setting a record for exorbitant price. In our new PL-550 direct-drive turntable, we used the most precise speed control system there is. With Pioneer's Quartz PLL (phase-locked loop) method, the output waveform of a generator on the rotor of the motor is compared with the waveform of the Quartz element reference oscillator. A solid-state phase comparator insures that the precision of rotation is perfectly identical to the precision of the Quartz oscillator.

In addition, advanced fabrication techniques have resulted in reducing the wow & flutter to no more than 0.025% (WRMS) and increasing the S/N ratio to more than 70dB (DIN B). After that, the high-torque motor resists even the most minute amounts of friction from stylus pressure for outstanding rotational precision.

The visual manifestation of this incredible accuracy is displayed on the built-in strobe. In comparison to conventional types, the PL-550's strobe utilizes only one row of markings. In addition, a conventional light source powered by line voltage is subject to fluctuation of up to 0.1%. In the PL-550, strobe lighting is Quartz reference pulsive lighting unaffected by changes in power supply frequency.

Tonal quality is further enhanced by the high-trackability of the S-shaped tone arm. High precision angular contact bearings prevent deterioration in the mid and high frequency range and a thick aluminum mounting base assures integrity in the bass range. An anti-skating device eliminates harmful inward forces and a cueing device protects records and stylus against accidental damage.

Included with this turntable is Pioneer's own PC-550E/II cartridge. Frequency response is flat and the transient characteristics are excellent.

And for protection from outside influences, the monocoque design cabinet combines the ideal weight/mass ratio with large solid insulators.

Pioneer's PL-550 Quartz PLL direct-drive turntable. When it came to building in high performance accuracy, we held nothing back. When it came to keeping the price down, we made everything count.

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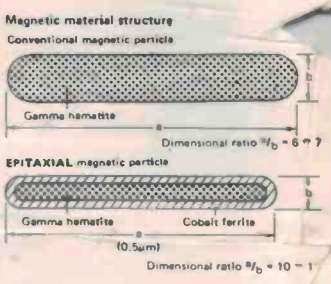
leads the world in sound.

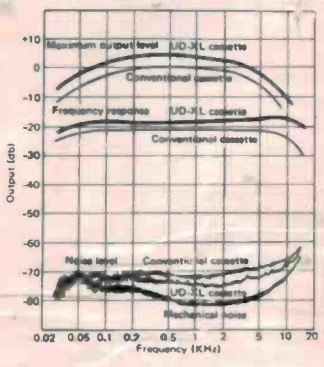
Introducing the revolutionary UD-XL EPITAXIAL cassette

UD XL

Developed by MAXELL this completely new EPITAXIAL magnetic material combines the advantages of the two materials (gamma-hematite and cobalt-ferrite): the high sensitivity and reliable output of the gamma-hematite in the low and mid-frequency ranges and the excellent performance of the cobalt-ferrite in the high-frequency range. The result is excellent high-frequency response plus wide dynamic range over the entire audio frequency spectrum.



Compared to chrome tape, sensitivity has been improved by more than 3.5dB. Because EPITAXIAL is non-abrasive, it extends to the life of the head. Consequently, the UD-XL delivers smooth, distortion-free performance during live recording with high input. When using UD-XL it is recommended that tape selector be in the NORMAL position.



Fidelity is also ensured by a precision-manufactured cassette shell with a special anti-jamming rib that provides smooth tape travel and helps eliminate wow and flutter.

Another good idea of the UD-XL cassette is a replaceable self-index label. Simply peel off the old label and put on a new one when you change the recording contents. No more mess on the label.

maxell®

For further information please write to Maxell Advisory Service, P.O. Box 49, Kensington, N.S.W. 2033.

WT.GD. 76M